Technical Report 978

Micro Computer Feedback Report for the Strategic Leader Development Inventory

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U.S. Army Research Institute

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13. ABSTRACT (Maximum 200 words)

This report describes the FeedBack micro computer program written to print reports for participants who have responded to the preliminary form of the Strategic Leader Development Inventory (SLDI). The SLDI is a self-assessment inventory enabling comparison of self-ratings on a number of positive and negative leadership dimensions with those from former superiors, peers, and subordinates. The final form of the SLDI is now being developed by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) Strategic Leadership Technical Area, in collaboration with the U.S. Army War College and the Industrial College of the Armed Forces.

In its present form, the FeedBack program produces a 2-page assessment containing eight graphs for each participant, reflecting self-ratings compared with those from others. Future plans call for revision of the SLDI based on factor analysis of data obtained during academic year 1992. The revision will produce SLDI forms with fewer items and a cleaner factor structure. The revised feedback will then require modification of the code described in this report.

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Micro Computer Feedback Report for the Strategic Leader Development Inventory

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FOREWORD

Enhancing the continued growth of leadership skills is a central element in the Senior Service College mission. Feedback from others is a useful tool for that purpose.

The Strategic Leadership Development Inventory (SLDI) is a questionnaire designed to obtain feedback from seniors, peers, and subordinates on dimensions of leader actions and attributes thought to be important for senior leader development. In practice, perceptions from each of these sources can be compared both among themselves and with perceptions of the individual who provides a self-description. The comparison can provide insights about an individual's "blind spots" and indications about how future development might be guided.

A crucial element using the SLDI is the cost-effective generation of feedback to leaders in a form that truly aids understanding and development. The present report documents the development of software that will accept formatted data from a mark-sense scoring machine, perform the statistical computations necessary to develop feedback sheets for individual students, and then print the sheets.

This work was made possible by the U.S. Army Summer Associateship Program for High School Science and Mathematics Faculty, through which expertise was made available for the critical software development part of the project.

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As a member of the Largo High School Mathematics Department, I participated in the U.S. Army Summer Associateship Program for High School Science and Mathematics Faculty. My summer associateship was supported by the U.S. Army Research Institute for the Behavioral and Social Sciences, Strategic Leadership Technical Area, Dr. T. O. Jacobs, Chief, under the auspices of the U.S. Army Research Office Scientific Sciences Program administered by Battelle.

I wish to express my appreciation to Dr. Jacobs and Dr. Stewart for allowing me to be part of the Strategic Leader Development Inventory project. They told me what they wanted the FeedBack program to accomplish and gave me the responsibility of completing the task.

MICRO COMPUTER FEEDBACK REPORT FOR THE STRATEGIC LEADER DEVELOPMENT INVENTORY

EXECUTIVE SUMMARY

Requirement:

To develop an automated capability for generating completed feedback forms for Senior Service College students who had completed (and on whom former superiors, peers, and subordinates had completed) the Strategic Leader Development Inventory (SLDI).

Procedure:

The SLDI was generated from descriptions of effective and ineffective senior leader behavior. Content analysis of these descriptions generated dimensions that were then represented by logical clusters of items. These items made up the preliminary form of the SLDI. To provide feedback to participating students, code was written to accept data files generated from scanning scoring sheets. The code computes quartile points for all four data distributions and then prints feedback sheets showing the distribution of responses for each dimension; first, second, and third quartiles; the individual's self-rating; and the rating of that individual by former superiors, peers, and subordinates.

Findings:

The individual may thus compare himself or herself with others in the same class, and with the perceptions of these significant others from whom data were obtained about himself or herself.

Utilization of Findings:

The feedback system was used for the academic year 1992 classes at the U.S. Army War College and the Industrial College of the Armed Forces. It will be revised as the SLDI is revised for academic year 1993 and subsequent years, based on factor analysis of 1992 data, and will become operational at both as an additional tool for leader development.

MICRO COMPUTER FEEDBACK REPORT FOR THE STRATEGIC LEADER DEVELOPMENT INVENTORY

CONTENTS

MICRO COMPUTER FEEDBACK REPORT FOR THE STRATEGIC LEADER DEVELOPMENT INVENTORY

INTRODUCTION

The Strategic Leader Development Inventory (SLDI) is currently under development by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), Strategic Leadership Technical Area (SLTA), in collaboration with the U.S. Army War College (USAWC) and the Industrial College of the Armed Forces (ICAF). The SLDI is a self-assessment survey to enable participants to learn more about themselves.

Participants in the SLDI complete a self-assessment survey and select three superiors, three peers, and four subordinates to evaluate them. After all the surveys are completed, the participants receive a report summarizing the results. The SLDI reports enable the participants to learn how they are perceived by their superiors, peers, and subordinates. Coupling these reports with their own ratings, the participants can develop a better understanding of their strengths and weaknesses.

My assignment was to write a micro computer program that would print graphs for the SLDI reports. Because the SLDI is designed to provide the participants with information about themselves, I chose to name the micro computer program FeedBack.

The FeedBack program produces a 2-page assessment containing eight graphs. Each graph displays a participant's evaluation and the average rating of his or her peers, superiors, and subordinates. The first page contains four positive factor graphs entitled the Success Factors. The second page contains four negative factor graphs entitled Failure Factors. Appendix A contains a sample of the FeedBack graphs.

Accompanying the FeedBack graphs is a summary of the goals of the SLDI and the characteristics included in each factor. A copy appears in Appendix B. In addition to the written description, the participants discuss their assessments in group forums.

SLDI DATA FILES

Before the SLDI answers are ready for the FeedBack program, they must be processed by two other computer programs. An optical scanner transfers the data from the answer sheets to a computer disk. A statistical program is used for factor analysis and to compute the average score used by the FeedBack program.

I helped compile the computer data from the SLDI answer sheets for the ICAF class of 93. An optical scanner at the Army War College was used to read the answer sheets. Each side of the answer sheet was read into a separate ASCII data file. I used the following names for the data files: Self_IA, Self_IB, Self_II, Super_I, Super_II, Peer_I, Peer_II, Subor_I, and Subor_II. The "I" in the file name means part one of the SLDI data or the positive questions. The "II" on the file name means part two of the SLDI data or the negative questions. The "Self" part one data is in two files because there were more than 100 questions. Self_IA contains the answer to the first 100 questions. Self_IB contains the answers beginning with question 101.

The information from one answer sheet became a single line in the data file. The first three digits of the line are the participant's identification number (ID). The first answer will be in column 4, the next answer in column 5, etc. The scanner converted the letters from the answer sheet into numbers (A = 5, B = 4, C = 3, D = 2, E = 1). A space means no answer was given, and an underline means the scanner could not determine the answer.

The optical scanner does a good job, but there are going to be mistakes in the data files. I used an ASCII text editor to correct data errors. Most of the errors were the result of human mistakes, like marking two answers to the same question. This would appear in the data file as an underline. This type of error occurs when an answer is changed and the first answer is not completely erased. I used the original answer sheet to determine the desired response. If one mark is not darker than the other, the underscore is converted to a space, meaning no answer.

I checked the first three digits of each line to make sure it was a valid ID number. Errors occur when the participant forgets to bubble in the ID number on the answer sheet. This then appears as three spaces at the beginning of the data line. I located the original answer sheet and added the missing ID number to the data file.

I discovered that the scanner made errors. The most common error occurred when an answer was left blank. The scanner always marked a blank answer with a space. Sometimes the scanner added an extra space to the data line. The extra space moves all the other answers one digit to the right. The answers do not match the questions. Fortunately this type of error is easy to detect. The number of answers in each data line are the same; therefore, each data line should be the same length. I used an ASCII text editor to check the end of each line. If a line was not the correct length, I compared the scanned answers to the original answer sheet to locate the error.

Analysis of the answers was accomplished with the statistical program "SPSS." I created a DERAIL file by combining all the part II files into one data file named DERAIL. Before combining the data files, I inserted a letter after the ID number. The letter is needed to identify the data as Self, Peer, Superior, or Subordinate. I used "A" for Superior, "B" for Peer, "C" for Superior, and "D" for Self. I recommend that in the future SPSS use the four separate part II files as input. This change will eliminate the need for creating a DERAIL file.

The SPSS analysis of the data created two data files containing average scores for the FeedBack program. Names of the Feedback data files must end with ".POS" for the Success Factors and ".NEG" for the Failure Factors. The NEG file created by SPSS was ready for printing using the FeedBack program.

The POS file had extra data and was edited using an ASCII text editor. Appendix C contains instructions for converting the POS file to the format needed by the FeedBack program. I recommend that in the future SPSS create a POS file without the extra data. The correct format for the POS and NEG FeedBack data files is listed in Appendix D.

FEEDBACK DOCUMENTATION

I wrote the FeedBack program using 8086 micro assembler language. It will operate correctly on a computer using an MS DOS or a compatible operating system. The FeedBack program is designed to print FeedBack graphs on a Hewlett Packard LaserJet or compatible printer. A compatible printer must support Hewlett Packard's Printer Control Language (PCL).

The FeedBack program is menu driven using a Lotus style menu bar. The first line of the menu lists the commands and the second line is a sentence describing the highlighted command. An information box at the bottom of the screen provides instructions for operating the menu bar.

An important feature of the FeedBack program is the use of the <Esc> key to cancel a command. Users feel in control of the program when they can undo a command by pressing the <Esc> key.

Between the Menu Bar and the program title there is a two line Program Status Display. If a data file is open, it will show the file name and the number of ID's contained in the file. Before the graphs can be printed, the data file must be ranked to compute the percentiles. The Program Status Display informs the user if the percentiles are computed. It also lists the status of the selected printer port. It must say "printer is ready" before the report can be printed.

The term "printer is ready" is misleading. It means there is a peripheral attached to the LPT port that is ready to receive data. FeedBack assumes the peripheral is a printer. If the user is not sure which port the printer is using, there are two choices. The easiest may be the trial and error method. Make sure the printer is turned on and use the "LPT" command to select one of the three parallel ports. If FeedBack says the "printer is ready" try printing a report.

Another method to locate the printer port is to examine a program that uses the printer. The most common printing program is a word processor. Use the word processors documentation to learn what port the word processor is using. See Appendix E for instructions on using WordPerfect to learn the printer port assignment.

If the printer is connected to one of the COM ports, the DOS "MODE" command can be used to redirect LPT1 to the desired COM port. Consult the DOS documentation for instructions on use of the "MODE" command. After LPT1 has been reassigned, FeedBack will think it is sending data to LPT1 but DOS will be redirecting the output to the assigned COM port. The ICAF graphs for the class of 93 were printed using a computer with a Zenith DOS operating system. The Zenith "CONFIGUR" command was used to redirect the LPT1 output to the desired COM port.

When using the FeedBack program with a monochrome monitor, check to see if the words in the second line of the menu are clearly displayed. If the words are difficult to

read, restart FeedBack with the command "FeedBack m". Some laptop computers use monochrome monitors but operate in a color video mode. The "m" command can be used to force the Feedback program into the monochrome mode.

When beginning the FeedBack program, the user should select the "File" command which allows FeedBack to locate the SPSS files containing the report data. The name of the "Positive Factors" data file ends with ".POS". The name of the "Failure Factors" data file name ends with ".NEG". Both data files are stored in ASCII and can be read using an ASCII text editor. WordPerfect can import the file as a DOS text file. I recommend not saving the file from WordPerfect. The data file will be damaged if WordPerfect splits any of the data lines. A data line in the FeedBack file begins with a three digit identification number (ID) ranging from "001" to "999". The FeedBack program reads the data file one line at a time. If the first three digits of the line are an ID number, the program assumes the line is a data line. See Appendix D for the format of the data line.

After selecting a data file, it must be ranked to allow FeedBack to compute the percentiles needed to produce the printout. The "Rank" command also locate any values that are larger than 5.0 or smaller than 1.0. in the data file. If an error is found, the user will be shown the offending data and given its row and column position in the data file. An ASCII text editor can be used to correct any errors. After the errors are corrected, use FeedBack to rank the file again before printing.

In an ID data line, the values are a three digit ASCII number. To save space the decimal point is left out so 2.35 will appear as "235". Feedback rounds all of its input to two digits. "235" would become "2.4" and "234" would become "2.3". Feedback does all its error checking on the rounded numbers not the original data values. Therefore a 5.01 is out of bounds but the rounded value is not, so the value would be accepted. A 5.05 would round to 5.1 and would be an error.

If the rank command completes its task without any errors, the ranking information is added to the end of the data file. By appending the ranking data to the file, it allows the ranking command to be skipped the next time the data file is used. The ranking information will appear at the end of the data file as one long line of numbers. The ranking data line will always begin with an ID number of "000" which is a reserved ID number and must not be assigned to a participant. The format for the ranking data line is listed in Appendix F.

When viewing the data file with a text editor it is advisable to remove the rank data line. Many text editors will split the rank data into two or more lines. The FeedBack program expects the data in one long line. The easiest way around this potential problem is to erase the rank data line and use the FeedBack program to rank the file again.

It is possible to rank a file more than one time without removing the old "000" data line. The last ranking will be the one used to print the graphs. The ranking information

will not be saved in the data file if an error is detected. If a FeedBack data file has more than one "000" data line, I suggest removing all the "000" lines and asking FeedBack to rank the file.

Programming for future expansion was a high priority in the design of the FeedBack program. Because the SLDI is under development it will continue to change and the FeedBack program will need to be updated. The names of the current factors can be changed using an ASCII text editor. Increasing the number of factors requires making small changes in many sections of the source code. It will take approximate three days to update the source code to increase the number of factors.

I believe the SLDI has great potential. The survey questions must be improved to produce a wider range of statistically stable factors. The FeedBack program has the potential to become an expert system producing graphs and individualized analysis.

APPENDIX A:

Sample FeedBack Graphs

STRATEGIC LEADER DEVELOPMENT INVENTORY

ID Number: 101

Success Factors

Scored: 08/25/92

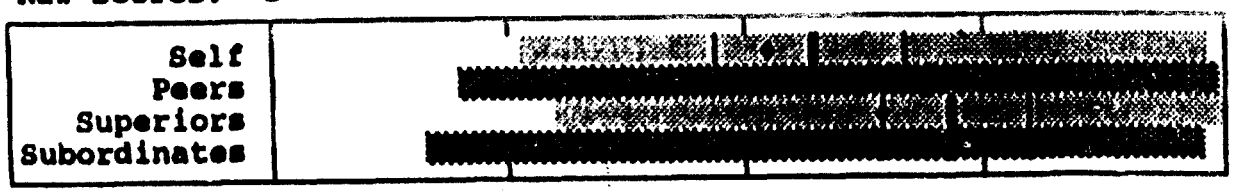
DIMENSIONS:

←Below Average Better Than Most The Best→

Raw Scores: 1 . . . . . 2 . . . . . 3 . . . . . 4 5

CONCEPTUAL EFFECTIVENESS

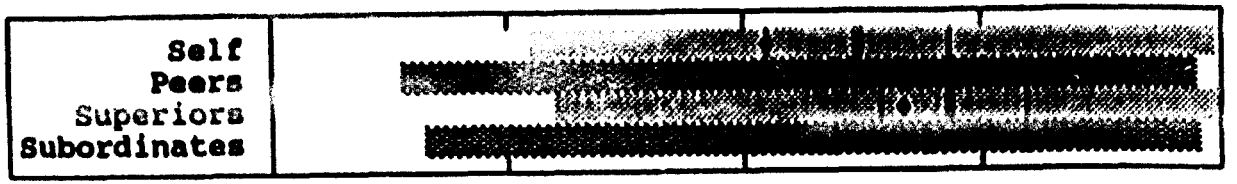
Self
Peers
Superiors
Subordinates



Raw Scores: 1 . . . . . 2 . . . . . 3 . . . . . 4 5

TEAM BUILDING

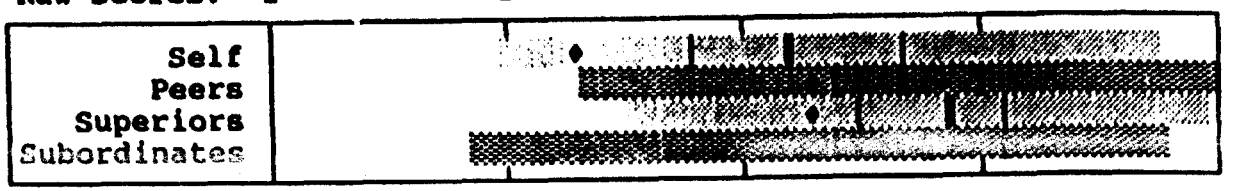
Self
Peers
Superiors
Subordinates



Raw Scores: 1 . . . . . 2 . . . . . 3 . . . . . 4 5

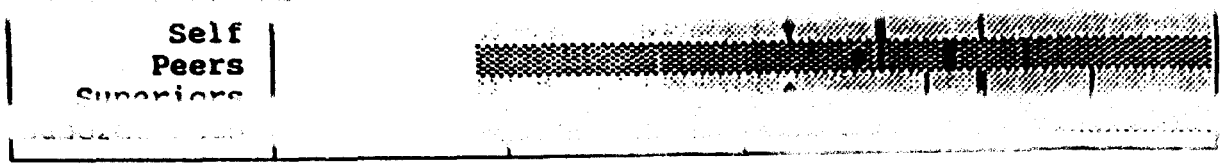
STRATEGIC POTENTIAL

Self
Peers
Superiors
Subordinates



PERFORMANCE UNDER STRESS

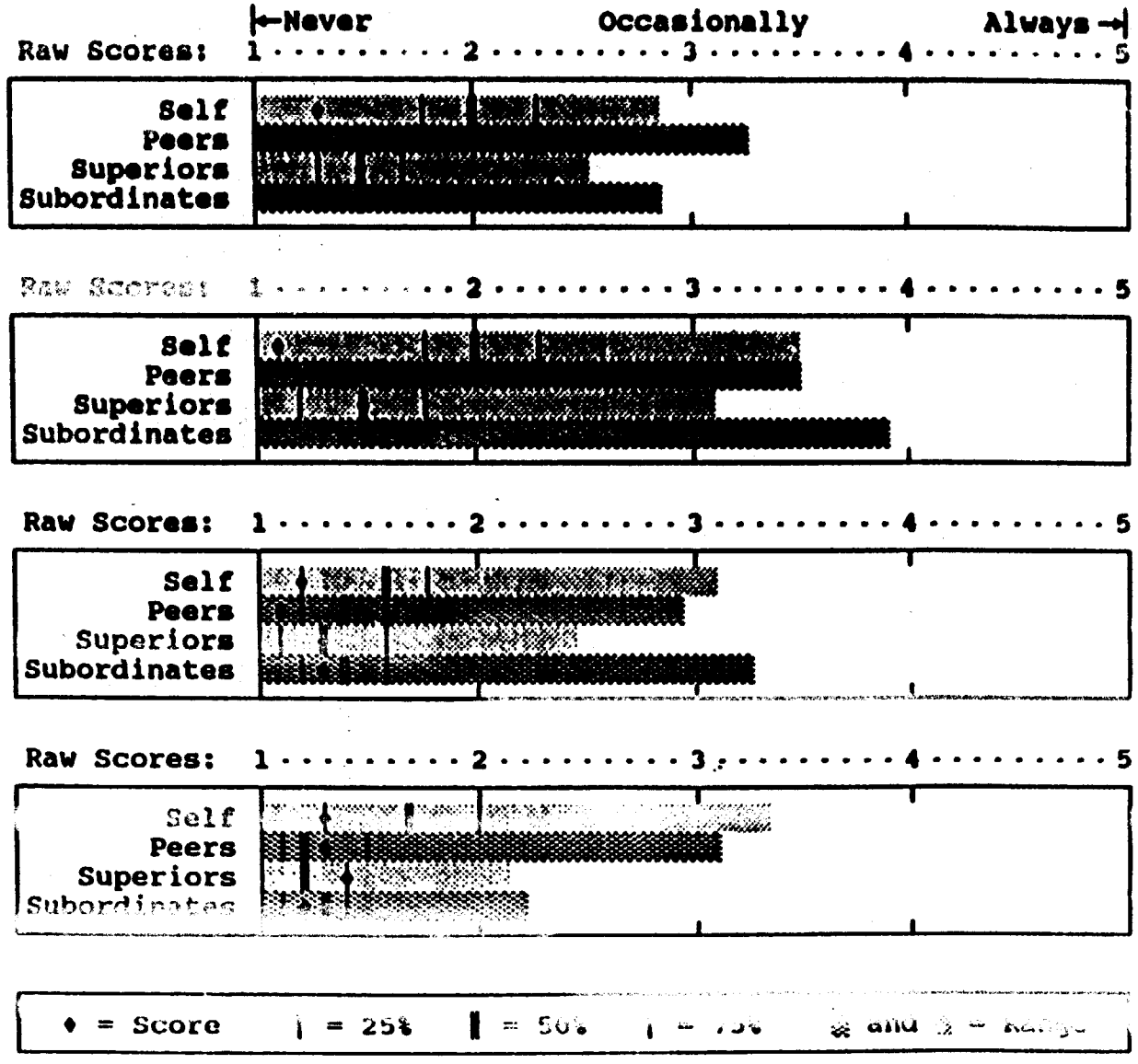
Self
Peers
Superiors



STRATEGIC LEADER DEVELOPMENT INVENTORY

ID Number: 101 — **Failure Factors** — **Scored: 08/24/92**

DIMENSIONS:



A3

APPENDIX B:

Description of SLDI

STRATEGIC LEADER DEVELOPMENT INVENTORY (SLDI)

GENERAL: There are three levels of leadership: Direct, Senior, and Strategic. Direct leaders command units -- battalions, squadrons, ships, and, in some instances, branches or directorates. Senior leaders operate at a level higher. They command organizations and face problems much broader in scope and complexity. Their leadership becomes indirect. You get things done by working through a large number of "others". You can't personally influence everything that needs to be done. Strategic leaders command Joint/Combined operations. They are even more removed from the direct action. These are three and four star billets and civilian equivalents.

Your selection for attendance at a Senior Service College (SSC) signifies you have been successful direct leaders. The SSC aids you in making a critical transition -- from the Direct to the Senior leadership level. It also exposes you to guest speakers and other experiences so that you can see what the requirements of Strategic leaders are.

A specific rationale is behind the development of this instrument and two theories support the rationale. The specific rationale and two theories will be briefly explained. Then, each factor assessed with the SLDI is described.

SPECIFIC RATIONALE FOR THE SLDI: The SLDI is an assessment tool. You learn more about yourself with the data it provides. The logic behind the SLDI is very simple. You must accurately know yourself before your can accurately assess and understand the strengths and weaknesses of others. You cannot be a good leader without adequate self-knowledge.

You must know yourself for another important reason. You cannot develop yourself without this information. This will probably be your final school assignment. Development beyond this assignment will be your responsibility.

The SLDI taps multiple frames of reference: Yours and those of your peers, subordinates, and superiors. You can "triangulate" from these multiple perspectives to form a more rounded and accurate understanding of your strengths and weaknesses.

THEORIES UNDERLYING THE SLDI: Elliot Jaques' and Robert Kegan's theories underlie the SLDI's factors we'll define later.

Jaques' theory states individuals vary in ability to deal with abstraction and complexity in thought processing. Direct, senior, and strategic leaders must use successively more complex thought processing because the conceptual demands of the positions they occupy become progressively more difficult. The problems to be solved become more and more unstructured or non-routine.

Senior and strategic leaders must develop a vision of desired future states, develop plans to achieve them, and proactively manage the process of getting there. How far you can project plans ahead for your work is an indicator of the complexity you bring to the job. Table 1 summarizes the variables being described here. It shows the timespans -- "planning horizons" -- associated by organizational level using the Army as an example. Business organization equivalents are also shown.

TIMESPAN	WORK LEVEL	MILITARY	BUSINESS
50 YRS	VII	ARMY (General)	CORPORATION
20 YRS	VI	CORPS (Lt. General)	GROUP
10 YRS	V	DIVISION (Maj. General)	STRATEGIC UNIT
5 YRS	IV	BRIGADE (Brig General/ Colonel)	GENERAL MANAGEMENT
2 YRS	III	BATTALION (Lt. Colonel)	OPERATING UNIT
1 YR	II	COMPANY (Captain)	SECTION
3 MTHS	I	PLATOONS SQUADS (NCOs)	SUPERVISORS, OPS CLERKS

Table 1. LEVELS OF WORK

Research suggests the transition from Work Level III to IV is critical and difficult to make. You have been conditioned in your career to be good at leading directly. It is challenging to learn indirect leadership skills. You will be facing problems too complex for you to solve on your own. The SLDI is intended to aid the transition process. To make the other major transition, from work level V to VI and VII, you will most likely be on your own.

Kegan's theory is about emotional maturing. It specifies where one's self-definition comes from. Kegan believes there are six stages of maturity (stage 0 thru V). We won't describe them all, only the two we have found apply to SSC students and more senior officers. These are stages III and IV. Based on

empirical research done at ICAF and the Army War College, we can predict that most of you are in transition between these two stages and some have reached the more advanced stage (IV).

If you are in stage III, you are not fully capable of seeing yourself as you really are. What you think are "good" and "bad" person characteristics and qualities are defined by your organization and by the society you live in. People in stage III are sometimes called "organization men or women." They respect their contemporaries, appreciate mutual and reciprocal relationships, can become a part and product of "group think" (they will not usually take on positions contrary to the norm for fear of rejection and ridicule) and otherwise define themselves as their context defines them. True self-perception, what they are actually like, is lost in an external "ideal". They are not yet emotionally ready to develop a definition and an identity of themselves apart from their primary reference group.

For you to reach stage IV, being fully capable of self-definition, you must accurately understand yourself as you are. Acceptance and accountability are vital keys. You can accomplish this through a process Kegan, Lewis, Kuhnert and Maginnis refer to as "De-Centering." This means stepping "outside" yourself to see yourself as others see you. Their perceptions may be different than yours, but still valid. You must be able to accept without defensiveness the differing perceptions of others and synthesize them to form a more objective, holistic "picture" of yourself. The SLDI has been designed to aid in developing this more objective, holistic "picture".

Research suggests that cognitive and emotional development are not independent. They are inter-related. SSC students need to advance to the fourth level of cognitive and ego development to be effective problem solvers at the senior leadership level. Otherwise, they cannot "see" problems objectively (and, thus, define them correctly) or have the thinking capacity to deal with them effectively.

SLDI FACTORS.

Through an analysis process we identified four "SUCCESS" and "FAILURE" factors from the questions you and your superiors, peers, and subordinates answered. SUCCESS factors are those things that, if developed well, can lead to successful performance in successively higher positions. FAILURE factors are practices that could lead to what has been called "De-Railment", failure to achieve the potential one has. The four SUCCESS factors are called:

- Conceptual Effectiveness.

  Broad Perspective -- understands the

perspectives of superiors, how the mission of own unit meshes with that of others, values long range planning, and thinks strategically.

Conceptual Grasp -- understands complex situations, is comfortable with paradox and contradiction, and can pinpoint cause and effect relationships in complex situations.

Time Horizon -- develops long-term objectives and anticipates resources for achieving them, has a good sense of how future world events may affect the military and works to insure own initiatives are carried out by successors.

Analytic Clarity -- can work from the abstract to the concrete. This means developing a concept and then making it a reality - gets to the heart of the matter quickly and sorts out what is important from what isn't.

Conceptual Flexibility -- willing to adjust quickly when obstacles are encountered, has an understanding that guidelines are not fixed or rigid, remains focused when the unexpected occurs, and changes courses of action when new information emerges.

Conceptual Complexity -- views all sides of a problem and alternative ways of solving them, manages more than one project at a time, considers many contingencies when making operational plans, envisions multiple courses of action when considering various scenarios, and integrates own plans with those of other units.

Personal Objectivity -- has a good grasp of personal strengths and weaknesses, maintains own objectivity when others get caught up in the heat of the moment and has a coherent rationale for own actions.

- o <u>Team Building</u>.

  Judgement/Character -- able to judge quality in others, provides wise counsel to others, maintains a balance between work and personal life, has a good, non-hostile sense

of humor, shows confidence and humility, puts mission before career, and sets high but realistic standards.

Communication Effectiveness -- keeps subordinates informed and encourages them to express disagreement. You are able to understand subordinates' points of view and their problems. You are willing to tell subordinates things they might not want to hear about themselves and help them to understand the bigger picture, maintain a sincere interest in what others have to say, are approachable, and listen well.

Team Orientation -- actively works to build effective teams without loosing sight of individuals. Empower others to accomplish the mission and recognizes good performers from those that only "look" good. Works hard for subordinates, backs them when appropriate, delegates authority and responsibility, and shows interest in their professional development.

Creates Good Work Climate -- does not play favorites, resolves conflict among subordinates and gains their trust and support. Creates a supportive work context, treats subordinates fairly, helps them learn from mistakes and able to get them to be effective without the use of rank or position.

Drive/Energy Level -- has high energy level and enthusiasm, a strong work ethic, hangs in there when things get tough, engenders enthusiasm in subordinates.

- Strategic Potential.

Manages Self-Development -- seeks to become knowledgeable in areas outside current job responsibilities; works to correct own weaknesses; manages own career direction; solicits feedback to grow professionally; optimistic about the future.

Shows Cultural/Political Sensitivity -- persuades others to support desired actions, knows who to talk to to get things done, shows judgement in politically sensitive

matters, recognizes the unique concerns of minorities and women in and outside of the military culture, accepts the fact that politics are a key part of organizational life, recognizes the potential impact of the external political environment on own plans and programs and accepts community standards as legitimate constraints on personal behavior.

o Performance Under Stress. Seizes opportunities when they arise, takes calculated risks, takes charge in crisis situations, works well under pressure, and dependable in key situations.

The four FAILURE factors are:

o Limited Perspective. This factor is related to the first positive factor, but it is not necessarily "the other side of the coin". It is defined by six dimensions which are described below. Lower scores are preferred.

Technical/Tactical Incompetence -- fails to achieve technical competence in new areas, fails to get the facts straight, shows lapses of common sense, ignores important details, judged by others as being generally technically ineffective.

Insulated -- inaccessible to subordinates, generally is unapproachable, favors management by memorandum rather than through face-to-face communication, works within a very limited "inner circle," is secretive -- unwilling to share thoughts with others.

Indecisive -- shrinks from making hard decisions. Easily influenced by what others think -- particularly by higher ranking officials, reluctant to make a decision without achieving a consensus, fails to stay focused on primary issues. In short, likes to "play it safe."

Narrow Perspective -- cannot develop a long-term vision, tied to standard ways of doing things, parochial -- would have a hard time adapting to a multi-agency or joint environment, has difficulty being political when necessary, tends to get bogged down in details.

Lacks Conceptual Grasp -- crisis oriented -- always putting out "brush fires", reactive rather than proactive, prefers to work on one project at a time and be linear rather than multi-linear and integrative.

Dependent on Clear Structure -- needs extensive guidance to get things done, displays generally an intolerance of uncertainty, looks for the perfect solution to problems.

- Egocentric.

Self-Centered -- likes to draw attention, is arrogant and thinks the rules apply only to others, holds to own position even in the face of contradicting information, takes special privileges, impressed with own rank and status.

Defensive -- has difficulty recognizing own limitations, will not admit to not having all the answers, suspicious of others, reacts negatively to dissenting opinions.

Disregards Others -- criticizes subordinates in front of others and generally "talks down" to them, tends to take credit for others' work, and berates others even for honest mistakes.

Temperamental -- acts impulsively and easily looses control, looses temper easily, jumps to conclusions, makes snap judgements about people.

Micromanages -- gets bogged down in details, nit picks about what others have done, insists on precision in trivial matters.

Inflexible -- wants everything done own way, generally autocratic in dealing with subordinates.

Untrusting -- has hidden agendas, fails to meet established deadlines, gossips and complains about others behind their back, is vindictive, tolerates back stabbing, encourages destructive competition among subordinates.

o Careerist. Looks out for self more than for others, puts own career and interests ahead of the goals of the organization and promoting professional development of others. Will not "rock the boat" when needed. Lets others take the heat for failures. Willing to abuse subordinates to further career.

o Unprofessional. Behaves with questionable ethics, uses foul language excessively, fails to maintain physical fitness, and "falls on sword" over unimportant issues.

INTERPRETING THE SLDI SUMMARY DATA SHEETS.

Two Data Sheets summarizing your scores on the SLDI accompany this hand-out. One covers the SUCCESS factors and the second one covers the FAILURE factors.

The average score for self, peers, superiors, and subordinates is shown for each SUCCESS and FAILURE factor. The "diamond" shows the average of items for you, and your peers, superiors, and subordinates on each factor. These averages are specific to the particular individuals that provided assessments for you. Pay particular attention to these averages -- they are a "benchmark" specific to YOU. Pay attention to the degree of each rating (whether it is "high or low" to identify strengths and weaknesses) and to the discrepancies between your assessments of self and the assessments of each of the other reference groups. Large discrepancies mean that others are not perceiving you as you perceive yourself. This can be a problem for reasons already stated. On the other hand, you may have intentionally caused the discrepancies because you made a conscious decision to portray yourself differently to each of the reference groups. You may be the only one who can assess what the reasons for any large discrepancies between how you rated yourself and others rated you.

The light and dark shaded bars are used to display normative information. These bars show the range of scores across all respondents of each type. Also coded within each bar are the 25th, 50th, and 75th percentiles. This allows you to see where the scores you provided about yourself, by your peers, superiors, and subordinates are located with respect to all such ratings provided for the entire class of '93. A legend defining the percentiles is at the bottom of each summary sheet. Anchors for the factor rating scale are shown at the top of each summary. Note that for the SUCCESS factors, higher scores are better. For the FAILURE factors, lower score are better.

APPENDIX C:

Converting the POS File

Strategic Leader Development Inventory

For the ICAF data printed in August of 92 the SPSS program created a POS data file with the format listed below. This file was edited before it can be used by the FeedBack program. I used an ASCII text editor to move and delete some columns. See Appendix D for the correct format of the POS and NEG data files.

Original Columns	New Columns	
1-3	1-3	ID number range: '001' to '499' raw scores format: 2.03 will be "203"
4-6	delete	Self on Conceptual Effectiveness (Self vs Peers)
7-9	delete	Self on Team Building (Self vs Peers)
10-12	10-12	Self on Strategic Potential (Self vs Peers)
13-15	delete	Self on Performance Under Stress (Self vs Peers)
16-18	4-6	Self on Conceptual Effectiveness (Self vs Sup.)
19-21	delete	Self on Team Building (Self vs Sup.)
22-24	delete	Self on Strategic Potential (Self vs Sup.)
25-27	delete	Self on Performance Under Stress (Self vs Sup.)
28-30	delete	Self on Conceptual Effectiveness (Self vs Sub.)
31-33	7-9	Self on Team Building (Self vs Sub.)
35-36	delete	Self on Strategic Potential (Self vs Sub.)
37-39	13-15	Self on Performance Under Stress (Self vs Sub.)
40-42	16-18	Peer mean on Conceptual Effectiveness
43-45	19-21	Peer mean on Team Building
46-48	22-24	Peer mean on Strategic Potential
49-51	25-27	Peer mean on Performance Under Stress
52-54	28-30	Superiors mean on Conceptual Effectiveness
55-57	31-33	Superiors mean on Team Building
58-60	34-36	Superiors mean on Strategic Potential
61-63	37-39	Superiors mean on Performance Under Stress
64-66	40-42	Subordinates mean on Conceptual Effectiveness
67-69	43-45	Subordinates mean on Team Building
70-72	46-48	Subordinates mean on Strategic Potential
73-75	49-51	Subordinates mean on Performance Under Stress

APPENDIX D:

Format for FeedBack Data Files

Strategic Leader Development Inventory

Line format of input ASCII data files:

DOS File name: *.POS = Positive Factors data file.
Columns format for a each data line of the .POS data file:

Columns		
1-3	ID number	range: '001' to '999' raw scores format: 2.03 will be "203"
4-6	Self on Conceptual Effectiveness	(Self vs Superiors)
7-9	Self on Team Building	(Self vs Subordinates)
10-12	Self on Strategic Potential	(Self vs Peers)
13-15	Self on Performance Under Stress	(Self vs Subordinates)
16-18	Peer mean on Conceptual Effectiveness	
19-21	Peer mean on Team Building	
22-24	Peer mean on Strategic Potential	
25-27	Peer mean on Performance Under Stress	
28-30	Superiors mean on Conceptual Effectiveness	
31-33	Superiors mean on Team Building	
34-36	Superiors mean on Strategic Potential	
37-39	Superiors mean on Performance Under Stress	
40-42	Subordinates mean on Conceptual Effectiveness	
43-45	Subordinates mean on Team Building	
46-48	Subordinates mean on Strategic Potential	
49-51	Subordinates mean on Performance Under Stress	

DOS File name: *.NEG = Negative Factors data file
Columns format for a each data line of the .NEG data file:

Columns		
1-3	ID number	range: '001' to '999' raw scores format: 2.03 will be "203"
4-6	Self on Limited Perspective	
7-9	Self on Egocentric	
10-12	Self on Careerist	
13-15	Self on Unprofessional	
16-18	Peer mean on Limited Perspective	
19-21	Peer mean on Egocentric	
22-24	Peer mean on Careerist	
25-27	Peer mean on Unprofessional	
28-30	Superiors mean on Limited Perspective	
31-33	Superiors mean on Egocentric	
34-36	Superiors mean on Careerist	
37-39	Superiors mean on Unprofessional	
40-42	Subordinates mean on Limited Perspective	
43-45	Subordinates mean on Egocentric	
46-48	Subordinates mean on Careerist	
49-51	Subordinates mean on Unprofessional	

APPENDIX E:

Locating WordPerfect's Printer Port

To use WordPerfect to discover the printer port assignment use following steps:

1. Start the WP program.

   If you make a mistake in steps 2 - 5 use the F1 key to cancel the command.

2. Use the Shift-F7 command to bring up the print menu.

3. Use the "S" command to display the Select Printer screen.

4. Use the "Edit" command listed at the bottom of the screen.

5. The edit screen lists the current port assignment on the upper half of the screen. It should say port: LPT1, LPT2, or LPT3.

   If it says COM1 or COM2 FeedBack cannot be used on this computer unless the DOS 'MODE' command has been used to reassign the LPT port to the listed COM port.

6. To return to the main screen without making any changes to WordPerfect, press the F1 key until the word processing screen appears.

7. Use the F7 command to exit WordPerfect.

APPENDIX F:

Format for FeedBack Variable Strings

Strategic Leader Development Inventory

Offsets in data files, [FileBuf] and [PerCnt] memory strings

Data File Columns: (3 ascii bytes)		[FilleBuf] (3 ascii bytes)	[PerCnt] Low	High	Med	25%	75%
1-3	ID number	0 - 2		(ascii words)			
		Self Data Locations					
4-6	Self Dim1	3 - 5	5	7	9	11	13
7-9	Self Dim2	6 - 8	15	17	19	21	23
10-12	Self Dim3	9 - 11	25	27	29	31	33
13-15	Self Dim4	12 - 14	35	37	39	41	43
		Peers Data Locations					
16-18	Peer Dim1	15 - 17	45	47	49	51	53
19-21	Peer Dim2	18 - 20	55	57	59	61	63
22-24	Peer Dim3	21 - 23	65	67	69	71	73
25-27	Peer Dim4	24 - 26	75	77	79	81	83
		Superiors Data Locations					
28-30	Supr Dim1	27 - 29	85	87	89	91	93
31-33	Supr Dim2	30 - 32	95	97	99	101	103
34-36	Supr Dim3	33 - 35	105	107	109	111	113
37-39	Supr Dim4	36 - 38	115	117	119	121	123
		Subordinates Data Locations					
40-42	Subd Dim1	39 - 41	125	127	129	131	133
43-45	Subd Dim2	42 - 44	135	137	139	141	143
46-48	Subd Dim3	45 - 47	145	147	149	151	153
49-51	Subd Dim4	48 - 50	155	157	159	161	163

APPENDIX G:

Source Code for the FeedBack Program

```
 ;FeedBack.ASM          Summer 1992        James E. Hopkins
;A program to print Strategic Leader Develoment Inventory's
;self feedback reports on a HP Laser Jet printer.
      .MODEL small
;
      STACKSIZE     EQU    2024

      .STACK  STACKSIZE
;

      INCLUDE FBD.ASM                        ;data for printer proc
      INCLUDE FBR.ASM                        ;ranking procedures
      INCLUDE FBA.ASM                        ;print procedures
      INCLUDE FBB.ASM                        ;printer subroutines
      INCLUDE FBM.ASM                        ;menu procedures
      INCLUDE FBT.ASM                        ;title procedures
      INCLUDE FBU.ASM                        ;universal procedures
      INCLUDE FBS.ASM                        ;select file procudures
      INCLUDE FBF.ASM                        ;file procudures
      INCLUDE FBE.ASM                        ;edit path procedures
      INCLUDE FBN.ASM                        ;input ID number proc
;
      .DATA                                 ;the data segment.
ErrCode db     0                             ;ret error msg to DOS
;note: If Debug is ON the printing time will be twice as long.
Debug   db     0                             ;0 = OFF   Other = ON
;
;video data
Vidmode db     0                              ;video mode
vidpage db     0                             ;video page
vidcurs dw     0                             ;cursor type
vidfont dw     0                             ;font size
vidattr db     07h                           ;default Lt White/Black
vidbord db     07h                            ;border color
;
;Color variables
Color   db     07h                           ;active color
System  db     07h                            ;default Lt White/Black
Menu    db     0                             ;Menu main color
Normal  db     07h                            ;Main display screen
HiLite  db     0                             ;display screen titles
MenuMes db     0                              ;menu messages line
Warning db     0                             ;accent color
Border  db     0                             ;display screen box
;
;Memory Block variables
VarSeg  dw     0                              ;seg of var mem block
DirSeg  dw     0                             ;seg of dir mem block
MaxFile db     0                             ;number of files 0-250
MaxDim  db     0                              ;number of diminisions
BarPos  dw     0101h                          ;position of hilite bar
```

```
;
;Data file variables
PosTyp db     '.POS',0                    ;Positive dim data type
NegTyp db     '.NEG',0                    ;Deraliment dim data
FlTyp db     '.SLD',0                    ;file type
FileNa db     '????????.SLD',0              ;ASCIIZ file name
SearNa db     '????????.SLD',0              ;ASCIIZ file name
FileHd dw     0                           ;file handle
FileDr db     0                           ;0 = default, 1 = A etc
DataEr db     0                           ;0 = FALSE Other = TRUE
EOF    db     0                           ;0 = FALSE Other = TRUE
Report db     0                           ;0 = Pos. Other = Neg.
Ranked db     0                           ;0 = NO  Other = YES
MaxNo  dw     0                           ;number of ID's in file
;buffer used for data storage:
Flibuf db     192 DUP (0h),0h             ;file data input
; Lowest, Highest, Median, 25th and 75th persentiles for 4 groups
; and 4 dimensions = 160 bytes
;Data format: 0Dh,0Ah,I,D,#,lowest, highest, median, 25%, 75% etc stored in ASCII
PerCnt db     192 DUP (0h),0h             ;
;
;Printer port (the program expects an HP Laser Jet assigned to a parallel port)
LPT    dw     0                           ;default = LPT1
;0 = LPT1, 1 = LPT2, & 3 = LPT3
;
;Path Editor variables
Path   db     82 DUP (0h)
Input  db     82 DUP (0h)                 ;input ASCIIZ string.
Search db     82 DUP (0h)
Digit  db     1                           ;0 = OFF  Other = ON
Insert db     0                           ;0 = OFF  Other = ON
EndFld db     0                           ;0 = OFF  Other = ON
;
;Sound string
Beep   dw     6000,2,4500,2,0
       .CODE                              ;the code segment
MAIN:
;-----Determine Color and Graphics Mode
       MOV    AX,@data                    ;get data segment
       MOV    DS,AX                       ;put in data segment reg
       CALL   COLOR_MODE                  ;define default colors
       CALL   TEXT_VIDEO                  ;save default settings
;-----Main procedure for FeedBack
       CALL   INTERRUPT_HANDLER           ;INT23 & INT24 handlers
       CALL   RELEASE_MEM                 ;release unused memory
       JC     Error                       ;display Dos error
       CALL   MAIN_MENU                   ;Program's MAIN LOOP
       JC     Error                       ;display Dos error
       CALL   CLOSE_FILE                  ;close SLDI file if open
       JC     Error                       ;display DOS error.
;-----Exit to DOS                         ;progam always ends here
Exit:  CALL   RESTORE_VIDEO                ;restore users settings
```

```
        MOV     AL,[ErrCode]                    ;load errorlevel number
        MOV     AH,4Ch                          ;Exit function number
        INT     21h                             ;return to DOS
;------End of Main porcedure for FeedBack
Error:  CALL    DISPLAY_ERROR                   ;show DOS extend error
        JMP     SHORT Exit
;------End of the source code
        END     MAIN

        .DATA
;--- HP PCL strings used to position a point on the graph
NextNo  db      32,1Bh,'&k2S',1Bh,'&a+19C',1Bh,'&k0S',0 ;space + 19 comp. spaces
NextUn  db      1Bh,'&k2S',1Bh,'&a+2C',1Bh,'&k0S',0     ;2 compressed spaces
HalfSp  db      1Bh,'&k2S',1Bh,'&a+1C',1Bh,'&k0S',0     ;1 compressed spaces
BackSp  db      1Bh,'&k2S',1Bh,'&a-1C',1Bh,'&k0S',0     ;1 compressed spaces
FullBk  db      1Bh,'&k2S',1Bh,'&a-2C',1Bh,'&k0S',0     ;1 compressed spaces
;
;--- HP PCL strings used by printing procedures
Heder   db      1Bh,'(s3BSTRATEGIC LEADER DEVELOPMENT INVENTORY',0
;
IDstr   db      'ID Number: '
ID      db      '123',0                         ;3 digit ASCII number
;
PosT    db      1Bh,'&a+23C',1Bh,'&f0SSuccess Factors',1Bh,'&f1S',1Bh,'&a+2R'
        db      1Bh,'&a+3C',1Bh,'(s0B'                  ;post.row/col & unbold
        db      '|',1Bh,'&k2S',1Bh,'&a-1C',1Bh,'&k0S^Q'
        db      1Bh,'&k2S',1Bh,'&a-1C',1Bh,'&k0S-'
        db      1Bh,'&k2S',1Bh,'&a-1C',1Bh,'&k0S-'
        db      'Below Average    Better Than Most     The Best '
        db      1Bh,'&k2S',1Bh,'&a-1C',1Bh,'&k0S-'
        db      1Bh,'&k2S',1Bh,'&a-1C',1Bh,'&k0S-'
        db      1Bh,'&k2S',1Bh,'&a-1C',1Bh,'&k0S^P'
        db      1Bh,'&k2S',1Bh,'&a-1C',1Bh,'&k0S|'
        db      1Bh,'(s3B',0                    ;bold and EndOfString

NegT    db      1Bh,'&a+23C',1Bh,'&f0SFailure Factors',1Bh,'&f1S',1Bh,'&a+2R'
        db      1Bh,'&a+3C',1Bh,'(s0B'                  ;post.row/col & unbold
        db      '|',1Bh,'&k2S',1Bh,'&a-1C',1Bh,'&k0S^Q'
        db      1Bh,'&k2S',1Bh,'&a-1C',1Bh,'&k0S-'
        db      1Bh,'&k2S',1Bh,'&a-1C',1Bh,'&k0S-'
        db      'Never          Occasionally        Always '
        db      1Bh,'&k2S',1Bh,'&a-1C',1Bh,'&k0S-'
        db      1Bh,'&k2S',1Bh,'&a-1C',1Bh,'&k0S-'
        db      1Bh,'&k2S',1Bh,'&a-1C',1Bh,'&k0S^P'
        db      1Bh,'&k2S',1Bh,'&a-1C',1Bh,'&k0S|'
        db      1Bh,'(s3B',0                    ;bold and EndOfString
;
DTstr   db      'Scored: '
Date    db      '07/24/92',0                    ;file date
;
Dlstr   db      'DIMENSIONS:',1Bh,'(s0B',0              ;unBold, EndStMarker
;
```

```
FFeed  db    0Ch,0                          ;formfeed string
Point  db    4,0                           ;4  = "^D"
Median db    186,0                          ;179 = "||"
Left   db    179,0                         ;179 = "|"
Right  db    179,0                          ;179 = "|"
UntLt  db    177,0                          ;177 = "▒"
UntDk  db    178,0                          ;178 = "▓"
TenLT  db    13 DUP (177),0
TenDk  db    13 DUP (178),0
;---An HP PCL string used by Initialize_HP procedure
Init   db    1Bh,'E'                       ;reset printer
       db    1Bh,'&l1O'                     ;landscape
       db    1Bh,'&k0S'                     ;10.0 cpi
       db    1Bh,'(10U'                     ;PC-8 symbol set
       db    1Bh,'(s0P',0                   ;Fixed spacing
;---An HP PCL string used by Restore_HP procedure
Rest   db    1Bh,'&l0O'                     ;portrait
       db    1Bh,'(8U'                     ;Roman-8 symbol set
       db    1Bh,'(s1P'                    ;Proportional spacing
       db    1Bh,'E',0                     ;reset printer
;---An HP PCL string used by HPGOTOYX procedure
GoTo   db    1Bh,'&a'                       ;set hp laser to
col    dw    0                             ;ASC II column number
       db    'C',1Bh,'&a'                   ;set hp laser to
row    dw    0                             ;ASC II row number
       db    'R',0                         ;end of string marker
;---An HP PCL string to draw a graphing box and the present cursor position
Box    db    1Bh,'&f0S Raw Scores:  1'              ;starting Push
    ;ticks and "2"
       db    1Bh,'&k2S - - - - - - - - - ',1Bh,'&k0S'   ;compressed mode
       db    1Bh,'&f0S',0Ah,194,1Bh,'&f1S'              ;top tick mark
       db    1Bh,'&f0S',1Bh,'&a+6R',193,1Bh,'&f1S2'     ;bottom tick and "2"
    ;ticks and "3"
       db    1Bh,'&k2S - - - - - - - - - ',1Bh,'&k0S'   ;compressed mode
       db    1Bh,'&f0S',0Ah,194,1Bh,'&f1S'              ;top tick mark
       db    1Bh,'&f0S',1Bh,'&a+6R',193,1Bh,'&f1S3'     ;bottom tick and "3"
    ;ticks and "4"
       db    1Bh,'&k2S - - - - - - - - - ',1Bh,'&k0S'   ;compressed mode
       db    1Bh,'&f0S',0Ah,194,1Bh,'&f1S'              ;top tick mark
       db    1Bh,'&f0S',1Bh,'&a+6R',193,1Bh,'&f1S4'     ;bottom tick and "4"
    ;ticks and "5"
       db    1Bh,'&k2S - - - - - - - - - ',1Bh,'&k0S5'  ;compress and "5"
       db    1Bh,'&f1S',0Ah             ;ending Pop + line feed = next line
    ;top line
       db    1Bh,'&f0S',218,13 DUP (196),194,49 DUP (196),191
       db    1Bh,'&f1S',0Ah                          ;next line
    ;self line
       db    1Bh,'&f0S',179,'      Self ',179,1Bh,'&a+49C',179
       db    1Bh,'&f1S',0Ah                          ;next line
    ;peers line
       db    1Bh,'&f0S',179,'      Peers ',179,1Bh,'&a+49C',179
       db    1Bh,'&f1S',0Ah                          ;next line
```

```
    ;superiors line
      db    1Bh,'&f0S',179,'  Superiors ',179,1Bh,'&a+49C',179
      db    1Bh,'&f1S',0Ah                          ;next line
    ;subordinates line
      db    1Bh,'&f0S',179,'Subordinates ',179,1Bh,'&a+49C',179
      db    1Bh,'&f1S',0Ah                          ;next line
   ;bottom line
      db    192,13 DUP (196),193, 49 DUP (196),217,0   ;EndOfString marker
;---An HP PCL string to draw a graphing box and the present cursor position
Inform db    1Bh,'&f0S',218,63 DUP (196),191
      db    1Bh,'&f1S',0Ah                          ;next line
    ;self line
      db    1Bh,'&f0S',179
      db    ' ^D = Score   | = 25%   || = 50%   | = 75%   ▒ and ▒ = Range '
      db    179,1Bh,'&f1S',0Ah                        ;next line
   ;bottom line
      db    192, 63 DUP (196),217,0             ;EndOfString marker
;---An HP PCL string to label Postive Dimension #1
Pos1   db  1Bh,'(s3B'                          ;bold ON
      db  'CONCEPTUAL EFFECTIVENESS'
      db  1Bh,'(s0B'                           ;bold OFF
      db  0                                   ;current EndOfString
;---An HP PCL string to label Postive Dimension #2
Pos2   db  1Bh,'(s3B'                          ;bold ON
      db  'TEAM BUILDING'
      db  1Bh,'(s0B'                           ;bold OFF
      db  0                                   ;current EndOfString
;---An HP PCL string to label Postive Dimension #3
Pos3   db  1Bh,'(s3B'                          ;bold ON
      db  'STRATEGIC POTENTIAL'
      db  1Bh,'(s0B'                           ;bold OFF
      db  0                                   ;current EndOfString
;---An HP PCL string to label Postive Dimension #4
Pos4   db  1Bh,'(s3B'                          ;bold ON
      db  'PERFORMANCE UNDER STRESS'
      db  1Bh,'(s0B'                           ;bold OFF
      db  0                                   ;current EndOfString
;---An HP PCL string to label Derailment Dimension #1
Neg1   db  1Bh,'(s3B'                          ;bold ON
      db  'LIMITED PERSPECTIVE'
      db  1Bh,'(s0B'                           ;bold OFF
      db  0                                   ;current EndOfString
;---An HP PCL string to label Derailment Dimension #2
Neg2   db  1Bh,'(s3B'                          ;bold ON
      db  'EGOCENTRIC'
      db  1Bh,'(s0B'                           ;bold OFF
      db  0                                   ;current EndOfString
;---An HP PCL string to label Derailment Dimension #3
Neg3   db  1Bh,'(s3B'                          ;bold ON
      db  'CAREERIST'
      db  1Bh,'(s0B'                           ;bold OFF
      db  0                                   ;current EndOfString
```

```
;----An HP PCL string to label Derailment Dimension #4
Neg4   db  1Bh,'(s3B'                          ;bold ON
       db  'UNPROFESSIONAL'
       db  1Bh,'(s0B'                          ;bold OFF
       db  0                                   ;current EndOfString
       .CODE
;      Rank the data to compute lowest, 25th, 50th, 75th percentiles, and last
;      Input = None
;      Output = if completed [Ranked] < > 0 or TRUE
;               if [DataEr] = 0 a '000' data line to appended to the file
;               [PerCnt + 5] points to percentile variables
;
PROC   RANK_DATA
       PUSH   AX                               ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
       CALL   IS_RANK                          ;is file open, unranded
       JC     RD5                              ;and [MaxNo] > 0 ?
       CALL   GET_VAR_BLK                      ;create var mem block
       JC     RD5                              ;exit on DOS error
       XOR    AX,AX                            ;zero to ax
       MOV    [DataEr],AL                      ;set data error = False
       CALL   RANK_WAIT_MESS                   ;estimate how much time
       CALL   RANK_INSTRU                      ;bottom message box
       MOV    CX,16                            ;number of var to rank
RD0:   CALL   READ_VAR                         ;one var for all ID's
       CMP    AX,3                             ;were 3 or more found?
       JNC    RD1                              ;is Yes continue else
       CALL   ID_ERR                           ;display error message
       JMP    SHORT RD2                        ;loop to next variable
RD1:   CALL   PROGRESS_MESS                    ;tell user of progress
       CALL   VAR_SORT                         ;sort in DOS mem bock
       CALL   CHECK_DATA                       ;is data in bounds
       JC     RD4                              ;carry flag = abort
       CALL   STORE_VAR                        ;get median,25% & 75%
;-----Check keyboard buffer to see if the <Esc> key been pressed?
RD2:   MOV    AX,0600h                         ;DOS function # 6
       MOV    DL,0FFh                          ;read char from key-
       INT    21h                              ;board buffer.
       JZ     RD3                              ;NO key pressed continue
       CMP    AL,1Bh                           ;was it the <ESC> key?
       JNZ    RD3                              ;if NO continue
       CALL   ESC_YN                           ;if YES inform user
       JC     RD4                              ;carry flag = abort
;-----loop until each column is ranked.
RD3:   LOOP   RD0                              ;loop until cx = 0
       MOV    AL,0FFh                          ;[ranked]<>0 = TRUE
       MOV    [Ranked],AL                      ;mark file ranked
;-----if no errors write data line to file
       CMP    BYTE PTR [DataEr],0              ;any errors found?
       JNZ    RD4                              ;if Yes exit else
```

```
      CALL   APPEND_FILE                    ;save data to file
;-----normal exit point
RD4:   CALL   RELEASE_VAR_BLK                    ;release mem var block
RD5:   CLC
       POP    DX                            ;restore registers
       POP    CX
       POP    BX
       POP    AX
       RET
ENDP   RANK_DATA
;
;      Is the data file open, unranked, and ID > 0
;      Input = None
;      Output = Carry flag if Not Ready.
PROC   IS_RANK
       PUSH   AX                            ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
;-----is file selected?
       MOV    BX,[FileHd]                     ;get file handle
       CMP    BX,0                          ;is a file open?
       JNZ    RK1
       CALL   FILE_ERR
       JMP    SHORT RK4
;-----were the percentiles in the data file?
RK1:   MOV    CL,[Ranked]                        ;are percentiles set?
       CMP    CL,0                          ;if NO goto next test
       JZ     RK2
       CALL   PERCT_ERR                         ;Rerank file ?
       JC     RK5                           ;carry flag = NO
;-----is MaxNo > two ?
RK2:   MOV    AX,[MaxNo]
       CMP    AX,3
       JNC    RK5
       CALL   ID_ERR
RK4:   STC                                   ;set error flag
RK5:   POP    DX                              ;restore registers
       POP    CX
       POP    BX
       POP    AX
       RET
ENDP   IS_RANK
;
;      Input = none
;      Output = none
PROC   ID_ERR
       CALL   CLEAR_MESSAGE
       MOV    AL,[Warning]                    ;warning color
       MOV    CL,[Color]                    ;save original color
       MOV    [Color],AL                    ;set color
       MOV    AX,020Ah                       ;row 3/Col 8
```

```
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      ' Can not rank values if less than three scores.'
        db      '  Press Any Key. ',0
        MOV     [Color],CL                      ;restore original color
        CALL    HIDE_CUR
        CALL    ERR_SOUND
        CALL    GET_CHAR
        RET
ENDP    ID_ERR
;
;       Input = none
;       Output = none
PROC    PERCT_ERR
        CALL    CLEAR_MESSAGE
        MOV     AL,[Warning]                    ;warning color
        MOV     CL,[Color]                      ;save original color
        MOV     [Color],AL                      ;set color
        MOV     AX,020Bh                        ;row 3/Col 8
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      ' This data file is already ranked.  '
        db      'Rank it again?  Y/[N] ',0
        MOV     [Color],CL                      ;restore original color
        CALL    HIDE_CUR
        CALL    ERR_SOUND
PER1:   CALL    GET_CHAR
        AND     AL,5Fh                          ;turn off bits 6 & 8
        CMP     AL,'N'                          ;is it No?
        JZ      PER3                            ;if yes exit
        CMP     AL,0Dh                          ;is it <Enter>?
        JZ      PER3                            ;if not continue
        CMP     AL,'Y'                          ;is it Yes?
        JNZ     PER1                            ;if not get another
PER2:   CLC
        JMP     SHORT PER4
PER3:   STC                                     ;clear carry flag
PER4:   RET
ENDP    PERCT_ERR
;
; Release the memory variable block.
;       Input = None
;       Output = Carry flag if DOS error
;       [VarSeg] = starting segment address for variable block.
;
PROC    RELEASE_VAR_BLK
        PUSH    BX
        PUSH    CX
        PUSH    DX
        PUSH    ES
        XOR     AX,AX                           ;zero AX
        CMP     [VarSeg],AX                     ;is VarSeg assigned?
```

```
        JZ      REL1                    ;If not assigned go on
;-----release assigned memory block
        MOV     AX,[VarSeg]               ;get memory segment
        MOV     ES,AX                   ;place in ES register
        MOV     AX,4900h                  ;release funcdtion no
        INT     21h                     ;release memory block
        JC      REL1                    ;If No error continue
;-----initialize variable
        XOR     AX,AX                     ;zero to register
        MOV     [VarSeg],AX               ;set memory bock to 0
        CLC                             ;clear carry flag
REL1:   POP     ES
        POP     DX                      ;restore registers
        POP     CX
        POP     BX
        RET
ENDP    RELEASE_VAR_BLK
;
;
; Create a byte array to be used to rank each variable.
;       Input = [MaxNo] > 0
;       Output = Carry flag if DOS error
;       [VarSeg] = Starting segment address of memory block.
;       [MaxNo] = total number ID's in the file.
;
PROC    GET_VAR_BLK
        PUSH    BX
        PUSH    CX
        PUSH    DX
        PUSH    ES
        CALL    RELEASE_VAR_BLK
        JNC     CRV0                    ;continue if no error
        JMP     CRV9                    ;exit on DOS error
CRV0:   MOV     AX,[MaxNo]                    ;get number of ID's
        MOV     CL,3                    ;no. bits to shift
        SHR     AX,CL                   ;paragraph = ID/8 +2
        MOV     BX,AX                   ;paragraph count to BX
        INC     BX                      ;get an extra paragraph
        INC     BX                      ;get an extra paragraph
        MOV     AH,48h                    ;allocate men function
        INT     21h                     ;request memory block
        JC      CRV2                    ;jump if memory error.
        MOV     [VarSeg],AX               ;base address of seg
        JMP     SHORT CRV8                ;normal exit of proc.
CRV2:   MOV     CL,[Color]                ;save original color
        MOV     AL,[Warning]              ;warning color
        MOV     [Color],AL              ;set color
        MOV     AX,0207h                ;row/Col
        CALL    GOTOYX                  ;position cursor
        CALL    CSTR_OUT                ;send string to screen
        db      ' Not enough memory to rank the variables. '
        db      'Press Any Key to Continue. ', 0
```

```
        MOV     [Color],CL                      ;restore original color
        CALL    HIDE_CUR                          ;hide cursor off screen
        CALL    ERR_SOUND
        CALL    GET_CHAR                            ;wait for key is pressed
        STC                                     ;set carry flag = error
        JMP     SHORT  CRV9
CRV8:   CLC                                       ;clear carry flag
CRV9:   POP     ES
        POP     DX                              ;restore registers
        POP     CX
        POP     BX
        RET
ENDP    GET_AR_BLK
;
;
; Clear Input Buffer.
;       Input = None
;       Output = None  192 hex 0 to [FilBuf]
;
PROC    CLEAR_FILBUF
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        PUSH    ES
;-----fill [FilBuf] with 192 hex 0's
        MOV     AX,DS                           ;Make ES = DS
        MOV     ES,AX
        MOV     CX,95                           ;max number of words
        MOV     BX,Offset FilBuf                  ;pointer to ASCIIZ str
        XOR     AX,AX                           ;hex 0's to AX register
        MOV     [BX],AX                           ;0 to first word of str
        MOV     DI,BX                           ;DI = pointer to next
        INC     DI                              ;ptr to next word
        INC     DI
        MOV     SI,BX                             ;SI = ptr to hex 0's
        CLD                                     ;auto inc DI and SI
        REP     MOVSW                               ;fill string with 0's
        CLC                                     ;clear carry flag
        POP     ES
        POP     DX                                ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    CLEAR_FILBUF
;
;
; Clear Percentile variables.
;       Input = None
;       Output = None  192 hex 0 to [PerCnt]
;
```

```
PROC   CLEAR_PERCNT
       PUSH   AX
       PUSH   BX
       PUSH   CX
       PUSH   DX
       PUSH   ES
;------fill [FilBuf] with 192 hex 0's
       MOV    AX,DS                    ;Make ES = DS
       MOV    ES,AX
       MOV    CX,96                    ;max number of words
       MOV    BX,Offset PerCnt           ;pointer to ASCIIZ str
       XOR    AX,AX                    ;hex 0's to AX register
       MOV    [BX],AX                   ;0 to first word of str
       MOV    DI,BX                    ;DI = pointer to next
       INC    DI                      ;ptr to next word
       INC    DI
       MOV    SI,BX                     ;SI = ptr to hex 0's
       CLD                            ;auto inc DI and SI
       REP    MOVSW                       ;fill string with 0's
       CLC                            ;clear carry flag
       POP    ES
       POP    DX                       ;restore registers
       POP    CX
       POP    BX
       POP    AX
       RET
ENDP   CLEAR_PERCNT
;
;
; Read a variable for each ID number into DOS memory block.
;      Input = None
;      Output = AX = No of variables to sort
;                   Carry flag if DOS error
;      [VarSeg] = starting segment address for variable block.
;      NOTE: Offset for each variable are computed from the loop counter.
;      BX = stores offset ptr in memory blk or No of variables found.
;      DX = stores offset in [FilBuf]  (loop count x 3)
PROC   READ_VAR
       PUSH   BX
       PUSH   CX
       PUSH   DX
       PUSH   DS
       XOR    AX,AX                     ;zero AX
       MOV    BX,AX                     ;destination pointer
       CMP    [VarSeg],AX                 ;is VarSeg assigned?
       JZ     RVR9                     ;if not assigned go on
;------compute offset in [FilBuf]
       MOV    AX,CX                     ;loop counter to AX
       MOV    AH,AL                     ;save number in AH
       SHL    AL,1                     ;counter x 2
       ADD    AL,AH                     ;+ org counter = times 3
       XOR    AH,AH                     ;convert to 16 bits
```

```
        MOV     CX,Offset FilBuf                ;start of file buffer
        ADD     AX,CX                           ;add buffer to start
        MOV     DX,AX                           ;save offset in [FilBuf]
        CALL    GOTO_TOP                        ;reset file pointer
        JC      RVR9                            ;exit on DOS error
;-----set default ID string to ASCII zeros
        MOV     DI,Offset ID                    ;ptr to string to fill
        MOV     AX,3030h                        ;ASCII zeros
        MOV     [DI],AX                         ;place 1st two bytes
        XOR     AH,AH                           ;zero = end of string
        INC     DI                              ;advance string ptr
        INC     DI
        MOV     [DI],AX                         ;ASCII 0 and hex 0
;-----locate ID number in the data file
RVR1:   CALL    CLEAR_FILBUF                    ;hex 0's to file buffer
        CALL    READ_LINE                       ;1 line from data file
        JNC     RVR2                            ;not EndOfFile
        MOV     AL,0FFH                         ;mark EndOfFile true
        MOV     [EOF],AL                        ;<> 0 = True
;-----is this a '000' data line?
RVR2:   MOV     CX,3                            ;loop counter
        MOV     DI,Offset ID                    ;ptr to ID number
        MOV     SI,Offset FilBuf                ;ptr to data file line
        CLD                                     ;auto inc DI and SI
        REPZ    CMPSB                           ;are the bytes = ?
        JZ      RVR5                            ;skip if ID = '000'
;-----is this an ID number line?
        MOV     SI,Offset FilBuf                ;ptr to data file line
        MOV     CX,3                            ;loop counter
RVR4:   MOV     AL,[SI]                         ;get first byte
        CMP     AL,'0'                          ;is it < ASCII 0
        JC      RVR5                            ;if Yes read next line
        CMP     AL,':'                          ;is it a digit?
        JNC     RVR5                            ;if No read next line
        INC     SI                              ;point to next byte
        LOOP    RVR4                            ;check next byte
;-----is this the EndOfLine or a <spaces>?
;NOTE: this filter is designed to allow errors into the sorting array.
;  The CHECK_DATA procedure will report false data values.
        MOV     SI,DX                           ;ptr to buffer section
        MOV     AX,2000h                        ;ASCII <space>, hex 0
        CMP     [SI],AH                         ;is it a space?
        JZ      RVR5                            ;is yes skip variable
        CMP     [SI],AL                         ;is it past EndOfLine?
        JZ      RVR5                            ;if yes skip variable
        CALL    VAR_TO_BLK                      ;move variable to block
        INC     BX                              ;ptr to next word
        INC     BX
;-----is this the last line ?
RVR5:   XOR     AL,AL                           ;zero AX register
        CMP     AL,[EOF]                        ;is EndOfFile TRUE?
        JZ      RVR1                            ;False = get next line
```

```
RVR9:  MOV    AX,BX                    ;return no of variables
       SHR    AX,1                    ;number of var found
       CLC                            ;clear carry flag
       POP    DS
       POP    DX                      ;restore registers
       POP    CX
       POP    BX
       RET
ENDP   READ_VAR
;
;
;  Move twobyte ASCII number in data file to memory [VarSeg]
;      Input = BX = Offset in [VarSeg]
;              DX = Offset in [FilBuf]
;      Output = None
PROC   VAR_TO_BLK
       PUSH   AX
       PUSH   BX
       PUSH   CX
       PUSH   DX
       PUSH   ES
       MOV    AX,[VarSeg]             ;ptr to base of memblk
       MOV    ES,AX                   ;ES set to memory blk
       MOV    SI,DX                   ;source pointer
       MOV    DI,BX                   ;destination pointer
       INC    DI                      ;skip first word
       INC    DI
       MOV    AL,'5'                  ;check for rounding
       CMP    [SI + 2],AL             ;round the number ?
       JC     VTB1                    ;if < 5 = no round
;------round the number
       INC    SI                      ;point to unit byte
       INC    BYTE PTR [SI]           ;advance units digit
       CMP    BYTE PTR [SI],':'       ;is it a '9' + 1 ?
       JNZ    VTB0                    ;OK! continue
;------if over flow adjust both digits
       MOV    AL,'0'                  ;ASCII 0 to AL
       MOV    [SI],AL                 ;replace with zero
       DEC    SI                      ;ptr tens digit
       INC    BYTE PTR [SI]           ;advance tens digit
       JMP    SHORT VTB1              ;move rounded word
VTB0:  DEC    SI                      ;ptr to tens digit
;------copy word to memory for sorting
VTB1:  MOVSW
       CLC                            ;clear carry flag
VTB2:  POP    ES
       POP    DX                      ;restore registers
       POP    CX
       POP    BX
       POP    AX
       RET
ENDP   VAR_TO_BLK
```

```
;
;
;------Sort the Word Variables in [SegVar].
;
;     Input = AX = count of word variables.
;     Output = None
;     Note: this routine reassigns the DS and ES registers to [SegVar]
;     Special Note: It does not sort the first word of [SegVar] so
;                   ranking variables begin at [SegVar] + 2 Offset and
;                   go to (2 x numbers found) Offset
;     This sort is based on the following TPASCAL procedure:
;     PROCEDURE Sort;          {A Shell Sort}
;     VAR
;       Gap,J : Integer;
;       Temp : string[13];
;       TempNo : Integer;
;     Begin
;       Gap := MaxRec Div 2;
;       While gap > 0  Do
;       Begin
;         For I := (Gap + 1) to MaxRec Do
;         Begin
;           J := I-Gap;
;           While J > 0 Do
;           Begin
;             If A[J] > A[J+Gap] then
;             Begin
;               Temp := A[J];
;               A[J] := A[J+Gap];
;               A[J+Gap] := Temp;
;               J := J-Gap;
;             End
;               Else J := 0;
;           End;
;         End;
;         Gap :=Gap DIV 2;
;       End;
;     End;
;     The follow registers hold the above variables:
;     AX = Gap;  BX = J;  CX = I;  DX = MaxRec; and  BP = temp storage
;
PROC   VAR_SORT
       PUSH   AX                          ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
       PUSH   DS
       PUSH   ES
       PUSH   BP
       MOV    DX,AX                       ;store MaxRec in DX
       MOV    AX,[VarSeg]                  ;get Index base segment
       MOV    DS,AX                       ;reassign the  DS & ES
```

```
        MOV     ES,AX                   ;to ptr to the Index.
        XOR     BX,BX                   ;zero buffer pointer
        MOV     AX,2020h                 ;two spaces to pad
        MOV     [BX],AX                 ;first two unused bytes
        MOV     AX,DX                   ;Gap = MaxRec
        SHR     AX,1                   ;Gap = Gap Div by 2
VARS1:  CMP     AX,0                     ;when Gap = 0 exit.
        JLE     VARS4                  ;exit if <= 0
        MOV     CX,AX                   ;I is stored in CX
        INC     CX                     ;I = Gap + 1
VARS2:  MOV     BX,CX                       ;J in BX
        SUB     BX,AX                  ;J = I - Gap
        JZ      VARS3                  ;skip if J = 0
        JC      VARS3                  ;skip if J is < 0.
        CALL    COMPARE_VAR                 ;repeat until J = 0
VARS3:  INC     CX                      ;I = I + 1
        CMP     DX,CX                   ;Is I < or = MaxRec
        JNC     VARS2                   ;If yes then loop.
        SHR     AX,1                   ;Gap = Gap Div by 2
        JMP     SHORT VARS1
VARS4:  POP     BP                      ;restore registers
        POP     ES
        POP     DS
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET                             ;sort is complete.
;
;-----Campare and swap words if needed.
;
;       Input = AX = Gap;  BX = J;   DS & ES point to the base of index file.
;       Output = [none]     items swaped in memory if needed
;
PROC    COMPARE_VAR
        PUSH    AX                      ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     DX,AX                   ;save Gap in DX
;       Compare the first 2 bytes of each pointer
COMV1:  MOV     BP,BX                       ;save J in BP
        ADD     AX,BX                   ;AX = J + Gap
        SHL     AX,1                   ;ptr to J+Gap in mem
        SHL     BX,1                   ;ptr to J in mem
        CLD                            ;auto-inc SI, DI
        MOV     DI,AX                   ;offset of J + Gap
        MOV     SI,BX                   ;offset of J
        MOV     CX,2                    ;byte counter
        REPE    CMPSB                     ;compare strings
        JLE     COMV3                   ;exit if < or =.
;       Swap the 2 bytes of index record if string A > string A+Gap
```

```
        MOV     DI,AX                   ;offset of J + Gap
        MOV     SI,BX                   ;offset of J
        MOV     AX,[SI]                 ;read word each str.
        MOV     BX,[DI]
        MOV     [SI],BX                 ;write word each str.
        MOV     [DI],AX
        MOV     AX,DX                    ;restore gap to AX
        MOV     BX,BP                    ;restore J to BX
        SUB     BX,AX                   ;J = J - gap
        JZ      COMV3                    ;exit if J = 0.
        JNC     COMV1                     ;continue if J > 0.
COMV3:  POP     DX                        ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET                             ;return to Shell_Sort
ENDP    COMPARE_VAR
ENDP    VAR_SORT
;
;
;
; Copy first,last, median, 25th and 75th percentiles the [PerCnt] data string.
;       Input = AX = Number of variables found
;               Round AX to and even number = ptr to 50%    50/2=25%   50%+25%=75%
;               CX = loop counter (to compute which variable)
;                   6(counter-1) + 5 = position in PerCnt
;       Output =  Median  and 25% and 75% stored in [PerCnt]
;
PROC    STORE_VAR
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        PUSH    ES
        MOV     DX,AX                    ;save number found
;-----compute offset in PerCnt buffer based upon loop counter
        DEC     CX                      ;loop count -1
        MOV     AX,CX                    ;counter -1 to AL
        MOV     CL,10                    ;multiplier
        MUL     CL                      ;AX = AL times 10
        ADD     AX,5                    ;offset for median value
        MOV     BX, Offset PerCnt           ;begin of var string
        ADD     BX,AX                    ;BX= ptr to med varable
        MOV     AX,[VarSeg]                ;base of memory block
        MOV     ES,AX                    ;ES ptr to block seg
;-----get the lowest
        MOV     DI,2                    ;ptr to lowest score
        MOV     AX,[ES:DI]                ;get lowest score
        MOV     [BX],AX                  ;store lowest score
        INC     BX                      ;advance [percnt]
        INC     BX                      ;word pointer.
;-----get the highest
```

```
        MOV     AX,DX                   ;get 50% ptr
        SHL     AX,1                    ;multiply by 2
        MOV     DI,AX                   ;ptr to highest score
        MOV     AX,[ES:DI]              ;get last score
        MOV     [BX],AX                 ;store last score
        INC     BX                      ;advance [percnt]
        INC     BX                      ;word pointer.
;-----get the 50%
        TEST    DL,01h                  ;is the number even?
        JZ      STV1                    ;if Yes goto next test
        INC     DL                      ;if NO make it even
STV1:   MOV     DI,DX                   ;50% ptr
        MOV     AX,[ES:DI]              ;get 50% value
        MOV     [BX],AX                 ;store 50% value
        INC     BX                      ;advance [percnt]
        INC     BX                      ;word pointer.
;-----get the 25% and 27%
        MOV     AX,DX                   ;restore 50% ptr
        SHR     AX,1                    ;50%/2 =ptr to 25%
        TEST    AL,01h                  ;is the number even?
        JZ      STV2                    ;if Yes goto next test
        INC     AX                      ;if NO make it even
STV2:   MOV     DI,AX                   ;25% ptr in DI
        ADD     DX,AX                   ;75% ptr in DX
        MOV     AX,[ES:DI]              ;get 25% value
        MOV     [BX],AX                 ;stroe 25% value
        INC     BX                      ;advance [percnt]
        INC     BX                      ;word pointer.
        MOV     DI,DX                   ;75% ptr to DI
        MOV     AX,[ES:DI]              ;get 25% value
        MOV     [BX],AX                 ;stroe 25% value
        CLC                             ;clear carry flag
        POP     ES
        POP     DX                      ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    STORE_VAR
;
;
;       Input = none
;       Output = none
PROC    RANK_WAIT_MESS
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
;-----please wait message to screen.
        XOR     AX,AX                   ;clear menu area
        CALL    MENU_BOX
        MOV     CL,[Color]              ;save original attri
```

```
        MOV     AL,[Warning]                    ;warning color
        MOV     [Color],AL                      ;set color
        MOV     AX,010Bh                        ;row 3/Col 12
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      ' Please wait .....     Ranking the data file: ',0
        MOV     AX, Offset FileNa
        CALL    DSTR_OUT
        CALL    CSTR_OUT
        db      ' ',0
        MOV     [Color],CL                      ;restore original attri
        CALL    HIDE_CUR
        CLC
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    RANK_WAIT_MESS
;
;       Input = AX = number of scores
;               CX = loop count  16 = columns 49 - 51
;                                15 = columns 46 - 48   etc
;       Output = message to the screen
PROC    PROGRESS_MESS
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
;-----please wait message to screen.
        MOV     BX,AX                           ;save no. of scores
        MOV     DL,[Color]                      ;save original attri
        MOV     AL,[Menu]                       ;menu color
        MOV     [Color],AL                      ;set color
        MOV     AX,0108h                        ;row 3/Col 12
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      ' Please wait .....     Ranking ',0
        MOV     AX,BX                           ;restore no. of scores
        CALL    BIN_OUT
        CALL    CSTR_OUT
        db      ' scores in columns ',0
        MOV     AX,CX                           ;loop count to AX
        SHL     AX,1                            ;multiplier by two
        ADD     AX,CX                           ;AX = 3(loop count)
        INC     AX
        CALL    BIN_OUT
        CALL    CSTR_OUT
        db      ' and ',0
        INC     AX
        CALL    BIN_OUT
        CALL    CSTR_OUT
```

```
        db      '.   ',0
        MOV     [Color],DL                      ;restore original attri
        CALL    HIDE_CUR
        CLC
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    PROGRESS_MESS
;
;
;
; Check ends of sort for out of bounds data.
;       Input = AX = Number of variables found
;       Output = carry flag = abort ranking
;               EndOfArray =  Offset AX x 2
;               BeginOfArray = Offset 2
;Note: The second byte of out of bounds data maybe be rounded up one ASCII no.
;
PROC    CHECK_DATA
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        PUSH    ES
        SHL     AX,1                            ;No. found x 2 = offset
        MOV     DI,AX                           ;to EndOfArray
        MOV     AX,[VarSeg]                     ;base of memory block
        MOV     ES,AX                           ;ES ptr to block seg
        MOV     AX,[ES:DI]                      ;get end value
        MOV     DX,AX                           ;save value in DX
;-----is endofarray value larger than "50"?
        CMP     AL,'6'                          ;is digit > 5
        JNC     CDK3                            ;if Yes then error
        CMP     AL,'5'                          ;is it = '5'?
        JNZ     CKD1                            ;is Yes check for '0'
        CMP     AH,'0'                          ;is it = '0'
        JNZ     CDK3                            ;if NO then error
        JMP     SHORT CKD2
CKD1:   CMP     AH,':'                          ;is digit > 9
        JNC     CDK3                            ;if Yes then error
;-----is beginofarray valus less than "10" ?
CKD2:   MOV     DI,2                            ;to BeginOfArray
        MOV     AX,[ES:DI]                      ;get end value
        MOV     DX,AX                           ;save value in DX
        CMP     AL,'1'                          ;is digit < '1'?
        JC      CDK3                            ;if Yes then error
        CMP     AH,'0'                          ;is it < '0'?
        JNC     CDK4                            ;if NO then normal exit
;-----report data error
CDK3:   CALL    DATA_ERR                        ;inform user of error
```

```
CDK4:  POP    ES
       POP    DX                          ;restore registers
       POP    CX
       POP    BX
       POP    AX
       RET
ENDP   CHECK_DATA
;
;
;
; Inform user of err found in the data file.
;      Input CX = Loop counter (used to compute column number)
;           DX = WORD that is out of bounds
;      Output   Carry flag = abort ranking
;Note: The second byte of out of bounds data maybe be rounded up one ASCII no.
;A zero line no. means the GET_LINE_NO search failed. This should never happen!
PROC   DATA_ERR
       PUSH   AX
       PUSH   BX
       PUSH   CX
       PUSH   DX
;-----compute offset in [FilBuf]
       MOV    AX,CX                        ;loop counter to AX
       MOV    AH,AL                        ;save number in AH
       SHL    AL,1                        ;counter x 2
       ADD    AL,AH                        ;+ org counter = times 3
       XOR    AH,AH                        ;convert to 16 bits
         INC    AX                                ;change to 1 - ? form
         MOV    CX,AX                             ;CX = column no 1-?
       CALL   GET_LINE_NO                     ;line No. of error
       JNC    DAE1                        ;BP = Word found
       XOR    AX,AX                       ;0 = line not found????
DAE1:  MOV    BX,AX                          ;BX = line no 1 - ?
       MOV    AL,[Warning]                  ;warning color
         MOV    DL,[Color]                        ;save original color
       MOV    [Color],AL                  ;set color
       MOV    AX,0207h                     ;row 3/Col 6
       CALL   GOTOYX                       ;set cursor
       CALL   CSTR_OUT                     ;display warning
       db     " Data Error in file:  '",0
         MOV    SI, Offset ID + 1
         MOV    AX,BP
       MOV    [SI],AX
       MOV    AX,SI
       CALL   DSTR_OUT
       CALL   CSTR_OUT                        ;display warning
       db     "' in line ",0
         MOV    AX,BX
         CALL   BIN_OUT
         CALL   CSTR_OUT                              ;display warning
         db     ', column ',0
         MOV    AX,CX
```

```
        CALL   BIN_OUT
      CALL   CSTR_OUT                    ;display warning
      db     '. Press Any Key. ',0
      MOV    [Color],DL                  ;restore original color
      CALL   HIDE_CUR
      CALL   ERR_SOUND
      CALL   GET_CHAR
      CMP    AL,1Bh                      ;was it the <ESC> key?
      JNZ    DAE2                        ;if NO continue
      CALL   ESC_YN                      ;if YES inform user
      JC     DAE3                        ;carry flag = abort
DAE2: CALL   CLEAR_MESSAGE
      CLC                                ;clear carry flag
DAE3: POP    DX                          ;restore registers
      POP    CX
      POP    BX
      POP    AX
      RET
ENDP  DATA_ERR
;
;
; Locate a WORD in a given column of the data file.
;       Input = DX = WORD  (looking for word or word + 1)
;              CX = Column counter (1 - ? Form)
;       Output = AX = Line Number  (1 to ?? form)
;              BP = WORD found
;              Carry flag = no find
PROC  GET_LINE_NO
      PUSH   BX
      PUSH   CX
        PUSH  DX
      PUSH   DS
        CALL   GOTO_TOP                  ;reset file pointer
      JC     FDW4                        ;exit on DOS error
;-----assign buffer offset
        MOV    BX, Offset FilBuf
        DEC    CX                        ;column to 0 - ? form
        ADD    BX,CX                     ;bx = buffer pointer
        XOR    CX,CX                     ;zero line counter
      MOV    BP,DX                       ;store original value
      DEC    DH                          ;adjust for loop
FDW1: INC    DH                          ;dx = search word + 0
        CALL   CLEAR_FILBUF              ;hex 0's to file buffer
      CALL   READ_LINE                   ;1 line from data file
      JNC    FDW2                        ;not EndOfFile
      MOV    AL,0FFH                     ;mark EndOfFile true
      MOV    [EOF],AL                    ;<> 0 = True
;-----is this the correct line?
FDW2: INC    CX                          ;Inc line counter
      CMP    [BX],DX                     ;is this a match
      JZ     FDW3
      DEC    DH                          ;dx = search word - 1
```

```
        CMP     [BX],DX                         ;is this a match
        JZ      FDW3
;-----is this the last line ?
        XOR     AL,AL                           ;zero AX register
        CMP     AL,[EOF]                        ;is EndOfFile TRUE?
        JZ      FDW1                            ;False = get next line
        STC                                     ;cf = word not found
        JMP     FDW4                            ;mark not found
;-----OK! Word is found
FDW3:   MOV     BP,DX                           ;return WORD in BP
        MOV     AX,CX                           ;Line number to AX
        CLC                                     ;clear carry flag
FDW4:   POP     DS
        POP     DX                              ;restore registers
        POP     CX
        POP     BX
        RET
ENDP    GET_LINE_NO
;
;
;       Input = none
;       Output = carry flag = abort printing
PROC    ESC_YN
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        CALL    CLEAR_MESSAGE
        MOV     CL,[Color]                      ;store original Color
        MOV     AL,[Warning]                    ;warning color
        MOV     [Color],AL                      ;set color
        MOV     AX,020Dh                        ;row 3/Col 12
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      " Do you want to ABORT the ranking process ? "
        db      " Y/N ",0
        MOV     [Color],CL                      ;restore original color
ESY1:   CALL    HIDE_CUR
        CALL    GET_CHAR
        AND     AL,0DFh                         ;turn off bit 6
        CMP     AL,'N'                          ;is it No?
        JZ      ESY4                            ;if yes exit
ESY2:   CMP     AL,'Y'                          ;is it Yes?
        JNZ     ESY3                            ;if not continue
        STC                                     ;set carry flag = abort
        JMP     SHORT ESY5                      ;exit
ESY3:   CALL    ERR_SOUND
        JMP     SHORT ESY1
ESY4:   CALL    CLEAR_MESSAGE                   ;empty message line
        CLC                                     ;clear cf = continue
ESY5:   POP     DX
        POP     CX
```

```
        POP     BX
        POP     AX
        RET
ENDP    ESC_YN
;
;
;------Instructions for rank command.
;       Input = None
;       Output = None
;
PROC    RANK_INSTRU
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AX,1500h                        ;row 21,column 0
        CALL    MENU_BOX                        ;draw menu box
        MOV     CL,[Color]                      ;get assigned color
        MOV     AL,[Menu]                       ;get menu color
        MOV     [Color],AL                      ;set menu color
        MOV     AX,160Ah                        ;row 22,column 12
        CALL    GOTOYX
        CALL    CSTR_OUT
        db      'Press the <Esc> key to pause or cancel the '
        db      'ranking of scores.',0
        CALL    HIDE_CUR
        MOV     [Color],CL                      ;restore assigned color
        POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    RANK_INSTRU
;
;
; Append the [PerCnt] string to the data file.
;       Input = None
;       Output = [PerCnt] variables to end of data file.
;
PROC    APPEND_FILE
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        PUSH    ES
        MOV     AX,DS                           ;Make ES = DS
        MOV     ES,AX
        MOV     BX,Offset PerCnt
;------place <return> and <line feed> beginning of data string
        MOV     AX,0A0Dh                        ;line feed & carry ret
        MOV     [BX],AX                         ;place in data string
        INC     BX
```

```
        INC     BX
;-----place and ID of '000' in data string
        MOV     AX,'00'
        MOV     [BX],AX
        INC     BX
        INC     BX
        MOV     [BX],AL
;-----place  two (<return> + <line feed>) at end of string
        MOV     BX,Offset PerCnt + 165
        MOV     AX,0A0Dh                        ;line feed & carry ret
        MOV     [BX],AX                         ;place in data string
        INC     BX                              ;ptr to PerCnt + 103
        INC     BX
        MOV     [BX],AX                         ;place in data string
;-----place file pointer to the End of File.
        MOV     BX,[FileHd]                     ;get file handle
        XOR     CX,CX                           ;set offset = 0
        MOV     DX,CX                           ;set offset = 0
        MOV     AX,4202h                        ;set file pointer no.
        INT     21h                             ;set to End of File
        JC      APP1                            ;exit if error.
;-----inform user if disk is full
        MOV     AX,169                          ;number of bytes needed
        CALL    IS_FULL                         ;is room available?
        JC      APP1                            ;if NO skip write
;-----Append 169 bytes to the file.
        MOV     AX,4000h                        ;write to file: func. no.
        MOV     CX,169                          ;no. of bytes to write
        MOV     DX,Offset PerCnt                ;ptr to data to write
        INT     21h                             ;write to the file
;-----No error checking because nothing is lost if the write failes.
APP1:   CLC                                     ;clear carry flag
        POP     ES
        POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    APPEND_FILE
;
        .CODE
;
;-----Print a report for each ID number in the data file.
;       Input = None
;       Output = None
;       BX = DOS timer ticks + 25 seconds
PROC    PRINT_ALL_REPORTS
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        CALL    GOTO_TOP                        ;file ptr to top of file
```

```
        JC      PRA5                    ;exit on DOS error
        CALL    PROGRESS_MESSAGE                ;inform user of progress
        CALL    PRINT_INSTRU            ;display bottom box
        CALL    INITIALIZE_HP           ;hp to portrait mode
        JC      PRA4                    ;exit if printer error
;-----get DOS timer ticks
PRA1:   MOV     AH,0                    ;function number
        INT     1Ah                     ;get DOS clock ticks
        MOV     BX,DX                   ;save ticks in CX
        MOV     AX,455                  ;18.2 ticks per second
        ADD     BX,AX                   ;add 25 seconds
        JC      PRA1                    ;loop if over flow
;-----locate next ID number
        CALL    FIND_DATA_LINE          ;locate Next ID number
        JC      PRA3                    ;Normal Exit EndOfFile
        CALL    PROGRESS_MESSAGE                ;inform user of progress
        CALL    PRINT_TITLE             ;print report header
        JC      PRA4                    ;exit if printer error
;-----print each dimension
        CALL    PRINT_DIM1              ;print dimension 1
        JC      PRA4                    ;exit if printer error
        CALL    PRINT_DIM2              ;print dimension 2
        JC      PRA4                    ;exit if printer error
        CALL    PRINT_DIM3              ;print dimension 3
        JC      PRA4                    ;exit if printer error
        CALL    PRINT_DIM4              ;print dimension 4
        JC      PRA4                    ;exit if printer error
        CALL    EJECT                   ;eject chart from HP
        JC      PRA4                    ;exit if printer error
;-----is 25 seconds up yet?
PRA2:   MOV     AH,0                    ;function number
        INT     1Ah                     ;get DOS clock ticks
        CMP     DX,BX                   ;has time run out ?
        JC      PRA2                    ;if not loop until done
;-----loop until all graphs are printed
        JMP     SHORT PRA1              ;go print next graph
;-----normal exit point
PRA3:   CALL    RESTORE_HP                      ;reset to normal defaults
        CLC                             ;normal exit
        JMP     SHORT PRA5
;-----abort exit point
PRA4:   CALL    RESTORE_HP
        STC                             ;abort or error exit
PRA5:   POP     DX                      ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    PRINT_ALL_REPORTS
;
;-------Print a report for a user supplied ID number.
;       Input = None
```

```
;     Output = None
PROC   PRINT_ONE_REPORT
       PUSH   AX                          ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
;------get ID number
       CALL   GET_ID
       JC     PRI5                        ;exit on <Esc> key
;------locate ID number in the data file
       CALL   LOCATE                        ;locate ID Number
       JC     PRI5                        ;exit if not found
;------printing of a report begins here
       CALL   PROGRESS_MESSAGE                  ;inform user of progress
       CALL   PRINT_INSTRU                   ;display bottom box
       CALL   INITIALIZE_HP                 ;hp to portrait mode
       JC     PRI4                        ;exit if printer error
       CALL   PRINT_TITLE                   ;print report header
       JC     PRI4                        ;exit if printer error
;------print each dimension
       CALL   PRINT_DIM1                    ;print dimension 1
       JC     PRI4                        ;exit if printer error
       CALL   PRINT_DIM2                    ;print dimension 2
       JC     PRI4                        ;exit if printer error
       CALL   PRINT_DIM3                    ;print dimension 3
       JC     PRI4                        ;exit if printer error
       CALL   PRINT_DIM4                    ;print dimension 4
       JC     PRI4                        ;exit if printer error
       CALL   EJECT                       ;eject chart from HP
       JC     PRI4                        ;exit if printer error
PRI3:  CALL   RESTORE_HP                        ;reset to normal defaults
       CLC                                 ;normal exit
       JMP    SHORT PRI5
PRI4:  CALL   RESTORE_HP
       STC                                 ;abort or error exit
PRI5:  POP    DX                           ;restore registers
       POP    CX
       POP    BX
       POP    AX
       RET
ENDP   PRINT_ONE_REPORT
;
;
;------Print positive dimension number 1 on an HP laser.
;     Input = None
;     Output = Cary flag = abort printing
PROC   PRINT_DIM1
       PUSH   AX                          ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
;------print dimension name
```

```
        MOV     AX,0B06h                ;row/col hex
        CALL    HPGOTOYX                ;set positon
        JNC     P10                     ;if on error continue
        JMP     P13                     ;exit on printer error
;-----is this a POS or NEG dimensions?
P10:    CMP     BYTE PTR [Report],0     ;get type of report
        JZ      P11                     ;jump if positive
        MOV     AX,Offset Neg1          ;ptr to derailment str
        JMP     SHORT P12               ;jump to print the str
P11:    MOV     AX,Offset Pos1          ;ptr to positive str
P12:    CALL    PRINT_STRING            ;print the string
        JC      P13                     ;exit on printer error
;-----draw chart outline
        MOV     AX,0822h                ;row/col hex
        CALL    HPGOTOYX                ;set positon
        JC      P13                     ;exit on error
        MOV     AX,Offset Box           ;ptr to draw box string
        CALL    PRINT_STRING            ;draw the dim box
        JC      P13                     ;exit on printer error
;-----chart percentile for selfs, peers, superiors and subordinates
        MOV     AX,0A30h                ;row/col of '1' hex
        MOV     BX,Offset PerCnt + 5    ;ptr to self data
        CALL    CHART_RANGE_L           ;draw shaded area
        JC      P13                     ;exit on error
        CALL    CHART_PERCENTILES       ;draw the data
        JC      P13                     ;exit on error
        INC     AH                      ;row to peers
        MOV     BX,Offset PerCnt + 45   ;ptr to peers data
        CALL    CHART_RANGE_D           ;draw shaded area
        JC      P13                     ;exit on error
        CALL    CHART_PERCENTILES       ;draw the data
        JC      P13                     ;exit on error
        INC     AH                      ;row to superiors
        MOV     BX,Offset PerCnt + 85   ;ptr to superiors data
        CALL    CHART_RANGE_L           ;draw shaded area
        JC      P13                     ;exit on error
        CALL    CHART_PERCENTILES       ;draw the data
        JC      P13                     ;exit on error
        INC     AH                      ;row to subordinates
        MOV     BX,Offset PerCnt + 125  ;ptr to subordinates
        CALL    CHART_RANGE_D           ;draw shaded area
        JC      P13                     ;exit on error
        CALL    CHART_PERCENTILES       ;draw the data
        JC      P13                     ;exit on error
;-----chart points for self, peers, superiors and subordinates
        MOV     AX,0A30h                ;restore row/col of '1'
        MOV     BX,Offset FillBuf + 3   ;ptr to self point
        CALL    CHART_POINT             ;ax=starting row/col
        JC      P13                     ;exit on error
        INC     AH                      ;row to peers
        MOV     BX,Offset FillBuf + 15  ;ptr to self point
        CALL    CHART_POINT             ;ax=starting row/col
```

```
        JC      P13                             ;exit on error
        INC     AH                              ;row to superiors
        MOV     BX,Offset FillBuf + 27              ;ptr to self point
        CALL    CHART_POINT                         ;ax=starting row/col
        JC      P13                             ;exit on error
        INC     AH                              ;row to subordinates
        MOV     BX,Offset FillBuf + 39              ;ptr to self point
        CALL    CHART_POINT                         ;ax=starting row/col
        JC      P13                             ;exit on error
;-----check if to see if any special messages need to be printed.
;       NOTE: to be completed at a later date.
;
        CLC                                     ;clear carry flag
P13:    POP     DX                                  ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    PRINT_DIM1
;
;-----Print positive dimension number 2 on an HP laser.
;       Input = None
;       Output = Cary flag = abort printing
PROC    PRINT_DIM2
        PUSH    AX                                  ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
;-----print dimension name
        MOV     AX,1306h                            ;row/col hex
        CALL    HPGOTOYX                            ;set positon
        JNC     P20                                 ;if on error continue
        JMP     P23                                 ;exit on printer error
;-----is this a POS or NEG dimensions?
P20:    CMP     BYTE PTR [Report],0                     ;get type of report
        JZ      P21                             ;jump if positive
        MOV     AX,Offset Neg2                      ;ptr to derailment str
        JMP     SHORT P22                           ;jump to print the str
P21:    MOV     AX,Offset Pos2                      ;ptr to positive str
P22:    CALL    PRINT_STRING                        ;print the string
        JC      P23                             ;exit on printer error
;-----draw chart outline
        MOV     AX,1022h                            ;row/col hex
        CALL    HPGOTOYX                            ;set positon
        JC      P23                             ;exit on error
        MOV     AX,Offset Box                       ;ptr to draw box string
        CALL    PRINT_STRING                        ;draw the dim box
        JC      P23                             ;exit on printer error
;-----chart percentile for selfs, peers, superiors and subordinates
        MOV     AX,1230h                            ;row/col of '1' hex
        MOV     BX,Offset PerCnt + 15               ;ptr to self data
        CALL    CHART_RANGE_L                       ;draw shaded area
```

```
        JC      P23                             ;exit on error
        CALL    CHART_PERCENTILES                   ;draw the data
        JC      P23                             ;exit on error
        INC     AH                              ;row to peers
        MOV     BX,Offset PerCnt + 55               ;ptr to peers data
        CALL    CHART_RANGE_D                       ;draw shaded area
        JC      P23                             ;exit on error
        CALL    CHART_PERCENTILES                   ;draw the data
        JC      P23                             ;exit on error
        INC     AH                              ;row to superiors
        MOV     BX,Offset PerCnt + 95               ;ptr to superiors data
        CALL    CHART_RANGE_L                       ;draw shaded area
        JC      P23                             ;exit on error
        CALL    CHART_PERCENTILES                   ;draw the data
        JC      P23                             ;exit on error
        INC     AH                              ;row to subordinates
        MOV     BX,Offset PerCnt + 135              ;ptr to subordinates
        CALL    CHART_RANGE_D                       ;draw shaded area
        JC      P23                             ;exit on error
        CALL    CHART_PERCENTILES                   ;draw the data
        JC      P23                             ;exit on error
;-----chart points for self, peers, superiors and subordinates
        MOV     AX,1230h                        ;restore row/col of '1'
        MOV     BX,Offset FillBuf + 6           ;ptr to self point
        CALL    CHART_POINT                     ;ax=starting row/col
        JC      P23                             ;exit on error
        INC     AH                              ;row to peers
        MOV     BX,Offset FillBuf + 18              ;ptr to self point
        CALL    CHART_POINT                         ;ax=starting row/col
        JC      P23                             ;exit on error
        INC     AH                              ;row to superiors
        MOV     BX,Offset FillBuf + 30              ;ptr to self point
        CALL    CHART_POINT                         ;ax=starting row/col
        JC      P23                             ;exit on error
        INC     AH                              ;row to subordinates
        MOV     BX,Offset FillBuf + 42              ;ptr to self point
        CALL    CHART_POINT                         ;ax=starting row/col
        JC      P23                             ;exit on error
;-----check if to see if any special messages need to be printed.
;       NOTE: to be completed at a later date.
;
        CLC                                     ;clear carry flag
P23:    POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    PRINT_DIM2
;
;-----Print positive dimension number 3 on an HP laser.
;       Input = None
;       Output = Cary flag = abort printing
```

```
PROC   PRINT_DIM3
       PUSH   AX                          ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
;------print dimension name
       MOV    AX,1B08h                      ;row/col hex
       CALL   HPGOTOYX                        ;set positon
       JNC    P30                          ;if on error continue
       JMP    P33                          ;exit on printer error
;------is this a POS or NEG dimensions?
P30:   CMP    BYTE PTR [Report],0               ;get type of report
       JZ     P31                          ;jump if positive
       MOV    AX,Offset Neg3                    ;ptr to derailment str
       JMP    SHORT P32                         ;jump to print the str
P31:   MOV    AX,Offset Pos3                    ;ptr to positive str
P32:   CALL   PRINT_STRING                       ;print the string
       JC     P33                          ;exit on printer error
;------draw chart outline
       MOV    AX,1822h                      ;row/col hex
       CALL   HPGOTOYX                        ;set positon
       JC     P33                          ;exit on error
       MOV    AX,Offset Box                     ;ptr to draw box string
       CALL   PRINT_STRING                      ;draw the dim box
       JC     P33                          ;exit on printer error
;------chart percentile for selfs, peers, superiors and subordinates
       MOV    AX,1A30h                      ;row/col of '1' hex
       MOV    BX,Offset PerCnt + 25             ;ptr to self data
       CALL   CHART_RANGE_L                     ;draw shaded area
       JC     P33                          ;exit on error
       CALL   CHART_PERCENTILES                 ;draw the data
       JC     P33                          ;exit on error
       INC    AH                           ;row to peers
       MOV    BX,Offset PerCnt + 65             ;ptr to peers data
       CALL   CHART_RANGE_D                     ;draw shaded area
       JC     P33                          ;exit on error
       CALL   CHART_PERCENTILES                 ;draw the data
       JC     P33                          ;exit on error
       INC    AH                           ;row to superiors
       MOV    BX,Offset PerCnt + 105            ;ptr to superiors data
       CALL   CHART_RANGE_L                     ;draw shaded area
       JC     P33                          ;exit on error
       CALL   CHART_PERCENTILES                 ;draw the data
       JC     P33                          ;exit on error
       INC    AH                           ;row to subordinates
       MOV    BX,Offset PerCnt + 145            ;ptr to subordinates
       CALL   CHART_RANGE_D                     ;draw shaded area
       JC     P33                          ;exit on error
       CALL   CHART_PERCENTILES                 ;draw the data
       JC     P33                          ;exit on error
;------chart points for self, peers, superiors and subordinates
       MOV    AX,1A30h                      ;restore row/col of '1'
```

```
        MOV     BX,Offset FillBuf + 9           ;ptr to self point
        CALL    CHART_POINT                      ;ax=starting row/col
        JC      P33                             ;exit on error
        INC     AH                              ;row to peers
        MOV     BX,Offset FillBuf + 21          ;ptr to self point
        CALL    CHART_POINT                      ;ax=starting row/col
        JC      P33                             ;exit on error
        INC     AH                              ;row to superiors
        MOV     BX,Offset FillBuf + 33          ;ptr to self point
        CALL    CHART_POINT                      ;ax=starting row/col
        JC      P33                             ;exit on error
        INC     AH                              ;row to subordinates
        MOV     BX,Offset FillBuf + 45          ;ptr to self point
        CALL    CHART_POINT                      ;ax=starting row/col
        JC      P33                             ;exit on error
;-----check if to see if any special messages need to be printed.
;       NOTE: to be completed at a later date.
;
        CLC                                     ;clear carry flag
P33:    POP     DX                               ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    PRINT_DIM3
;
;-----Print positive dimension number 4 on an HP laser.
;       Input = None
;       Output = Cary flag = abort printing
PROC    PRINT_DIM4
        PUSH    AX                               ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
;-----print dimension name
        MOV     AX,2308h                         ;row/col hex
        CALL    HPGOTOYX                         ;set positon
        JNC     P40                             ;if on error continue
        JMP     P43                             ;exit on printer error
;-----is this a POS or NEG dimensions?
P40:    CMP     BYTE PTR [Report],0              ;get type of report
        JZ      P41                             ;jump if positive
        MOV     AX,Offset Neg4                  ;ptr to derailment str
        JMP     SHORT P42                       ;jump to print the str
P41:    MOV     AX,Offset Pos4                   ;ptr to positive str
P42:    CALL    PRINT_STRING                     ;print the string
        JC      P43                             ;exit on printer error
;-----draw chart outline
        MOV     AX,2022h                         ;row/col hex
        CALL    HPGOTOYX                         ;set positon
        JC      P43                             ;exit on error
        MOV     AX,Offset Box                    ;ptr to draw box string
```

```
        CALL    PRINT_STRING                    ;draw the dim box
        JC      P43                             ;exit on printer error
;-----chart percentile for selfs, peers, superiors and subordinates
        MOV     AX,2230h                        ;row/col of '1' hex
        MOV     BX,Offset PerCnt + 35           ;ptr to self data
        CALL    CHART_RANGE_L                   ;draw shaded area
        JC      P43                             ;exit on error
        CALL    CHART_PERCENTILES               ;draw the data
        JC      P43                             ;exit on error
        INC     AH                              ;row to peers
        MOV     BX,Offset PerCnt + 75           ;ptr to peers data
        CALL    CHART_RANGE_D                   ;draw shaded area
        JC      P43                             ;exit on error
        CALL    CHART_PERCENTILES               ;draw the data
        JC      P43                             ;exit on error
        INC     AH                              ;row to superiors
        MOV     BX,Offset PerCnt + 115          ;ptr to superiors data
        CALL    CHART_RANGE_L                   ;draw shaded area
        JC      P43                             ;exit on error
        CALL    CHART_PERCENTILES               ;draw the data
        JC      P43                             ;exit on error
        INC     AH                              ;row to subordinates
        MOV     BX,Offset PerCnt + 155          ;ptr to subordinates
        CALL    CHART_RANGE_D                   ;draw shaded area
        JC      P43                             ;exit on error
        CALL    CHART_PERCENTILES               ;draw the data
        JC      P43                             ;exit on error
;-----chart points for self, peers, superiors and subordinates
        MOV     AX,2230h                        ;restore row/col of '1'
        MOV     BX,Offset FillBuf + 12          ;ptr to self point
        CALL    CHART_POINT                     ;ax=starting row/col
        JC      P43                             ;exit on error
        INC     AH                              ;row to peers
        MOV     BX,Offset FillBuf + 24          ;ptr to self point
        CALL    CHART_POINT                     ;ax=starting row/col
        JC      P43                             ;exit on error
        INC     AH                              ;row to superiors
        MOV     BX,Offset FillBuf + 36          ;ptr to self point
        CALL    CHART_POINT                     ;ax=starting row/col
        JC      P43                             ;exit on error
        INC     AH                              ;row to subordinates
        MOV     BX,Offset FillBuf + 48          ;ptr to self point
        CALL    CHART_POINT                     ;ax=starting row/col
        JC      P43                             ;exit on error
;-----check if to see if any special messages need to be printed.
;       NOTE: to be completed at a later date.
;
        CLC                                     ;clear carry flag
P43:    POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
```

```
        RET
ENDP    PRINT_DIM4
;
        .CODE
;
;
;-----Send ASCII string to the Line Printer at port [LPT]
;       Input = AX pointer to beginning of string in data section
;               CH = number of tries if busy   CL = store char
;       Output = Carry flag = abort printing
PROC    PRINT_STRING
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     BX,AX                           ;ptr to ASCII string
        XOR     CH,CH                           ;zero loop counter
;-----Check keyboard buffer to see if the <Esc> key been pressed?
PS1:    MOV     AX,0600h                        ;DOS function # 6
        MOV     DL,0FFh                         ;read char from key-
        INT     21h                             ;board buffer.
        JZ      PS2                             ;NO key pressed continue
        CMP     AL,1Bh                          ;was it the <ESC> key?
        JNZ     PS2                             ;If NO continue
        CALL    PRT_ERROR3                      ;If YES inform user
        JC      PS8                             ;carry flag = abort
;-----get character to be sent to LPT port
PS2:    MOV     AL,[BX]                         ;load Char to send
        CMP     AL,0                            ;is this end of string?
        JZ      PS8                             ;If yes normal exit.
;-----send character to assigned LPT port
        MOV     AH,0                            ;BIOS function number
        MOV     DX,[LPT]                        ;get LPT port assign.
        INT     17h                             ;get port status
        CMP     BYTE PTR [DeBug],0              ;is debug ON ?
        JZ      PS3                             ;If NO goto next test
        CALL    SHOW_AH                         ;bitmap of AH to screen
;-----test bit 5 of 8.  If bit 5 = 0 then no power.
PS3:    TEST    AH,10h                          ;Is printer powered up?
        JNZ     PS5                             ;OK! <>0 goto next test
        CALL    PRT_ERROR1                      ;display error message
        JC      PS8                             ;carry flag = abort
        CALL    PROGRESS_MESSAGE                ;inform user of progress
        JMP     SHORT PS1                       ;send same char again
;-----test bit 4 & 6 of 8.  bit 4 = I/O error; 6 = printer out of paper.
PS5:    XOR     CH,CH                           ;loop counter to zero
        TEST    AH,28h                          ;I/O or out of paper?
        JZ      PS6                             ;If NO send char
        CALL    PRT_ERROR2                      ;If YES tell user.
        JC      PS8                             ;cf = abort
        CALL    PROGRESS_MESSAGE                ;inform user of progress
        JMP     SHORT PS1                       ;send same char again
```

```
;------test bit 1 of 8.  If bit 1 = 1 then printer time-out
PS6:   TEST   AH,01                    ;is printer time-out?
       JZ     PS7                      ;if NO send next char
       CALL   PRT_ERROR4                 ;inform user or timeout
       JC     PS8                      ;cf = abort else
       CALL   PROGRESS_MESSAGE                ;inform user of progress
       JMP    SHORT PS1                ;send same char again
PS7:   INC    BX                       ;point to next char
       JMP    SHORT PS1                ;loop until finished
PS8:   POP    DX                       ;restore registers
       POP    CX
       POP    BX
       POP    AX
       RET
;
;      Input = none
;      Output = carry flag = abort printing
PROC   PRT_ERROR1
       PUSH   AX
       PUSH   BX
       PUSH   CX
       PUSH   DX
       CALL   CLEAR_MESSAGE              ;empty message line
       MOV    CL,[Color]                 ;store original Color
       MOV    AL,[Warning]               ;warning color
       MOV    [Color],AL                 ;set color
       MOV    AX,020Bh                   ;row 3/Col 12
       CALL   GOTOYX                     ;set cursor
       CALL   CSTR_OUT                   ;display warning
       db     " Printer is off line.  Do you want to try again ? "
       db     " Y/N ",0
       MOV    [Color],CL                 ;restore original color
PRE1:  CALL   HIDE_CUR
       CALL   ERR_SOUND
       CALL   GET_CHAR
       AND    AL,5Fh                     ;turn off bits 6 & 8
       CMP    AL,'N'                     ;is it No?
       JZ     PRE4                       ;if yes exit
PRE2:  CMP    AL,'Y'                     ;is it Yes?
       JNZ    PRE3                       ;if not continue
       CLC                               ;clear carry flag
       JMP    SHORT PRE5                 ;exit
PRE3:  CALL   ERR_SOUND
       JMP    SHORT PRE1
PRE4:  CALL   CLEAR_MESSAGE              ;empty message line
       STC                               ;set carry flag
PRE5:  POP    DX
       POP    CX
       POP    BX
       POP    AX
       RET
ENDP   PRT_ERROR1
```

```
;
;     Input = none
;     Output = carry flag = abort printing
PROC   PRT_ERROR2
       PUSH   AX
       PUSH   BX
       PUSH   CX
       PUSH   DX
       CALL   CLEAR_MESSAGE
       MOV    CL,[Color]                    ;store original Color
       MOV    AL,[Warning]                   ;warning color
       MOV    [Color],AL                    ;set color
       MOV    AX,0207h                      ;row 3/Col 12
       CALL   GOTOYX                         ;set cursor
       CALL   CSTR_OUT                       ;display warning
       db     " Printer Error. Check the paper. Do you want to continue ? "
       db     " Y/N ",0
       MOV    [Color],CL                    ;restore original color
PRR1:  CALL   HIDE_CUR
       CALL   ERR_SOUND
       CALL   GET_CHAR
       AND    AL,5Fh                        ;turn off bit 6 & 8
       CMP    AL,'N'                        ;is it No?
       JZ     PRR4                          ;if yes exit
PRR2:  CMP    AL,'Y'                         ;is it Yes?
       JNZ    PRR3                          ;if not continue
       CLC                                  ;clear carry flag
       JMP    SHORT PRR5                     ;exit
PRR3:  CALL   ERR_SOUND
       JMP    SHORT PRR1
PRR4:  CALL   CLEAR_MESSAGE                          ;empty message line
       STC                                  ;set carry flag
PRR5:  POP    DX
       POP    CX
       POP    BX
       POP    AX
       RET
ENDP   PRT_ERROR2
;
;
;     Input = none
;     Output = carry flag = abort printing
PROC   PRT_ERROR3
       PUSH   AX
       PUSH   BX
       PUSH   CX
       PUSH   DX
       CALL   CLEAR_MESSAGE
       MOV    CL,[Color]                    ;store original Color
       MOV    AL,[Warning]                   ;warning color
       MOV    [Color],AL                    ;set color
       MOV    AX,020Bh                      ;row 3/Col 12
```

```
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      " Do you want to ABORT the print instructions ? "
        db      " Y/N ",0
        MOV     [Color],CL                      ;restore original color
PEE1:   CALL    HIDE_CUR
        CALL    GET_CHAR
        AND     AL,5Fh                          ;turn off bit 6 & 8
        CMP     AL,'N'                          ;is it No?
        JZ      PEE4                            ;if yes exit
PEE2:   CMP     AL,'Y'                          ;is it Yes?
        JNZ     PEE3                            ;if not continue
        STC                                     ;set carry flag = abort
        JMP     SHORT PEE5                      ;exit
PEE3:   CALL    ERR_SOUND
        JMP     SHORT PEE1
PEE4:   CALL    CLEAR_MESSAGE                   ;empty message line
        CLC                                     ;clear cf = continue
PEE5:   POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    PRT_ERROR3
;
;
;       Input = none
;       Output = carry flag = abort printing
PROC    PRT_ERROR4
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        CALL    CLEAR_MESSAGE
        MOV     CL,[Color]                      ;store original Color
        MOV     AL,[Warning]                    ;warning color
        MOV     [Color],AL                      ;set color
        MOV     AX,0207h                        ;row 3/Col 12
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      " Printer Time-Out.  Press any key to try again or <Esc> "
        db      "to abort. ",0
        MOV     [Color],CL                      ;restore original color
        CALL    HIDE_CUR
        CALL    ERR_SOUND
        CALL    GET_CHAR
        CMP     AL,1Bh                          ;is it <Esc>
        JNZ     RPP1                            ;if yes exit
        STC                                     ;set carry flag = abort
        JMP     SHORT RPP2                      ;exit
RPP1:   CALL    CLEAR_MESSAGE                   ;empty message line
        CLC                                     ;clear cf = continue
```

```
RPP2:  POP    DX
       POP    CX
       POP    BX
       POP    AX
       RET
ENDP   PRT_ERROR4
ENDP   PRINT_STRING
;
;
; Locate the next ID data line in the file.
;      Input = None
;      Output = Carry Flag if EndOfFile
;             Carry flag if DOS error
PROC   FIND_DATA_LINE
       PUSH   AX
       PUSH   BX
       PUSH   CX
       PUSH   DX
       MOV    AX,DS
       MOV    ES,AX                    ;assign ES = DS
;-----set default ID string to ASCII zeros
       MOV    DI,Offset ID             ;ptr to string to fill
       MOV    AX,3030h                  ;ASCII zeros
       MOV    [DI],AX                  ;place 1st two bytes
       XOR    AH,AH                     ;zero = end of string
       INC    DI                       ;advance string ptr
       INC    DI
       MOV    [DI],AX                   ;ASCII 0 and hex 0
;-----locate ID number in the data file
FID1:  CALL   CLEAR_FILBUF                   ;hex 0's to file buffer
       CALL   READ_LINE                     ;1 line from data file
       JNC    FID2                     ;not EndOfFile
       MOV    AL,0FFH                   ;mark EndOfFile true
       MOV    [EOF],AL                  ;<> 0 = True
;-----is this a '000' data line?
FID2:  MOV    CX,3                      ;loop counter
       MOV    DI,Offset ID             ;ptr to ID number
       MOV    SI,Offset FilBuf          ;ptr to data file line
       CLD                             ;auto inc DI and SI
       REPZ   CMPSB                         ;are the bytes = ?
       JZ     FID5                     ;skip if ID = '000'
;-----is this an ID number line?
       MOV    SI,Offset FilBuf          ;ptr to data file line
       MOV    CX,3                     ;loop counter
FID4:  MOV    AL,[SI]                   ;get first byte
       CMP    AL,'0'                   ;is it < ASCII 0
       JC     FID5                     ;If Yes read next line
       CMP    AL,':'                   ;is it a digit?
       JNC    FID5                      ;If No read next line
       INC    SI                       ;point to next byte
       LOOP   FID4                      ;check next byte
;-----copy ID to [ID] string             ;0=OK! Found Data Line
```

```
        MOV     CX,3                    ;number of bytes to move
        MOV     DI,Offset ID            ;ptr to ID number
        MOV     SI,Offset FilBuf        ;ptr to data file line
        CLD                             ;auto inc DI and SI
        REP     MOVSB                   ;copy three bytes to ID
        JMP     SHORT  FID6             ;Exit found
;-----is this the last line ?
FID5:   XOR     AL,AL                   ;zero AX register
        CMP     AL,[EOF]                ;is EndOfFile TRUE?
        JZ      FID1                    ;False = get next line
        STC                             ;carry flag = None
        JMP     SHORT FID7              ;retrun EndOfFile
FID6:   CLC                             ;clear carry flag
FID7:   POP     DX                      ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    FIND_DATA_LINE
;
;-----Print a title on the HP laser.
;       Input = None
;       Output = None
PROC    PRINT_TITLE
        PUSH    AX                      ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AX,0321h                ;row/col hex
        CALL    HPGOTOYX
        JC      PT5                     ;exit on printer error
        MOV     AX,Offset Heder         ;ptr Title
        CALL    PRINT_STRING            ;string holds Bold ON
        JC      PT5                     ;exit on printer error
        MOV     AX,0508h                ;row/col hex
        CALL    HPGOTOYX
        JC      PT5                     ;exit on printer error
        MOV     AX,Offset IDStr
        CALL    PRINT_STRING
        JC      PT5                     ;exit on printer error
        CMP     BYTE PTR [Report],0     ;get type of report
        JZ      PT1                     ;jump if positive
        MOV     AX,Offset NegT          ;ptr to derailment str
        JMP     SHORT PT2               ;jump to print the str
PT1:    MOV     AX,Offset PosT          ;ptr to positive str
PT2:    CALL    PRINT_STRING            ;print the string
        JC      PT5                     ;exit on printer error
        MOV     AX,0553h                ;row/col hex
        CALL    HPGOTOYX
        JC      PT5                     ;exit on printer error
        MOV     AX,Offset DTStr
        CALL    PRINT_STRING
```

```
        JC      PT5                             ;exit on printer error
        MOV     AX,0708h                          ;row/col hex
        CALL    HPGOTOYX
        JC      PT5                             ;exit on printer error
        MOV     AX,Offset DIStr
        CALL    PRINT_STRING                          ;string holds Bold OFF
        JC      PT5                             ;exit on printer error
        MOV     AX,2822h                          ;row/col hex
        CALL    HPGOTOYX
        JC      PT5                             ;exit on printer error
        MOV     AX,Offset Inform                      ;bottom information box
        CALL    PRINT_STRING
        JC      PT5                             ;exit on printer error
PT5:    POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    PRINT_TITLE
;
;       Is the data file, report type and LPT port ready?
;       Input = None
;       Output = Carry flag if Not Ready.
PROC    IS_PRINT
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
;-----Is file selected?
        MOV     BX,[FileHd]                       ;get file handle
        CMP     BX,0                            ;is a file open?
        JNZ     PR1
        CALL    FILE_ERR
        JMP     SHORT PR4
;-----were the percentiles in the data file?
PR1:    MOV     CL,[Ranked]                           ;are percentiles set?
        CMP     CL,0                            ;is a type selected?
        JNZ     PR2
        CALL    RANK_ERR
        JMP     SHORT PR4
;-----Is the printer on line?
PR2:    CALL    ON_LINE
        JNC     PR3
        CALL    LPT_ERR
PR4:    STC                                     ;set error flag
PR5:    POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    IS_PRINT
;
```

```
;       Input = none
;       Output = none
PROC    LPT_ERR
        CALL    CLEAR_MESSAGE
        MOV     AL,[Warning]                    ;warning color
        MOV     CL,[Color]                      ;save original color
        MOV     [Color],AL                      ;set color
        MOV     AX,0207h                        ;row 3/Col 8
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      ' Printer Not On Line!  Check power or LPT assignment.'
        db      '  Press Any Key. ',0
        MOV     [Color],CL                      ;restore original color
        CALL    HIDE_CUR
        CALL    ERR_SOUND
        CALL    GET_CHAR
        RET
ENDP    LPT_ERR
;
;       Input = none
;       Output = none
PROC    RANK_ERR
        CALL    CLEAR_MESSAGE
        MOV     AL,[Warning]                    ;warning color
        MOV     CL,[Color]                      ;save original color
        MOV     [Color],AL                      ;set color
        MOV     AX,0207h                        ;row 3/Col 8
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      " Use the 'Rank' command to compute the percentiles."
        db      '  Press Any Key. ',0
        MOV     [Color],CL                      ;restore original color
        CALL    HIDE_CUR
        CALL    ERR_SOUND
        CALL    GET_CHAR
        RET
ENDP    RANK_ERR
;
;       Input = none
;       Output = none
PROC    FILE_ERR
        CALL    CLEAR_MESSAGE
        MOV     AL,[Warning]                    ;warning color
        MOV     CL,[Color]                      ;save original color
        MOV     [Color],AL                      ;set color
        MOV     AX,0207h                        ;row 3/Col 8
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      " Use the 'File' command to select a SLDI data file."
        db      '  Press Any Key. ',0
        MOV     [Color],CL                      ;restore original color
        CALL    HIDE_CUR
```

```
        CALL    ERR_SOUND
        CALL    GET_CHAR
        RET
ENDP    FILE_ERR
;
;
;       Input = none
;       Output = none
PROC    PROGRESS_MESSAGE
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AL,[Menu]                       ;menu color
        MOV     CL,[Color]                      ;save original color
        MOV     [Color],AL                      ;set color
        MOV     AX,0207h                        ;row 3/Col 8
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display string
        db      ' Please wait ..... Printing report for ID Number: ',0
        MOV     AX, Offset ID
        CALL    DSTR_OUT
        CALL    CSTR_OUT                        ;display period
        db      '.',0                           ;endOfSting marker
        MOV     [Color],CL                      ;restore original color
        CALL    HIDE_CUR
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    PROGRESS_MESSAGE
;
;
;       Input = ASCII number string in [ID]
;       Output = none
PROC    LOCATE_MESSAGE
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        CALL    CLEAR_MESSAGE
        MOV     AL,[Menu]                       ;menu color
        MOV     CL,[Color]                      ;save original color
        MOV     [Color],AL                      ;set color
        MOV     AX,0207h                        ;row 3/Col 8
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display string
        db      ' Please wait ..... Searching file for ID Number: ',0
        MOV     AX, Offset ID
        CALL    DSTR_OUT
        CALL    CSTR_OUT                        ;display period
```

```
        db      ':',0
        MOV     [Color],CL                      ;restore original color
        CALL    HIDE_CUR
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    LOCATE_MESSAGE
;
;------Request Printer Port Status
;       Input = Assign port in [LPT]  0 - 2
;       Output = Carry Flag = port not ready
PROC    ON_LINE
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AX,0200h                        ;get status function no
        MOV     DX,[LPT]                        ;ptr to port
        INT     17h                             ;request status
        AND     AH,10h                          ;Is printer ready ?
        JNZ     ISR1                            ;0 means printer error
        STC                                     ;set carry flag
ISR1:   POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    ON_LINE

;------Eject paper on HP laser.
;       Input = None
;       Output = None
PROC    EJECT
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AX,Offset FFeed
        CALL    PRINT_STRING
        POP     AX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    EJECT
;
;------Initialize the HP laser.
;       Input = None
;       Output = None
```

```
PROC   INITIALIZE_HP
       PUSH   AX                          ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
       MOV    AX,Offset Init
       CALL   PRINT_STRING
       POP    DX                          ;restore registers
       POP    CX
       POP    BX
       POP    AX
       RET
ENDP   INITIALIZE_HP
;
;-----Restore default setting to the HP laser.
;      Input = None
;      Output = None
PROC   RESTORE_HP
       PUSH   AX                          ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
       CALL   RESTORE_MESS                    ;inform user
       MOV    SI,Offset Rest               ;ptr to ASCII suring
;-----get character to be sent to LPT port
RR1:   MOV    AL,[SI]                      ;load Char to send
       CMP    AL,0                        ;is this end of string?
       JZ     RR4                         ;if yes normal exit.
;-----send character to assigned LPT port
       XOR    AH,AH                        ;0 = BIOS function No.
       MOV    DX,[LPT]                     ;get LPT port assign.
       INT    17h                         ;send char to printer
;-----test bit 5 of 8.  If bit 5 = 0 then no power.
       TEST   AH,10h                       ;Is printer powered up?
       JZ     RR4                         ;exit if NO
;-----test bit 1 of 8.  If bit 1 = 1 then printer time-out
       TEST   AH,01                        ;Is printer time-out?
       JNZ    RR4                         ;if YES then exit
;-----pause 1/3 second or up to 1/6 second once each hour.
RR2:   MOV    AH,0                         ;function number
       INT    1Ah                         ;get DOS clock ticks
       MOV    BX,DX                        ;save ticks in CX
       MOV    AX,3                         ;18.2 ticks per second
       ADD    BX,AX                        ;add 15 seconds
       JC     RR2                         ;loop if over flow
RR3:   MOV    AH,0                         ;function number
       INT    1Ah                         ;get DOS clock ticks
       CMP    DX,BX                        ;has time run out ?
       JC     RR3                         ;if not loop until done
       INC    SI                          ;point to next char
       JMP    SHORT RR1                       ;loop until finished
RR4:   CLC
```

```
        POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
;
;       Input = none
;       Output = none
PROC    RESTORE_MESS
        CALL    CLEAR_MESSAGE
        MOV     AL,[Menu]                       ;menu color
        MOV     CL,[Color]                      ;save original color
        MOV     [Color],AL                      ;set color
        MOV     AX,020Ah                        ;row 3/Col 8
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      ' Please wait . . . . . while resetting the '
        db      'HP Printer. ',0
        MOV     [Color],CL                      ;restore original color
        CALL    HIDE_CUR
        RET
ENDP    RESTORE_MESS
ENDP    RESTORE_HP
;
;------Place printer cursor in row/col position
;       Input = AX = row/col in hex
;       Output = None
PROC    HPGOTOYX
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     BX,AX                           ;save row/col
        CMP     AL,100                          ;is col < 100 ?
        JC      GOT1                            ;if yes Ok continue
        XOR     AL,AL                           ;if NO column = 0
GOT1:   XOR     AH,AH                           ;zero to high byte
        MOV     CL,10                           ;divisor to CL
        DIV     CL                              ;convert to decimal
        OR      AX,3030h                        ;convert to ASCII digit
        MOV     [Col],AX                        ;save digit
        MOV     AL,BH                           ;move row to AL
        CMP     AL,100                          ;is row < 100 ?
        JC      GOT2                            ;if yes Ok continue
        XOR     AL,AL                           ;if NO row = 0
GOT2:   XOR     AH,AH                           ;zero to high byte
        MOV     CL,10                           ;divisor to CL
        DIV     CL                              ;convert to decimal
        OR      AX,3030h                        ;convert to ASCII digit
        MOV     [Row],AX                        ;save digit
        MOV     AX,Offset GoTo
        CALL    PRINT_STRING
```

```
        POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    HPGOTOYX
;;;

;-----Show the contents of the AH register to screen.
;       Used for showing feedback from LPT port using INT 17h calls
;       Input = None
;       Output = None
;      Called from: PRINT_STRING if [Debug] is ON
;
PROC    SHOW_AH
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
;-----display contents of AH register in binary
        MOV     BL,AH                           ;save input in BX
        MOV     AX,0734h                        ;row/colm
        CALL    GOTOYX
        CALL    CSTR_OUT
        db      'low ',0
        MOV     CX,8                            ;loop counter
AH0:    MOV     AX,BX
        AND     AX,1                            ;zero all bit but first
        CALL    BIN_OUT
        CMP     CL,5
        JNZ     AH1
        CALL    CSTR_OUT
        db      ' to ',0
AH1:    SHR     BL,1
        LOOP    AH0                             ;loop 8 times
        CALL    CSTR_OUT
        db      ' high',0
        CLC
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    SHOW_AH
;
;
;-----Instructions for the Print command.
;       Input = None
;       Output = None
;
PROC    PRINT_INSTRU
        PUSH    AX                              ;save registers
```

```
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AX,1500h                ;row 21,column 0
        CALL    MENU_BOX                  ;draw menu box
        MOV     CL,[Color]              ;get assigned color
        MOV     AL,[Menu]                ;get menu color
        MOV     [Color],AL              ;set menu color
        MOV     AX,160Bh                 ;row 22,column 12
        CALL    GOTOYX
        CALL    CSTR_OUT
        db      'Press the <Esc> key to pause or cancel the '
        db      'printing of reports.',0
        CALL    HIDE_CUR
        MOV     [Color],CL                ;restore assigned color
        POP     DX                      ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    PRINT_INSTRU
;
;-----Find ID number in current open data file.
;       Input = three digit ASCII number in [ID]
;       Output = Carry flag = not found
;
PROC    LOCATE
        PUSH    AX                      ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AX,DS                    ;assign ES = DS
        MOV     ES,AX
        CALL    GOTO_TOP                    ;file ptr to BegOfFile
        JC      SEA6                    ;exit on error
;-----locate ID number in the data file
        CALL    LOCATE_MESSAGE                ;inform user of search
SEA1:   CALL    CLEAR_FILBUF                 ;hex 0's to file buffer
        CALL    READ_LINE                  ;1 line from data file
        JNC     SEA2                    ;not EndOfFile
        MOV     AL,0FFH                  ;mark EndOfFile true
        MOV     [EOF],AL                 ;<> 0 = True
SEA2:   MOV     CX,3                     ;loop counter
        MOV     DI,Offset ID            ;ptr to ID number
        MOV     SI,Offset FilBuf         ;ptr to data file line
        CLD                             ;auto inc DI and SI
        REP     CMPSB                      ;are the bytes = ?
        JZ      SEA7                    ;If YES exit found
        XOR     AL,AL                    ;zero AX register
        CMP     AL,[EOF]                   ;is EndOfFile TRUE?
        JZ      SEA1                    ;False = get next line
SEA5:   CALL    NOT_FOUND                       ;inform user not found
```

```
SEA6:  STC                              ;carry flag = not found
SEA7:  POP    DX                        ;restore registers
       POP    CX
       POP    BX
       POP    AX
       RET
;
;      Input = none
;      Output = none
PROC   NOT_FOUND
       PUSH   AX
       PUSH   BX
       PUSH   CX
       PUSH   DX
       MOV    CL,[Color]               ;store original Color
       MOV    AL,[Warning]             ;warning color
       MOV    [Color],AL               ;set color
       MOV    AX,0107h                 ;row 3/Col 12
       CALL   GOTOYX                   ;set cursor
       CALL   CSTR_OUT                 ;display warning
       db     ' The ID# is not in current data file. '
       db     'Press any key to continue. ',0
       MOV    [Color],CL               ;restore original color
       CALL   HIDE_CUR
       CALL   ERR_SOUND
       CALL   GET_CHAR
       CLC                             ;clear cf = continue
       POP    DX
       POP    CX
       POP    BX
       POP    AX
       RET
ENDP   NOT_FOUND
ENDP   LOCATE
;
PROC   ERR_SOUND
       PUSH   AX
       MOV    AX,Offset Beep
       CALL   SOUND
       POP    AX
       RET
ENDP   ERR_SOUND
;
;------Print a data point in the chart.
;      Input = AX = starting row/col of value 1
;              BX = Offset of data value in FIBuf
;      Output = Cary flag = abort printing
;      Note: this procedure is used to plot all data points "^D"
;              DX = store hex value of point
;              CX = loop counter
;      Note: points are loaded in with the units digit in AH and tens in AL
;
```

```
PROC   CHART_POINT
       PUSH   AX                          ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
;------set cursor at value "1" on the chart
       CALL   HPGOTOYX                        ;set position
       JC     CP8                         ;exit on printer error
;------get value from file data buffer
       MOV    AX,[BX]                       ;point value
       CMP    AX,2020h                       ;is it <spaces>?
       JZ     CP7                         ;if yes exit no error
       CMP    AX,0                          ;is it EndOfLine?
       JZ     CP7                         ;if yes exit no error
;------does it need rounding
       CMP    BYTE PTR [BX + 2],'5'               ;round the number ?
       JC     CP2                         ;if < 5 = no round
;------round the number
       CMP    AH,'9'                        ;is unit digit = 9
       JZ     CP1                         ;if Yes goto over flow
       INC    AH                          ;else advance units
       JMP    SHORT CP2                         ;goto next test
CP1:   MOV    AH,'0'                       ;adjust if over flow
       INC    AL                          ;example 29 to 30
CP2:   AND    AX,0CFCFh                          ;convert to hex
       MOV    DX,AX                        ;save number in DX
       XOR    CX,CX                        ;zero to loop counter
       ADD    CL,DL                        ;get tens digit
       JZ     CP7                         ;exit data error
       DEC    CX                           ;scale starts at 1 not 0
       JZ     CP4                         ;if zero skip tens
       CMP    CX,5                          ;is data in bounds?
       JNC    CP7                          ;exit if out of bounds
       MOV    AX,Offset NextNo                   ;ptr to next tens str
CP3:   CALL   PRINT_STRING                      ;advance to next tens
       JC     CP8                         ;exit on printer error
       LOOP   CP3                          ;loop until tens = 0
CP4:   XOR    CX,CX                        ;zero to loop counter
       ADD    CL,DH                        ;get units digit
       JZ     CP6                         ;if zero skip units
       CMP    CX,10                         ;is data in bounds?
       JNC    CP7                          ;exit if out of bounds
       MOV    AX,Offset NextUn                   ;ptr to next units str
CP5:   CALL   PRINT_STRING                      ;advance  to next unit
       JC     CP8                         ;exit on printer error
       LOOP   CP5                          ;loop until units = 0
CP6:   MOV    AX,Offset Point                    ;ptr to point string
       CALL   PRINT_STRING                     ;plot point in chart
       JC     CP8                         ;exit on printer error
CP7:   CLC
CP8:   POP    DX                           ;restore registers
       POP    CX
```

```
        POP     BX
        POP     AX
        RET
ENDP    CHART_POINT
;
;-------Place the cursor in the disired position in the chart.
;       Input = AX = Data value to position cursor in ASCII form
;       Output = Cary flag = abort printing
;       Note: this procedure more the cursor for ploting percentiles
;             DX = store hex value of point
;             CX = loop counter
;       Note: points are loaded in with the units digit in AH and tens in AL
;
PROC    POSITION_YX
        PUSH    AX                      ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        AND     AX,0CFCFh                 ;convert to hex
        MOV     DX,AX                   ;save number in DX
        XOR     CX,CX                   ;zero to loop counter
        ADD     CL,DL                   ;get tens digit
        JZ      PX5                     ;if zero out of bounds
        DEC     CX                      ;beg. scale at 1 not 0
        JZ      PX2                     ;if zero skip tens
        CMP     CX,5                    ;is data in bounds?
        JNC     PX5                     ;exit if out of bounds
        MOV     AX,Offset NextNo            ;ptr to next tens str
PX1:    CALL    PRINT_STRING                ;advance to next tens
        JC      PX6                     ;exit on printer error
        LOOP    PX1                     ;loop until tens = 0
PX2:    XOR     CX,CX                   ;zero loop counter
        ADD     CL,DH                   ;get units digit
        JZ      PX6                     ;if zero OK! exit
        CMP     CX,10                   ;is data in bounds?
        JNC     PX5                     ;exit if out of bounds
        MOV     AX,Offset NextUn            ;ptr to next units str
PX3:    CALL    PRINT_STRING                ;advance  to next unit
        JC      PX6                     ;exit on printer error
        LOOP    PX3                     ;loop until units = 0
        CLC                             ;normal exit
        JMP     SHORT PX6
PX5:    CALL    DATA_ERROR                  ;mark data error
PX6:    POP     DX                      ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
;
;       Input = none
;       Output = none
PROC    DATA_ERROR
```

```
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        CALL    CLEAR_MESSAGE
        MOV     AL,[Warning]                    ;warning color
        MOV     CL,[Color]                      ;save original color
        MOV     [Color],AL                      ;set color
        MOV     AX,0207h                        ;row 3/Col 8
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      ' The POSITION_YX procedure has OutOfRange data.'
        db      '  Press Any Key. ',0
        MOV     [Color],CL                      ;restore original color
        CALL    HIDE_CUR
        CALL    ERR_SOUND
        CALL    GET_CHAR
        CLC
        POP     AX
        POP     BX
        POP     CX
        POP     DX
        RET
ENDP    DATA_ERROR
ENDP    POSITION_YX
;
;------shaded area for lowest to highest score.
;       Input = AX = starting row/col of value 1
;               BX = Offset of data value in PerCnt
;       Output = Cary flag = abort printing
;       Note: this procedure is used to plot percentiles
;               DX = store hex value of length of shading
;               CX = loop counter
;       Note: points are loaded in with the units digit in AH and tens in AL

;------place percentiles in the chart.
;       Input = AX = starting row/col of value 1
;               BX = Offset of data value in PerCnt
;       Output = Cary flag = abort printing
;
PROC    CHART_PERCENTILES
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     DX,AX                           ;save row/col position
;------set cursor at value "1" on the chart
        CALL    HPGOTOYX                        ;set positon
        JC      CHM2                            ;exit on printer error
;------chart the median
        ADD     BX,4                            ;ptr median in buffer
        MOV     AX,[BX]                         ;get value from chart
```

```
        CMP     AX,2020h                ;is it <spaces>?
        JZ      CHM1                    ;if yes exit no error
        CMP     AX,0                    ;is it EndOfLine?
        JZ      CHM1                    ;if yes exit no error
        CALL    POSITION_YX             ;set cursor in chart
        JC      CHM2                    ;exit if error
        MOV     AX, Offset Median       ;ptr to median string
        CALL    PRINT_STRING            ;print the median
        JC      CHM2                    ;exit if error
;-----set cursor at value "1" on the chart
        MOV     AX,DX                   ;restore row/col
        CALL    HPGOTOYX                ;set positon
        JC      CHM2                    ;exit on printer error
;-----chart the 25%
        INC     BX                      ;ptr 25 percentile
        INC     BX
        MOV     AX,[BX]                 ;get value from chart
        CMP     AX,' '                  ;is it <spaces>?
        JZ      CHM1                    ;if yes exit no error
        CMP     AX,0                    ;is it EndOfLine?
        JZ      CHM1                    ;if yes exit no error
        CALL    POSITION_YX             ;set cursor in chart
        JC      CHM2                    ;exit if error
        MOV     AX, Offset Left         ;ptr to Left string
        CALL    PRINT_STRING            ;print the median
        JC      CHM2                    ;exit if error
;-----set cursor at value "1" on the chart
        MOV     AX,DX                   ;restore row/col
        CALL    HPGOTOYX                ;set positon
        JC      CHM2                    ;exit on printer error
;-----chart the 75%
        INC     BX                      ;ptr 75 percentile
        INC     BX
        MOV     AX,[BX]                 ;get value from chart
        CMP     AX,2020h                ;is it <spaces>?
        JZ      CHM1                    ;if yes exit no error
        CMP     AX,0                    ;is it EndOfLine?
        JZ      CHM1                    ;if yes exit no error
        CALL    POSITION_YX             ;set cursor in chart
        JC      CHM2                    ;exit if error
        MOV     AX, Offset Right        ;ptr to right string
        CALL    PRINT_STRING            ;print the median
        JC      CHM2                    ;exit if error
CHM1:   CLC
CHM2:   POP     DX                      ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    CHART_PERCENTILES
;
;
```

```
PROC   CHART_RANGE_L
       PUSH   AX                          ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
;------set cursor at value "1" on the chart
       CALL   HPGOTOYX                      ;set positon
       JNC    CPT1                         ;if no error continue
       JMP    CPT15                         ;error exit
;------get lowest values from file PerCnt buffer
CPT1:  MOV    AX,[BX]                        ;get lowest score
       CMP    AX,'  '                      ;is it <spaces>?
       JNZ    CPT2                          ;if no goto next test
       JMP    CPT14                         ;if yes exit no error
CPT2:  CMP    AX,0                           ;is it EndOfLine?
       JNZ    CPT3                         ;if no goto next test
       JMP    CPT14                         ;if yes exit no error
CPT3:  CMP    AX,'01'                        ;is the score 1.0 ?
       JNZ    CPT4                         ;if NO jump to CPT4
       MOV    DX,AX                         ;save value in DX
       MOV    AX,Offset HalfSp               ;ptr to 1/2 space str
       CALL   PRINT_STRING                   ;move cursor 1/2 space
       JC     CPT5                         ;exit on printer error
       MOV    AX,DX                          ;restore value to AX
CPT4:  CALL   POSITION_YX                    ;set cursor at 25%
CPT5:  JC     CPT15                          ;exit on printer error
       AND    AX,0CFCFh                      ;convert to hex
       MOV    DX,AX                         ;save in DX
;------get high values from file PerCnt buffer
       INC    BX                           ;ptr to highest score
       INC    BX
       MOV    AX,[BX]                        ;get high score
       CMP    AX,2020h                       ;is it <spaces>?
       JZ     CPT14                        ;if yes exit no error
       CMP    AX,0                         ;is it EndOfLine?
       JZ     CPT14                        ;if yes exit no error
       CMP    AX,'05'                      ;is it a 5.0?
       JNZ    CPT8                         ;if no continue
       MOV    CX,AX                          ;save value in CX
       CMP    DH,0                         ;is starting unit = 0?
       JNZ    CPT6                         ;if not back 1/2 space
       MOV    AX,Offset FullBk               ;ptr to full space str
       JMP    CPT7                         ;goto print_string
CPT6:  MOV    AX,Offset BackSp                    ;ptr to 1/2 space str
CPT7:  CALL   PRINT_STRING                    ;move cursor 1/2 space
       JC     CPT15                        ;exit on printer error
       MOV    AX,CX                          ;restore value to AX
CPT8:  AND    AX,0CFCFh                         ;convert to hex
;------sub low from high  (remember tens unit is in low register)
       CMP    AH,DH                          ;do I have to borrow?
       JNC    CPT9                         ;if no ready to sub
       ADD    AH,10                        ;add borrow to units
```

```
        DEC     AL                      ;tens = tens - 1
CPT9:   SUB     AH,DH                     ;subtarct unit digit
        SUB     AL,DL                   ;subtract ten digit
        JC      CPT14                   ;exit if value < 0
        MOV     DX,AX                    ;save answer in DX
        XOR     CX,CX                    ;zero to loop counter
        ADD     CL,DL                    ;get tens digit
        JZ      CPT11                   ;if zero skip tens
        CMP     CX,5                     ;is data in bounds?
        JNC     CPT14                    ;exit if out of bounds
        MOV     AX,Offset TenLt            ;ptr to next tens str
CPT10:  CALL    PRINT_STRING                    ;advance to next tens
        JC      CPT15                   ;exit on printer error
        LOOP    CPT10                    ;loop until tens = 0
CPT11:  XOR     CX,CX                      ;zero CX register
        ADD     CL,DH                    ;get units digit
        JZ      CPT14                   ;if zero skip units
        CMP     CX,10                    ;is data in bounds?
        JNC     CPT14                    ;exit if out of bounds
        CMP     CL,4                    ;is units 1,2 or 3 ?
        JC      CPT12                   ;if yes draw units
        INC     CL                      ;add 1 to units
        CMP     CL,7                     ;orig unit 4 5 or 6?
        JC      CPT12                   ;if yes draw units
        INC     CL                      ;add 1 to units
CPT12:  MOV     AX,Offset UntLt            ;ptr to next units str
CPT13:  CALL    PRINT_STRING                ;advance  to next unit
        JC      CPT15                   ;exit on printer error
        LOOP    CPT13                    ;loop until units = 0
CPT14:  CLC
CPT15:  POP     DX                       ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    CHART_RANGE_L
;
;
PROC    CHART_RANGE_D
        PUSH    AX                      ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
;----set cursor at value "1" on the chart
        CALL    HPGOTOYX                    ;set positon
        JNC     DPT1                    ;if no error continue
        JMP     DPT15                    ;error exit
;----get lowest values from file PerCnt buffer
DPT1:   MOV     AX,[BX]                    ;get lowest score
        CMP     AX,'  '                 ;is it <spaces>?
        JNZ     DPT2                    ;if no goto next test
        JMP     DPT14                    ;if yes exit no error
```

```
DPT2:  CMP    AX,0                    ;is it EndOfLine?
       JNZ    DPT3                    ;if no goto next test
       JMP    DPT14                   ;if yes exit no error
DPT3:  CMP    AX,'01'                 ;is the score 1.0 ?
       JNZ    DPT4                    ;if NO jump to DPT4
       MOV    DX,AX                   ;save value in DX
       MOV    AX,Offset HalfSp        ;ptr to 1/2 space str
       CALL   PRINT_STRING            ;move cursor 1/2 space
       JC     DPT5                    ;exit on printer error
       MOV    AX,DX                   ;restore value to AX
DPT4:  CALL   POSITION_YX             ;set cursor low range
DPT5:  JC     DPT15                   ;exit on printer error
       AND    AX,0CFCFh               ;convert to hex
       MOV    DX,AX                   ;save in DX
;-----get high values from file PerCnt buffer
       INC    BX                      ;ptr to higheet score
       INC    BX
       MOV    AX,[BX]                 ;get high score
       CMP    AX,2020h                ;is it <spaces>?
       JZ     DPT14                   ;if yes exit no error
       CMP    AX,0                    ;is it EndOfLine?
       JZ     DPT14                   ;if yes exit no error
       CMP    AX,'05'                 ;is it a 5.0?
       JNZ    DPT8                    ;if no continue
       MOV    CX,AX                   ;save value in CX
       CMP    DH,0                    ;is starting unit = 0?
       JNZ    DPT6                    ;if not backup 1/2 sp
       MOV    AX,Offset FullBk        ;ptr to full space str
       JMP    DPT7                    ;goto move curosr
DPT6:  MOV    AX,Offset BackSp        ;ptr to 1/2 space str
DPT7:  CALL   PRINT_STRING            ;move cursor 1/2 space
       JC     CPT15                   ;exit on printer error
       MOV    AX,CX                   ;restore value to AX
DPT8:  AND    AX,0CFCFh               ;convert to hex
;-----sub low from high  (remember tens unit is in low register)
       CMP    AH,DH                   ;do I have to borrow?
       JNC    DPT9                    ;if no ready to sub
       ADD    AH,10                   ;add borrow to units
       DEC    AL                      ;tens = tens - 1
DPT9:  SUB    AH,DH                   ;subtarct unit digit
       SUB    AL,DL                   ;subtract ten digit
       JC     DPT14                   ;exit if value < 0
       MOV    DX,AX                   ;save answer in DX
       XOR    CX,CX                   ;zero to loop counter
       ADD    CL,DL                   ;get tens digit
       JZ     DPT11                   ;if zero skip tens
       CMP    CX,5                    ;is data in bounds?
       JNC    DPT14                   ;exit if out of bounds
       MOV    AX,Offset TenDk         ;ptr to next tens str
DPT10: CALL   PRINT_STRING            ;advance to next tens
       JC     DPT15                   ;exit on printer error
       LOOP   DPT10                   ;loop until tens = 0
```

```
DPT11:  XOR     CX,CX                           ;zero CX register
        ADD     CL,DH                           ;get units digit
        JZ      DPT14                           ;if zero skip units
        CMP     CX,10                           ;is data in bounds?
        JNC     DPT14                           ;exit if out of bounds
        CMP     CL,4                            ;is units 1,2 or 3 ?
        JC      DPT12                           ;if yes draw units
        INC     CL                              ;add 1 to units
        CMP     CL,7                            ;orig unit 4 5 or 6?
        JC      DPT12                           ;if yes draw units
        INC     CL                              ;add 1 to units
DPT12:  MOV     AX,Offset UntDk                 ;ptr to next units str
DPT13:  CALL    PRINT_STRING                    ;advance to next unit
        JC      DPT15                           ;exit on printer error
        LOOP    DPT13                           ;loop until units = 0
DPT14:  CLC
DPT15:  POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    CHART_RANGE_D
;
;Data used by the Menu System
        .DATA
;Menu0data structure
menu0   dw      Offset menu0HK                  ;ptr to menu HotKeys
        db      '   File        Rank        Print        LPT'
        db      '        Quit      ',0
        db      05,6            ;lightbar:position in string and number of bytes
        dw      Offset m01      ;pointer to lightbar message
        db      18,6
        dw      Offset m02
        db      30,7
        dw      Offset m03
        db      44,5
        dw      Offset m04
        db      56,6
        dw      Offset m05
;
;the menu menu0HK string contains the hot keys that will activate the Choice.
;the letters in the string should include the first letters of each menu item.
;these letters must be in the same order as the menu items. Additional
;hot keys maybe added to the string if needed. The calling program must
;be able to filter these additional HotKeys. The hot key string must
;end with a zero.
menu0HK db      'FRPLQ',0                       ;Hotkey ASCIIZ string.
;
;messages can be up to 72 character in length. The length does not have to
;be the same. The previous message is cleared before the new message is
;written. The messages can be anywhere in the data section. The numbering
;system for messages: "m01" stands for menu0 message0
```

```
m01     db      '               Select a SLDI data file for printing.',0
m02     db      '    Compute the 25th and 75th percentiles for the data'
        db      ' file.',0
m03     db      '         Print SLDI FeedBack reports on a HP Laser Printer.',0
m04     db      '     Select the parallel port assigned to the HP Laser '
        db      'Printer.',0
m05     db      '               Exit the program and return to DOS.',0
;end of menu0 structure
;
;Menu1data structure
menu1   dw      Offset menu1HK                          ;ptr to menu HotKeys
        db      '       First LPT       Second LPT        Third '
        db      'LPT    ',0
        db      9,11            ;lightbar:position in string and number of bytes
        dw      Offset m11      ;pointer to lightbar message
        db      28,12
        dw      Offset m12
        db      48,11
        dw      Offset m13
;
;the menu menu1HK string contains the hot keys that will activate the Choice.
;the letters in the string should include the first letters of each menu item.
;these letters must be in the same order as the menu items. Additional
;hot keys maybe added to the string if needed. The calling program must
;be able to filter these additional HotKeys. The hot key string must
;end with a zero.
menu1HK db      'FST',0                         ;Hotkey ASCIIZ string.
;
;messages can be up to 72 character in length. The length does not have to
;be the same. The previous message is cleared before the new message is
;written. The messages can be anywhere in the data section. The numbering
;system for messages: "m11" stands for menu1 message1
m11     db      "       Send the SLDI data to the computer's LPT 1 "
        db      "output port.",0
m12     db      "       Send the SLDI data to the computer's LPT 2 "
        db      "output port.",0
m13     db      "       Send the SLDI data to the computer's LPT 3 "
        db      "output port.",0
;end of menu1 structure
;
;Menu2data structure
menu2   dw      Offset menu2HK                          ;ptr to menu HotKeys
        db      '    Success Factors        Failure Factors'
        db      '          Main Menu     ',0
        db      04,17           ;lightbar:position in string and number of bytes
        dw      Offset m21      ;pointer to lightbar message
        db      29,17
        dw      Offset m22
        db      54,11
        dw      Offset m23
```

```
;
;the menu menu2HK string contains the hot keys that will activate the Choice.
;the letters in the string should include the first letters of each menu item.
;these letters must be in the same order as the menu items. Additional
;hot keys maybe added to the string if needed. The calling program must
;be able to filter these additional HotKeys. The hot key string must
;end with a zero.
menu2HK db    'SFM',0                    ;Hotkey ASCIIZ string.
;
;messages can be up to 72 character in length. The length does not have to
;be the same. The previous message is cleared before the new message is
;written. The messages can be anywhere in the data section. The numbering
;system for messages: "m21" stands for menu2 message1
m21    db    '       Display the names of data files for positive '
       db    'factors. ',0
m22    db    '       Display the names of data files for negative '
       db    'factors. ',0
m23    db    "       Return to the Main Menu without selecting a file. ",0
;end of menu2 structure
;
;
;Menu3data structure
menu3  dw    Offset menu3HK                    ;ptr to menu HotKeys
       db    '          Single Report                  All Reports '
       db    '    ',0
       db    11,15          ;lightbar:position in string and number of bytes
       dw    Offset m31     ;pointer to lightbar message
       db    44,13
       dw    Offset m32
;
;the menu menu3HK string contains the hot keys that will activate the Choice.
;the letters in the string should include the first letters of each menu item.
;these letters must be in the same order as the menu items. Additional
;hot keys maybe added to the string if needed. The calling program must
;be able to filter these additional HotKeys. The hot key string must
;end with a zero.
menu3HK db    'SA',0                     ;Hotkey ASCIIZ string.
;
;messages can be up to 72 character in length. The length does not have to
;be the same. The previous message is cleared before the new message is
;written. The messages can be anywhere in the data section. The numbering
;system for messages: "m11" stands for menu1 message1
m31    db    "      Use the three digit ID number to select a report"
       db    " to print.",0
m32    db    "      Print reports for all the ID numbers in the"
       db    " data file.",0
;end of menu3 structure
;
       .CODE
;
;      Present the Main Menu and Title screen
;      Input = None
```

```
;     Output = If critical DOS error.  Error number is in AL
;          CH = last choice  CL = max number of choices
PROC   MAIN_MENU
       PUSH   AX
       PUSH   BX
       PUSH   CX
       PUSH   DX
;------draw playing screen
       XOR    AX,AX                    ;row 0 and column 0
       CALL   MENU_BOX                    ;draw top menu box
       CALL   DRAW_TITLE
       CALL   DISPLAY_STATUS                ;display name & LPT port
       CALL   MENU_INSTRU                   ;draw bottom box
       MOV    CH,01                     ;starting menu selection
MA1:   MOV     AX, Offset Menu0
       MOV    CL,5                      ;max choice for menu1
       CALL   GET_CHOICE                   ;get a menu selections
;------is it Esc key ?
       CMP    AH,0h                     ;was <ESC> key pressed?
       JNZ    MA2                       ;If not goto next test
       CALL   EXIT_YN                     ;exit to Dos Y/N ?
       JNC    MA1                       ;If no get next choice
       JMP    MA8                       ;Exit on <Esc> key
MA2:   MOV    CH,AH                        ;save current choice
;------is it Select a data file ?
       DEC    AH                        ;is this the choice?
       JNZ    MA3                       ;If not goto next test
       CALL   GET_PATH                     ;get file path
       JC     MA2B                      ;main menu if Esc key
       CALL   REPORT_MENU                    ;Open an SLDI data file
MA2B:  XOR     AX,AX                    ;row/column
       CALL   MENU_BOX                    ;clear menu box
       JMP    SHORT MA1                   ;get another choice
;------is it Rank the variables?
MA3:   DEC     AH                       ;is this the choice?
       JNZ    MA4                       ;If not goto next test
       CALL   RANK_DATA                    ;compute presentiles
       CALL   MENU_INSTRU                   ;restore bottom box
       CALL   DISPLAY_STATUS
       JMP    SHORT MA1                   ;get another choice
;------is it Print the data file?
MA4:   DEC     AH                       ;is this the choice?
       JNZ    MA5                       ;If not goto next test
       CALL   PRINT_MENU
       JMP    SHORT MA1                   ;get another choice
;------is it choose a Laser port?
MA5:   DEC     AH
       JNZ    MA6
       CALL   PORT_MENU                    ;Select LPT port
       JMP    SHORT MA7                   ;return to main menu
;------is it the Exit command ?
MA6:   DEC     AH
```

```
        JNZ     MA7                             ;go get another choice
        CALL    EXIT_YN                           ;exit to Dos Y/N ?
        JC      MA8                             ;if yes exit. else
MA7:    CALL    DISPLAY_STATUS                          ;display status report
        JMP     SHORT MA1                         ;get next choice.
MA8:    CLC                                     ;clear cf = normal exit
MA9:    POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    MAIN_MENU
;       Print Menu for selecting a single or all reports.
;       Input = None
;       Output = If critical DOS error  Error number is in AL
;            CH = last choice  CL = max number of choices
PROC    PRINT_MENU
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        CALL    IS_PRINT                          ;is data ready to print?
        JC      PI4                             ;exit if not ready.
        MOV     CH,1                              ;starting menu selection
PI1:    MOV     AX, Offset Menu3
        MOV     CL,2                              ;max choice for menu1
        CALL    GET_CHOICE                            ;get a menu selections
;-----is it Esc key ?
        CMP     AH,0h                             ;was <ESC> key pressed?
        JZ      PI4                             ;if yes exit menu
        MOV     CH,AH                             ;save current choice
;-----is it a Single Report ?
        DEC     AH                              ;is this the choice?
        JNZ     PI2                             ;if not goto next test
        CALL    PRINT_ONE_REPORT                        ;for a single ID number
        CALL    MENU_INSTRU                         ;restore bottom box
        JMP     SHORT PI4                         ;exit proceture
;-----is it Print them All ?
PI2:    DEC     AH                              ;is this the choice?
        JNZ     PI1                             ;NO =  get next choice
        CALL    PRINT_ALL_REPORTS                       ;for a all ID numbers
        CALL    MENU_INSTRU                         ;restore bottom box
PI4:    CLC                                     ;clear cf = normal exit
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    PRINT_MENU
;
;       Menu for selecting the LPT output port.
;       Input = None
```

```
;     Output = If critical DOS error  Error number is in AL
;          CH = last choice  CL = max number of choices
PROC   PORT_MENU
       PUSH   AX
       PUSH   BX
       PUSH   CX
       PUSH   DX
       MOV    CX,[LPT]                    ;current port assignment
       MOV    CH,CL                       ;place in CH register
       INC    CH                          ;starting menu selection
MI1:   MOV    AX, Offset Menu1
       MOV    CL,3                        ;max choice for menu1
       CALL   GET_CHOICE                  ;get a menu selections
;------Is it Esc key ?
       CMP    AH,0h                       ;was <ESC> key pressed?
       JZ     MI4                         ;If yes exit menu
       XOR    AL,AL                       ;zero LPT choice
       MOV    CH,AH                       ;save current choice
;------Is it Select LPT 1 ?
       DEC    AH                          ;is this the choice?
       JNZ    MI2                         ;If not goto next test
       XOR    AH,AH                       ;zero AH register
       MOV    [LPT],AX                    ;assign 0 to [LPT]
       JMP    SHORT MI4                   ;exit proceture
;------Is it Select LPT 2 ?
MI2:   INC    AL                          ;assign 1 to AL
       DEC    AH                          ;is this the choice?
       JNZ    MI3                         ;If not goto next test
       XOR    AH,AH                       ;zero AH register
       MOV    [LPT],AX                    ;assign 1 to [LPT]
       JMP    SHORT MI4                   ;exit procedure
;------Is it Select LPT 3 ?
MI3:   INC    AL                          ;assign 2 to AL
       DEC    AH                          ;is this the choice?
       JNZ    MI1                         ;NO =  get next choice
       XOR    AH,AH                       ;zero AH register
       MOV    [LPT],AX                    ;assign 2 to [LPT]
MI4:   CLC                                 ;clear cf = normal exit
       POP    DX
       POP    CX
       POP    BX
       POP    AX
       RET
ENDP   PORT_MENU
;
;     Menu for selecting the type of report to print.
;     Input = None
;     Output = If critical DOS error  Error number is in AL
;          CH = last choice  CL = max number of choices
PROC   REPORT_MENU
       PUSH   AX
       PUSH   BX
```

```
        PUSH    CX
        PUSH    DX
        XOR     AX,AX                   ;row 0 and column 0
        CALL    MENU_BOX                    ;draw top menu box
        CALL    MENU_INSTRU                  ;draw bottom box
        MOV     CH,1                    ;starting menu selection
RE1:    MOV     AX, Offset Menu2
        MOV     CL,3                    ;max choice for menu2
        CALL    GET_CHOICE                  ;get a menu selections
;-----is it Esc key ?
        CMP     AH,0h                    ;was <ESC> key pressed?
        JZ      RE4                     ;if yes exit menu
        MOV     CH,AH                     ;save current choice
;-----is it a Positive Report ?
        DEC     AH                      ;is this the choice?
        JNZ     RE2                     ;if not goto next test
        MOV     [Report],AH               ;assign 0 to [Report]

        JMP     SHORT RE5                   ;display files
;-----is it a Derailment Report ?
RE2:    DEC     AH                       ;is this the choice?
        JNZ     RE3                     ;if not goto next test
        DEC     AH                      ;0 - 1 =FFh
        MOV     [Report],AH               ;assign -1 to [Report]

        JMP     SHORT RE5                   ;display files
;-----is it  Main Menu ?
RE3:    DEC     AH                       ;is this the choice?
        JNZ     RE1                     ;if not display menu
RE4:    STC                             ;cf = goto Main Menu
        JMP     SHORT RE7
RE5:    CALL    SELECT_FILE                 ;pick a file to open
        CALL    MENU_INSTRU
        CALL    DRAW_TITLE                  ;redraw title screen
        CALL    DISPLAY_STATUS                ;display name & LPT port
        CMP     WORD PTR [FileHd],0           ;is a file open?
        JZ      RE1                     ;loop if NO exit if YES
RE6:    CLC                             ;clear cf = normal exit
RE7:    POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    REPORT_MENU
;
;-----Get a Choice from the Keyboard from the menu system pointed to by AX.
;       Input = AX points the desired Menu data structure
;             CH = Starting Choice (menu item to highlight)
;             CL = max number of choices in this menu.
;       Output = AH = Choice is returned to the calling program
;              AL = Char from the keyboard. (Return key or Esc key)
;       Calls  'Display_Menu' to display the menu on the screen.
```

```
;          'Hot_keys' to see is Char is a HotKey for this menu
;
PROC   GET_CHOICE
       PUSH   BX
       PUSH   CX
       PUSH   DX
       MOV    DX,AX
GE0:   CALL   DISPLAY_MENU                    ;menu to the screen
       MOV    BL,CH                           ;save old Choice in BL
GE1:   CALL   GET_CHAR                        ;get keyboard input.
       CMP    AL,'1'                          ;is Char < '1'
       JC     GE4                             ;if yes goto next test
       CMP    AL,':'                          ;is Char a digit ?
       JNC    GE4                             ;if not goto next test
       CALL   NUM_LOCK                        ;covert NumLock pad
GE4:   CMP    AL,4                            ;is it a right arrow?
       JNZ    GE5                             ;jump if not
       INC    CH                              ;Choice = Choice + 1
GE5:   CMP    AL,13h                          ;is it a left arrow?
       JNZ    GE6                             ;jump if not
       DEC    CH                              ;Choice = Choice -1
       JNZ    GE6                             ;if CH = 0 then
       MOV    CH,CL                           ;set CH = maxmenu.
GE6:   CMP    CL,CH                           ;is CH > maxmenu?
       JNC    GE7                             ;if yes then
       MOV    CH,1                            ;set CH = 1
GE7:   CMP    AL,0Dh                          ;is it a return key?
       JZ     GE10                            ;if yes return
       CMP    AL,1Bh                          ;is it an escape key?
       JNZ    GE8                             ;if no goto next test
       SUB    CH,CH                           ;if yes, choice = 0
       JMP    SHORT GE10                      ;exit; save new Choice
GE8:   CALL   HOT_KEYS                        ;is Char a hot key?
       JC     GE9                             ;carry = No; next char
       CMP    AH,CH                           ;has Choice changed?
       JZ     GE11                            ;if not then exit
       MOV    CH,AH                           ;save new Choice
       CALL   DISPLAY_MENU                    ;display menu on Exit
       JMP    SHORT GE11                      ;exit; save new choice
GE9:   CMP    CH,BL                           ;new Choice=old Choice?
       JZ     GE1                             ;yes = no menu display
       JMP    SHORT GE0                       ;no = call display menu
GE10:  MOV    AH,CH                           ;save choice on Exit
GE11:  POP    DX
       POP    CX
       POP    BX
       RET
;
PROC   NUM_LOCK
       AND    AL,0Fh                          ;convert to hex
       DEC    AL
       JNZ    NML0                            ;if not = 1 continue
```

```
        MOV     AL,6                    ;convert to End
        JMP     SHORT NML7                  ;exit
NML0:   DEC     AL
        JNZ     NML1                    ;If not = 2 continue
        MOV     AL,24                   ;convert to DnArrow
        JMP     SHORT NML7                  ;exit
NML1:   DEC     AL
        JNZ     NML2                    ;If not = 3 continue
        MOV     AL,3                    ;convert to PageDn
        JMP     SHORT NML7                  ;exit
NML2:   DEC     AL
        JNZ     NML3                    ;If not = 4 continue
        MOV     AL,19                   ;convert to LeftArrow
        JMP     SHORT NML7                  ;exit
NML3:   DEC     AL
        DEC     AL
        JNZ     NML4                    ;If not = 6 continue
        MOV     AL,4                    ;convert to RtArrow
        JMP     SHORT NML7                  ;exit
NML4:   DEC     AL
        JNZ     NML5                    ;If not = 7 continue
        MOV     AL,1                    ;convert to Home Key
        JMP     SHORT NML7                  ;exit
NML5:   DEC     AL
        JNZ     NML6                    ;If not = 8 continue
        MOV     AL,5                    ;convert to UpArrow
        JMP     SHORT NML7                  ;exit
NML6:   DEC     AL
        JNZ     NML7                    ;If not = 9 continue
        MOV     AL,18                   ;convert to PageUp
NML7:   RET
ENDP    NUM_LOCK
;
;       Examine the Hot Key ASCIIZ string to find out if Char is a Hot Key.
;       Input = AL = Char
;               CH = Choice
;               CL = MaxChoice
;               DX = pointer to the menu structure in data segment.
;                    the first word in the data structure is a pointer to
;                    the Hot Key ASCIIZ string.
;       Output = Carry Flag  If Char in AL is not a HotKey
;               AH = Choice
;               AL = menu match  AL = 0Dh
;                    nonmenu match AL = Char
;       Notes: Called by GET_CHOICE. Menu data must be in an exact format.
;              See Menu1data structure for an example of the corrcet format.
PROC    HOT_KEYS
        PUSH    BX                      ;save registers
        PUSH    CX
        PUSH    DX
        MOV     SI,DX                   ;ptr to HotKey string pointer
        MOV     BX,[SI]                 ;load ptr to ASCIIZ HotKey str.
```

```
        AND     AL,7Fh                  ;make 0 - 127 ASCII char.
        CMP     AL,'a'                  ;Is char a small letter?
        JC      HOT1                    ;If not, Ok continue.
        AND     AL,0DFh                 ;change to capital char
HOT1:   MOV     DX,AX                   ;save Char in DX
        XOR     AX,AX                   ;zero to AX
        MOV     SI,AX                   ;new Choice counter
        MOV     AL,DL                   ;Char returns to AL
HOT2:   CMP     [BX+SI],AH              ;Is this the End of String?
        JZ      HOT5                    ;exit; no match found
        CMP     [BX+SI],AL              ;Is Char a Hot Key?
        JZ      HOT3                    ;0 = found a Hot Key
        INC     SI                      ;choice = choice + 1
        JMP     SHORT HOT2              ;check the next Char in string.
        JMP     HOT4
HOT3:   INC     SI                      ;choice = choice + 1
        MOV     BX,SI                   ;choice counter to BL
        MOV     AH,CH                   ;original Choice to AH
        CMP     CL,BL                   ;Is choice a menu item?
        JC      HOT4                    ;carry = not a menu item
        MOV     AH,BL                   ;set new Choice
HOT4:   CLC                             ;clear carry = HotKey found
        JMP     SHORT HOT6              ;Exit (found)
HOT5:   MOV     AH,CH                   ;restore original Choice
        STC                             ;set carry flag = not HotKey
HOT6:   POP     DX                      ;restore registers
        POP     CX
        POP     BX
        RET
ENDP    HOT_KEYS
;
;       Display menu string; highlight one menu item; and write message string.
;       Input = DX pointer to the menu structure in data segment.
;             CH = Choice
;       Ouput = None
;       Notes: Called by GET_CHOICE. Menu data must be in an exact format.
;            See Men1data structure for an example of the corrcet format.
PROC    DISPLAY_MENU
        PUSH    AX                      ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        INC     DX                      ;skip HotKey string offset
        INC     DX                      ;ptr to beginning menu string
        MOV     AL,[Menu]               ;menu color attribute
        MOV     [Color],AL              ;change color attribute
        MOV     AX,0107h                ;starting position for cursor
        CALL    GOTOYX                  ;place cursor
        MOV     AX,DX                   ;Offset menu to AX
        CALL    DSTR_OUT                ;Display menu
        MOV     AL,[Warning]            ;color for lightbar
        MOV     [Color],AL              ;change color attribute
```

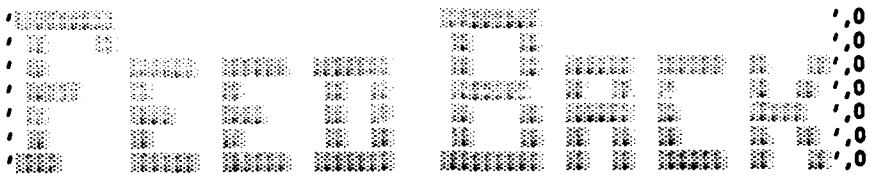
```
        SUB     AX,AX                   ;zero AX register
        ADD     AL,CH                   ;Choice to AL
        JZ      DIP1                    ;abort if Choice = 0
        DEC     AL                      ;(Choice-1) * 4 = offset
        MOV     CL,2                    ;number of shifts to CL
        SHL     AX,CL                   ;shift twice = ax*4
        INC     SI                      ;SI points to base of table
        ADD     SI,AX                   ;add offset
        MOV     BX,[SI]                 ;get 2 bytes from table
        MOV     CL,BH                   ;number of char to copy
        SUB     BH,BH                   ;zero BH
        DEC     BL                      ;BX = position in menu string
        MOV     AX,0107h                ;starting cursor postion
        ADD     AX,BX                   ;add offset to choice
        PUSH    SI                      ;save SI register
        CALL    GOTOYX                  ;position cursor
        POP     SI                      ;restore SI register
        MOV     AX,DX                   ;start of menu string to AX
        ADD     AX,BX                   ;add offset to choice
        MOV     DX,[SI + 2]             ;ptr to message from table.
        CALL    SUB_DSTR_OUT            ;highlight choice
        MOV     AL,[Menu]               ;set menu color
        MOV     [Color],AL              ;change color attribute
        MOV     AX,0207h                ;position cursor in 2rd row
        CALL    GOTOYX                  ;column 7 for message string.
        MOV     BX,024Eh                ;row 2 and column 78
        CALL    CLEAR_WINDOW            ;clear out old message.
        MOV     AL,[MenuMes]            ;set message color
        MOV     [Color],AL              ;change color attribute
        MOV     AX,DX                   ;pointer to message string
        CALL    DSTR_OUT                ;display message string
        MOV     AL,[Normal]             ;set normal color
        MOV     [Color],AL              ;change color attribute
        CALL    HIDE_CUR                ;hide the cursor.
DIP1:   POP     DX                      ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    DISPLAY_MENU
ENDP    GET_CHOICE
;

;
;------Instructions for use of the menu system highlight bar.
;       Input = None
;       Output = None
;
PROC    MENU_INSTRU
        PUSH    AX                      ;save registers
        PUSH    BX
        PUSH    CX
```

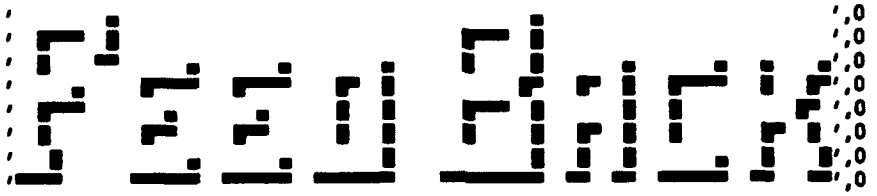
```
        PUSH    DX
        MOV     AX,1500h                        ;row 21,column 0
        CALL    MENU_BOX                          ;draw menu box
        MOV     AL,[Menu]
        MOV     [Color],AL
        MOV     AX,160Ch                        ;row 22,column 12
        CALL    GOTOYX
        CALL    CSTR_OUT
        db      'Use the ',17,205,' or ',205,16,' arrow keys to '
        db      'position the Highlight Bar.',0
        MOV     AX,1709h                        ;row 23,column 12
        CALL    GOTOYX
        CALL    CSTR_OUT
        db      'Press the <Enter> key or the first letter of the '
        db      'word to proceed.',0
        MOV     AL,[Normal]
        MOV     [Color],AL
        POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    MENU_INSTRU
;
;------Display the users selections.
;       Input = AX = none
;       Output = none
;       AX-DX register saved.
;
PROC    DISPLAY_STATUS
        PUSH    AX
        PUSH    BX                              ;save registers
        PUSH    CX
        PUSH    DX
        MOV     CL,[Color]                       ;save original color
        MOV     AL,[Normal]
        MOV     [Color],AL
        MOV     AX,0506h                         ;row/col
        CALL    GOTOYX
        CALL    CSTR_OUT
        db      'Data File = ',0
        XOR     AX,AX                           ;zero to AX
        MOV     BX,[FileHd]                      ;file handle
        CMP     BX,AX                           ;Is the file open?
        JZ      FLE1                            ;If no clear line
        MOV     AX,Offset FileNa                    ;ptr name of open file
        CALL    DSTR_OUT                         ;send to the screen
        JMP     SHORT FLE2
FLE1:   CALL    CSTR_OUT
        db      'NOT Selected',0
FLE2:   MOV     AX,0534h
        CALL    GOTOYX
```

```
        CALL    CSTR_OUT
        db      "Number of ID's = ",0
        MOV     AX,[MaxNo]                      ;report type
        CALL    BIN_OUT
        MOV     AX,0606h                        ;row/col
        CALL    GOTOYX
        CALL    CSTR_OUT
        db      'Percentiles are ',0
        XOR     AX,AX                           ;zero to AX
        MOV     AL,[Ranked]                       ;report type
        CMP     AH,AL                           ;is it not selected?
        JZ      FLE3                            ;if not goto next text
        CALL    CSTR_OUT                          ;send string to screen
        db      'computed.    ',0
        JMP     SHORT FLE7                        ;exit routine
FLE3:   CALL    CSTR_OUT                          ;send string to screen
        db      'NOT computed.',0
FLE7:   CALL    ON_LINE                           ;is printer on_line?
        JNC     FLE8                            ;carry flag means NO
        MOV     AX,0634h                          ;row/col
        CALL    GOTOYX                            ;set cursor
        CALL    CSTR_OUT
        db      'LPT ',0
        XOR     AX,AX
        MOV     AX,[LPT]
        INC     AX
        CALL    BIN_OUT
        CALL    CSTR_OUT                          ;send string to screen
        db      ' is NOT Ready.',0
        JMP     SHORT FLE9
FLE8:   MOV     AX,0634h                          ;row/col
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT
        db      'LPT ',0
        XOR     AX,AX
        MOV     AX,[LPT]
        INC     AX
        CALL    BIN_OUT
        CALL    CSTR_OUT                          ;send string to screen
        db      ' is Ready.   ',0
FLE9:   MOV     [Color],CL                        ;restore color value
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    DISPLAY_STATUS
;
```

```
        .DATA
TKey    db      '                                                ',0
        db      '                                                ',0
        db      '                                                ',0
        db      '                                                ',0
        db      '                                                ',0
        db      '                                                ',0
        db      '                                                ',0
```



```
Shade   db      '                                                ',0
        db      '                                                ',0
        db      '                                                ',0
        db      '                                                ',0
        db      '                                                ',0
        db      '                                                ',0
        db      '                                                ',0
```



```
        .CODE
;-------Display the programs title on the screen
;       Input = None
;             [color] = current attribute from data section
;       Output = None
;       Video mode: text   row = 25 Col = 80
;
PROC DRAW_TITLE
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        CALL    CLEAR_TITLE                     ;clear main window
        MOV     AL,[Warning]
        MOV     [Color],AL
        MOV     AX,0800h
        MOV     BX,134Fh
        CALL    CLEAR_WINDOW
        MOV     AL,[Menu]
        MOV     [Color],AL
        MOV     AX,0902h
        MOV     BX,124Dh
        CALL    CLEAR_WINDOW
;-------draw shading
        MOV     AL,[Border]
        MOV     [Color],AL
        MOV     CX,8                            ;line counter
        MOV     BX,0A05h                        ;row/col
```

```
        MOV     AX,Offset Shade
TIT2:   XCHG    AX,BX
        CALL    GOTOYX
        XCHG    AX,BX
        CALL    DSTR_OUT
        MOV     AX,SI
        INC     AX
        INC     BH
        LOOP    TIT2
;-----draw title
        MOV     AL,[Normal]
        MOV     [Color],AL
        MOV     CX,7                            ;line counter
        MOV     BX,0A04h                          ;row/col
        MOV     AX,Offset TKey
TIT1:   XCHG    AX,BX
        CALL    GOTOYX
        XCHG    AX,BX
        CALL    TITLE_OUT
        MOV     AX,SI
        INC     AX
        INC     BH
        LOOP    TIT1
TIT3:   POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    DRAW_TITLE
;
;------Clear the main display window in the EditKey view program.
;       Input = None
;       Output = None
;        16 colors   row = 25 Col = 80
;
PROC CLEAR_TITLE
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        MOV     CL,[Color]                       ;save orig. color attri
        MOV     AL,[Normal]                       ;get background color
        MOV     [Color],AL                      ;assign backgd color
        MOV     AX,0400h                         ;row 4 /column 0
        MOV     BX,144Fh                         ;row 20 /column 79
        CALL    CLEAR_WINDOW                          ;clear display window
        MOV     [Color],CL                      ;restore orig. color att
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    CLEAR_TITLE
;
```

```
;
;-----Send an ASCIIZ string to screen and skip all <space> but advance
;     the cursor for each space.
;
;     Input = AX must point to the string. The string must end with
;           a hex zero. The desired color attribute must be defined
;           in the data segment.
;     Output = None. All register are saved except SI.
;
PROC TITLE_OUT
     PUSH   AX                          ;save registers
     PUSH   BX
     PUSH   CX
     PUSH   DX
     MOV    SI,AX                       ;pointer to string.
     MOV    BH,0                        ;page 0 asummed
     MOV    CX,1                        ;from data segment.
     MOV    BL,[Color]                   ;load color attribute
TITL1: MOV    AL,[SI]                    ;get char from string
     CMP    AL,0                       ;Is it the end ?
     JZ     TITL2                      ;exit if end of string.
     CMP    AL,20h                      ;is it a space ?
     JNZ    TITL3                      ;if space skip ?
     CALL   INC_CURSOR
     JMP    SHORT TITL4
TITL3: MOV    AL,20h                    ;write a space
     MOV    DL,AL                      ;store char in DL
     MOV    AX,0920h                    ;write 1 space to
     PUSH   SI                         ;save SI register
     INT    10h                        ;set color attribute
     MOV    AH,0Eh                      ;fun.no. teletype mode
     MOV    AL,DL                       ;get char for DL reg.
     INT    10h                        ;char to the console
     POP    SI                         ;restore SI register
TITL4: INC    SI                       ;point to next char
     JMP    SHORT TITL1                    ;get next character.
TITL2: POP    DX
     POP    CX                         ;restore registers.
     POP    BX
     POP    AX
     RET
ENDP   TITLE_OUT
;
     .CODE
;
;-----Set the colors variables for the video mode.
;
;    Input: ES is a ptr to the (PSP) Program Segment Prefix
;    (when DOS programs are loaded the ES register points to PSP)
;    Output: None
;
```

```
PROC   COLOR_MODE
       MOV    DI,80h                ;offset to len COM tail
       XOR    AX,AX                 ;zero register
       ADD    AL,[ES:DI]            ;get len Com tail
       JZ     VID2                  ;jmp if no parameters
       MOV    CX,AX                 ;loop counter
VID0:  INC    DI                    ;ptr to next byte
       MOV    AL,[ES:DI]            ;is it the marker?
       AND    AL,5Fh                ;make a capital letter
       CMP    AL,'M'                ;is it the mono par?
       JZ     VID1                  ;If Yes jump  to Mono
       LOOP   VID0                  ;look through COM tail
       JMP    SHORT VID2                ;Not found get dis mode
VID1:  CALL   MONO_VIDEO                    ;set color variables
       JMP    SHORT VID5                ;exit
VID2:  XOR    AX,AX
       MOV    AH,0Fh                ;get display mode
       INT    10h                   ;BIOS function.
       CMP    AL,7                  ;is it Text-Mono ?
       JNZ    VID3                  ;No = jmp next test
       CALL   MONO_VIDEO                 ;set color variables
       JMP    SHORT VID5                ;exit
VID3:  CMP    AL,0Fh                ;is it Graph-Mono?
       JNZ    VID4                  ;No = jmp next test
       CALL   MONO_VIDEO                 ;set color variables
       JMP    SHORT VID5                ;exit
VID4:  CALL   COLOR_VIDEO                   ;set color variables
VID5:  RET
;
PROC   COLOR_VIDEO
       MOV    BX,Offset Menu
       MOV    AL,71h                ;Menu=Blue/Lt White
       MOV    [BX],AL
       INC    BX
       MOV    AL,1Fh                ;Normal=White/Blue
       MOV    [BX],AL
       INC    BX
       MOV    AL,1Eh                ;HiLite=Yellow/Blue
       MOV    [BX],AL
       INC    BX
       MOV    AL,7Fh                ;MenuMes=White/Lt White
       MOV    [BX],AL
       INC    BX
       MOV    AL,4Fh                ;Warning=White/Red
       MOV    [BX],AL
       INC    BX
       MOV    AL,070h               ;Border=Black/White
       MOV    [BX],AL
       RET
ENDP   COLOR_VIDEO
PROC   MONO_VIDEO
       MOV    BX,Offset Menu
```

```
        MOV     AL,70h                  ;Menu = Black/White
        MOV     [BX],AL
        INC     BX
        MOV     AL,0Fh                  ;Normal = White/Black
        MOV     [BX],AL
        INC     BX
        MOV     AL,0Fh                  ;HiLite = White/Black
        MOV     [BX],AL
        INC     BX
        MOV     AL,70h                  ;MenuMes = Black/White
        MOV     [BX],AL
        INC     BX
        MOV     AL,0Fh                  ;Warning = White/Black
        MOV     [BX],AL
        INC     BX
        MOV     AL,7Fh                  ;Border = White/Lt White
        MOV     [BX],AL
        RET
ENDP    MONO_VIDEO
ENDP    COLOR_MODE
;
; Save the current users video information to be restored by RESTORE_VIDEO
; set text video mode for this program.
;
;       Input = None
;       Output = set variables:  [vidmode],[vidpage],[vidcurs],[vidfont]
;                                [vidattr] and [vidbord]
;       Note: has no effect if the dos version is less than 3.30.
;
PROC    TEXT_VIDEO
;-----test for DOS 3.3 or greater
        MOV     AH,30h                  ;get dos ver number
        INT     21h
        XCHG    AH,AL                   ;high byte to ah
        CMP     AX,031Eh                ;is dos >= 3.30 ?
        JNC     SV0                     ;if yes continue else
        JMP     SV5                     ;exit assume text mode
;-----get video mode
SV0:    MOV     AH,0Fh                  ;get video mode
        INT     10h
        MOV     [vidmode],AL            ;save videomode
        MOV     [vidpage],BH            ;save videopage
;-----get cursor information
        MOV     AH,03h                  ;get cursor status
        INT     10h
        MOV     [vidcurs],CX            ;save cursor shape
;-----get font size
        MOV     AX,1130h                ;get font information
        XOR     BH,BH                   ;0 = current font
        INT     10h
        MOV     AX,1112h                ;assume small font
        CMP     CX,8                    ;is it 8x8 font ?
```

```
        JZ      SV1                             ;if yes save font
        MOV     AX,1114h
        CMP     CX,16                           ;is it 8x16 font ?
        JZ      SV1                             ;if yes save font
        MOV     AX,1111h                        ;assume 8x14 font
SV1:    MOV     [vidfont],AX                    ;save current font
;-----get current color attributes
        MOV     AH,08h                          ;read char and attri
        MOV     BH,[vidpage]                    ;get current video page
        INT     10h
        MOV     [vidattr],AH                    ;save color attribute
        MOV     CL,4                            ;counter
        SHR     AH,CL                           ;high nibble to low
        MOV     [vidbord],AH                    ;save background color
;-----is this a VGA system ?
        MOV     AX,1A00h                        ;read video config.
        INT     10h
        CMP     AL,1Ah                          ;is it an VGA ?
        JNZ     SV2                             ;if no then exit
        MOV     AX,1008h                        ;if yes get border color
        INT     10h
        MOV     [vidbord],BH                    ;save border color
;-----set font type
        MOV     AX,1114h                        ;8x16 character set
        XOR     BL,BL
        INT     10h
;-----set text video mode
SV2:    MOV     AX,0003                         ;default video text mode
        MOV     BL,[vidmode]                    ;get current mode
        CMP     BL,7                            ;is it mono text ?
        JZ      SV5                             ;if yes no change
        INT     10h                             ;set color text mode
SV5:    MOV     AL,[Normal]
        MOV     [Color],AL
        CALL    CLEAR_SCREEN
        CLC                                     ;clear carry flag
        RET
ENDP    TEXT_VIDEO
;
;
; Restore the users video information which was save by SAVE_VIDEO
; when the program began.
;
;       Input = None
;       Output = Clears the screen
;       Note: uses variables:  [vidmode],[vidpage],[vidcurs],[vidfont]
;                              [vidattr] and [vidbord]
;
PROC    RESTORE_VIDEO
        PUSH    ES
;-----test for DOS 3.3 or greater
        MOV     AH,30h                          ;get dos ver number
```

```
        INT     21h
        XCHG    AH,AL                   ;high byte to ah
        CMP     AX,031Eh                ;is dos > = 3.30 ?
        JC      REV2                    ;default to w/b
;-----restore original video mode
        MOV     AL,[vidmode]            ;get video mode no.
        XOR     AH,AH
        INT     10h
;-----return display page to 0
        MOV     AX,0500h
        INT     10h
;-----restore original font size
        MOV     AX,[vidfont]
        XOR     BL,BL
        INT     10h
;-----read cursor configuration
        MOV     AH,03h
        XOR     BH,BH
        INT     10h
;-----restore original video page
        MOV     AL,[vidpage]
        MOV     AH,5h
        INT     10h
;-----restore cursor shape
        MOV     CX,[vidcurs]
        MOV     AH,01h
        INT     10h
;-----set border color
        MOV     AX,1001h
        MOV     BH,[vidbord]
        INT     10h
;-----clear the screen if dos 3.3 or greater
        MOV     AX,0600h                ;scroll & clear window
        MOV     BH,[vidattr]            ;get color attribute
        XOR     CX,CX                   ;start row 0, col 0
        MOV     DX,40h                  ;bios data area
        MOV     ES,DX                   ;ptr to data area
        MOV     DX,[ES:4Ah]             ;get number of columns
        DEC     DX                      ;convert to 0 start
        MOV     DH,[ES:84h]             ;get number of rows
        INT     10h                     ;clear whole screen
        JMP     SHORT REV3
;-----clear screen if not dos 3.3 or greater
REV2:   MOV     AL,[Vidattr]            ;system color W/B
        MOV     [Color],AL              ;set color
        CALL    CLEAR_SCREEN            ;blank the screen
REV3:   CLC                             ;clear carry flag
        POP     ES
        RET
ENDP    RESTORE_VIDEO
;
;
```

```
;------ Open a Disk File using the file Handle method.
;       Input =  AX = ptr ASCIIZ name of the file.
;                shared/read/write access assumed.
;       Output = Carry flag set if an opening error or
;                file size in AX and DX; File Handel in BX.
;                is set to beginning of the file.
;       Note:    Registers are not saved.
;
PROC    OPEN
        MOV     DX,AX                   ;ptr to file name string
        MOV     AH,3Dh                  ;open file with handle
        MOV     AL,42h                  ;share/read/write mode
        INT     21h                     ;try to open file.
        JC      OP1                     ;carry = opening error
        MOV     BX,AX                   ;file handle in BX
        XOR     AX,AX                   ;zero AX
        MOV     CX,AX                   ;off set from EOF
        MOV     DX,AX                   ;= 0 in CX AND DX.
        MOV     AX,4202h                ;position at EOF
        INT     21h                     ;size of file in
        PUSH    AX                      ;bytes returns in
        PUSH    DX                      ;AX and DX.
        XOR     AX,AX                   ;zero AX
        MOV     CX,AX                   ;off set from BOF
        MOV     DX,AX                   ;= 0 in CX AND DX.
        MOV     AX,4200h                ;position file pointer
        INT     21h                     ;file ptr to BOF
        POP     DX                      ;size of file returns
        POP     AX                      ;in AX and DX regs.
        CLC                             ;clear carry flag
        JMP     SHORT OP4               ;return to calling prg.
OP1:    CMP     AX,0Ch                  ;is access code wrong?
        JNZ     OP2                     ;if not skip.
        XOR     AX,AX                   ;zero AX if wrong code
OP2:    CMP     AX,6                    ;is error code > 5 ?
        JC      OP3                     ;if not skip.
        MOV     AX,6                    ;end of error table
OP3:    MOV     [ErrCode],AL            ;save error code
        SHL     AX,1                    ;multi err code by 2
        MOV     BX,Offset OpenErr       ;open error table base
        ADD     BX,AX                   ;add err. offset to base
        CALL    CLEAR_MESSAGE
        MOV     CH,[Warning]            ;warning color
        MOV     CL,[Color]              ;save original color
        MOV     [Color],CH              ;set color
        MOV     AX,0207h                ;row 3/Col 8
        CALL    GOTOYX                  ;set cursor
        CALL    CSTR_OUT                ;output this line to
        db      ' Error! opening ',0    ;the screen.
        MOV     AX,DX                   ;File name pointer.
        CALL    DSTR_OUT                ;output file name.
        MOV     AX,[BX]                 ;ptr msg string to AX
```

```
        CALL    DSTR_OUT                        ;display type of error
        MOV     [Color],CL                      ;restore original color
        CALL    HIDE_CUR
        CALL    ERR_SOUND
        CALL    GET_CHAR                        ;to stop program
        STC                                     ;set carry flag
OP4:    RET
ENDP    OPEN
;
        .DATA
OpenErr dw      Offset OpE1,Offset OpE2,Offset OpE3
        dw      Offset OpE4,Offset OpE5,Offset OpE6,Offset OpE7
OpE1    db      ': Invalid access code. '.0
OpE2    db      ': Invalid function. ',0
OpE3    db      ': File not found. ',0
OpE4    db      ': Path not found. ',0
OpE5    db      ': No handles available. ',0
OpE6    db      ': Access denied. ',0
OpE7    db      ': Error code beyond table. ',0
;
        .CODE
;
;------Send a ASCII String of a given length in the Data Seg. to the console.
;       Input = AX must points to the first character to send in the string.
;               CL = number of bytes to send
;       Output = None.  AX-DX registers saved.
PROC SUB_DSTR_OUT
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     SI,AX                           ;pointer to string.
        MOV     DL,CL                           ;DL = number of chars
        MOV     BH,0                            ;page 0 asummed
        MOV     BL,[Color]                      ;load color attribute
        MOV     CX,1                            ;from data segment.
DSTR3:  MOV     AL,[SI]                         ;get char from string
        CMP     AL,0                            ;Is it the end ?
        JZ      DSTR4                           ;exit if end of string.
        MOV     DH,AL                           ;store char in DH
        MOV     AX,0920h                        ;write 1 space to
        PUSH    SI                              ;save SI register
        INT     10h                             ;set color attribute
        MOV     AH,0Eh                          ;fun.no. teletype mode
        MOV     AL,DH                           ;get char for DH reg.
        INT     10h                             ;char to the console
        POP     SI                              ;restore DI register
        INC     SI                              ;point to next char
        DEC     DL                              ;character counter
        JNZ     SHORT DSTR3                     ;get next character.
DSTR4:  POP     DX
        POP     CX                              ;restore registers.
```

```
        POP     BX
        POP     AX
        RET
ENDP    SUB_DSTR_OUT
;
;
;-----Position the cursor on the screen
;       Input = AH (row) AL (column) position in binary numbers.
;       Output = none. All registers restored.
;       Notes:  upper left hand corner = 0,0
;               page 0, 25 rows and 80 columns screen assumed.
;               Calling with DH = 25 will hide the cursor off screen!!!
PROC GOTOYX
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     DX,AX
        CMP     DH,26                           ;is row > 25 ?
        JC      @@LOC1                            ;if yes default to 0
        MOV     DH,0                            ;set row to top line
@@LOC1: CMP     DL,80                                 ;is column > 79 ?
        JC      @@LOC2                            ;if yes defualt to 0
        MOV     DL,0                            ;column to far right
@@LOC2: MOV     AH,02h                                ;set cursor funct, no.
        MOV     BH,0                            ;page 0 assumed
        INT     10h                            ;position cursor
        POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
;
;-----Advance cursor one column on the screen
;       Input = none
;       Output = none. All registers restored.
;               page 0, 25 rows and 80 columns screen assumed.
PROC INC_CURSOR
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AX,0300h
        MOV     BH,AL
        INT     10h
        CMP     DL,79
        JZ      INC1
        INC     DL
        JMP     SHORT INC2
INC1:   INC     DH
INC2:   MOV     AX,0200h
        INT     10h
```

```
        POP     DX                      ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    INC_CURSOR
;
;
;------Hide cursor at row 25, column 0 below the last line of the screen.
;       Input = None
;       Output = None
;       Calls  GOTOYX
;       Notes: Page 0 and 25 line text screen assumed.
;
PROC HIDE_CUR
        MOV     AX,1900h                ;row=25 col = 0
        CALL    GOTOYX                  ;place cursor
        RET
ENDP    HIDE_CUR
ENDP GOTOYX
;
;------Send an ASCII string in the Data Segment to the console.
;
;       Input = AX must point to the string. The string must end with
;               a hex zero.  The desired color attribute must be defined
;               in the data segment.
;       Output = None.  All register are saved except SI.
;
PROC DSTR_OUT
        PUSH    AX                      ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     SI,AX                   ;pointer to string.
        MOV     BH,0                    ;page 0 asummed
        MOV     AX,@DATA
        PUSH    DS
        MOV     DS,AX
        MOV     BL,[Color]              ;load color attribute
        POP     DS
        MOV     CX,1                    ;from data segment.
DSTR1:  MOV     AL,[SI]                 ;get char from string
        CMP     AL,0                    ;Is it the end ?
        JZ      DSTR2                   ;exit if end of string.
        MOV     DL,AL                   ;store char in DL
        MOV     AX,0920h                ;write 1 space to
        PUSH    SI                      ;save SI register
        INT     10h                     ;set color attribute
        MOV     AH,0Eh                  ;fun.no. teletype mode
        MOV     AL,DL                   ;get char for DL reg.
        INT     10h                     ;char to the console
        POP     SI                      ;restore SI register
```

```
        INC     SI                              ;point to next char
        JMP     SHORT DSTR1                             ;get next character.
DSTR2:  POP     DX
        POP     CX                              ;restore registers.
        POP     BX
        POP     AX
        RET
ENDP    DSTR_OUT
;
;
;-----Send a two byte unsigned binary number to the screen in decimal form.
;       Input = binary number in AX
;       Output = decimal number to the screen.  Registers restored on return.
;       Note: this recursive procedure could use up to 40 bytes of stack space.
;             leading zeros are surpressed and no space padding is used.
;             BIN_OUT and DIGIT_OUT must be NEAR procedures.
PROC BIN_OUT    NEAR
        PUSH    AX                              ;save dividend
        PUSH    BX
        PUSH    CX                              ;save CX register
        PUSH    DX                              ;save remainder
        SUB     DX,DX                           ;zero DX register
        MOV     CX,0Ah                          ;divisor is 10
        DIV     CX                              ;AX/10; answer in AX
        CMP     AX,0                            ;remainder digit in DL
        JZ      @@BIN                           ;if yes stop recursion
        CALL    BIN_OUT                         ;contine recursive call
@@BIN:  CALL    DIGIT_OUT                               ;display digit in DL
        POP     DX                              ;previous digit to DL
        POP     CX                              ;restore CX register
        POP     BX
        POP     AX                              ;restore AX register
        RET             ;NOTE: this RET will point to @@BIN: to display
                        ;each digit of the recursions stored in DL register.
                        ;After all digits are displayed it will return to
                        ;the calling program.
;------ Send a digit (0 to 9) stored in DL register to the screen
PROC DIGIT_OUT  NEAR
        MOV     BH,0                            ;page 0 asummed
        MOV     BL,[Color]                      ;load color attribute
        MOV     CX,1                            ;from data segment.
        MOV     AX,0920h                        ;write 1 space to
        INT     10h                             ;set color attribute
        MOV     AH,0Eh                          ;fun.no. teletype mode
        MOV     AL,DL                           ;get char for DL reg.
        OR      AL,30h                          ;convert to ASCII digit
        INT     10h                             ;char to the console
        RET
ENDP DIGIT_OUT
ENDP BIN_OUT
;
;-----Get a Char from the keyboard.  (keyboard buffer not cleared before input)
```

```
;     Input = none
;     Output = binary ASCII keyboard code in AL
;     Carry flag = extended code.
;     extended codes are converted to control keys by EXT_CHAR
PROC GET_TEXT
GET1:  MOV    AX,0700h                    ;input function number
       INT    21h                         ;wait for charactor
       CLC                                ;clear carry flag
       CMP    AL,0                         ;Is the Char extended?
       JNZ    @@TEXT                       ;If not extended return
       MOV    AH,07h                      ;unfilter char input
       INT    21h                         ;to get extended char.
       CALL   EXT_CHAR                     ;convert extended codes
       JC     GET1                         ;cf = not on the list
       STC                                ;set carry flag
@@TEXT: MOV    AH,0                        ;zero AH register.
       RET                                ;end of subroutine
ENDP GET_TEXT
;
;
;-----Get a Char from the Standard input device.  (keyboard assumed)
;     Input = none
;     Output = binary ASCII keyboard code in AX
;     Carry flag = extended code.
PROC GET_CHAR
GET0:  MOV    AX,0C07h                    ;clear keyboard buffer
       INT    21h                         ;and wait for char.
       CLC                                ;clear carry flag
       CMP    AL,0                         ;Is the Char extended?
       JNZ    @@CHAR                       ;If not extended return
       MOV    AH,07h                      ;unfilter char input
       INT    21h                         ;to get extended char.
       CALL   EXT_CHAR                     ;convert extended codes
       JC     GET0                         ;cf = not on the list
       STC                                ;set carry flag
@@CHAR: MOV    AH,0                        ;zero AH register.
       RET                                ;end of subroutine
;
;     A subroutine to convert extended codes to control codes.
;     Input = extended code in AL
;     Output = converted code in AL
;           Carry flag if not one of the Keys listed below:
;     Key    Extended Code  Converted to:  Ctrl-Char  Ctrl-Value
;     Home       47h                        ^A          1h
;     UpArr      48h                        ^E          5h
;     PgUp       49h                        ^R          12h
;     LtArr      4Bh                        ^S          13h
;     RtArr      4Dh                        ^D          4h
;     End        4Fh                        ^F          6h
;     DnArr      50h                        ^X          18h
;     PgDn       51h                        ^C          3h
;     Ins        52h                        ^V          16h
```

```
;     Del       53h                    ^G        7h
PROC   EXT_CHAR
       CMP       AL,47h
       JNZ       EXT0
       MOV       A_,1
       JMP       SHORT EXT10
EXT0:  CMP         AL,48h
       JNZ       EXT1
       MOV       AL,5
       JMP       SHORT EXT10
EXT1:  CMP         AL,49h
       JNZ       EXT2
       MOV       AL,12h
       JMP       SHORT EXT10
EXT2:  CMP         AL,4Bh
       JNZ       EXT3
       MOV       AL,13h
       JMP       SHORT EXT10
EXT3:  CMP         AL,4Dh
       JNZ       EXT4
       MOV       AL,4
       JMP       SHORT EXT10
EXT4:  CMP         AL,4Fh
       JNZ       EXT5
       MOV       AL,6
       JMP       SHORT EXT10
EXT5:  CMP         AL,50h
       JNZ       EXT6
       MOV       AL,18h
       JMP       SHORT EXT10
EXT6:  CMP         AL,51h
       JNZ       EXT7
       MOV       AL,3
       JMP       SHORT EXT10
EXT7:  CMP         AL,52h
       JNZ       EXT8
       MOV       AL,16h
       JMP       SHORT EXT10
EXT8:  CMP         AL,53h
       JNZ       EXT9
       MOV       AL,7
       JMP       SHORT EXT10
EXT9:  STC                                  ;set carry flag
       JMP       SHORT EXT11
EXT10: CLC                                  ;clear carry flag
EXT11: RET
ENDP   EXT_CHAR
;
;
ENDP GET_CHAR

;------Send an ASCII string in the Code segment to the console.
```

```
;       The call must be right before the string. The string must end with
;       a hex zero. This procedure must be called as a near procedure.
;       The desired [color] attribute must be stored in the Data segment.
;       Note: All registers save except SI.
PROC CSTR_OUT   NEAR
        POP     SI
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     BH,0                            ;page 0 asummed
        MOV     BL,[Color]                      ;load color attribute
        MOV     CX,1                            ;from data segment.
CSTR1:  MOV     AL,[CS:SI]                          ;get char from code seg
        CMP     AL,0
        JZ      CSTR2                           ;0 = end of string
        MOV     DL,AL                           ;store char in DL
        MOV     AX,0920h                        ;write 1 space to
        PUSH    SI                              ;save SI register
        INT     10h                             ;set color attribute
        MOV     AH,0Eh                              ;func.no.teletype mode
        MOV     AL,DL                           ;get char for DL
        INT     10h                             ;char to the console
        POP     SI                              ;restore SI register.
        INC     SI                              ;point to next char
        JMP     SHORT CSTR1                             ;get next character.
CSTR2:  INC     SI                              ;SI points to next
        POP     DX                              ;instruction in code.
        POP     CX                              ;restore registers.
        POP     BX
        POP     AX
        PUSH    SI                              ;store the CS pointer.
        RET                                     ;restore CS register.
ENDP    CSTR_OUT
;
;------Clear a Window
;       Input = AX = upperleft corner row/col     row 0 - 24
;               BX = lower right corner row/col   col 0 - 79
;               [color] = current attribute from data section
;               page 0 assumed.
;       Output = abort if row or column are out of bounds.
PROC CLEAR_WINDOW
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        CMP     BH,AH                           ;is starting row>ending?
        JC      WIN1                            ;exit if yes.
        CMP     BL,AL                           ;is starting col>ending?
        JC      WIN1                            ;exit if yes.
        CMP     BH,25                           ;is row out of bounds?
        JNC     WIN1                            ;exit if yes.
```

```
        CMP     BL,80                   ;is col out of bounds?
        JNC     WIN1                    ;exit if yes.
        MOV     CX,AX                   ;starting row/col to CX
        MOV     DX,BX                   ;ending row/col to DX
        MOV     AX,0600h                ;window function no
        MOV     BH,[Color]              ;get active color
        INT     10h                     ;clear the window
WIN1:   POP     DX                      ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    CLEAR_WINDOW
;
;-----Draw a 17 line 80 column display box for the Restaurant program.
;       It can also be used to clear the display screen and title screen.
;       Input = None
;       Output = None
;       Calls  CSTR_OUT  procedure
PROC DISPLAY_BOX
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AL,[Border]             ;change color attribute
        MOV     [Color],AL              ;for scren output.
        MOV     AX,0400h                ;row 4, column 0
        CALL    GOTOYX                  ;set cursor position
        CALL    CSTR_OUT                ;draw box
        db      201, 78 DUP (205),187
        db      186, 78 DUP (' '),186
        db      186, 78 DUP (' '),186
        db      186, 78 DUP (' '),186
        db      186, 78 DUP (' '),186
        db      186, 78 DUP (' '),186
        db      186, 78 DUP (' '),186
        db      186, 78 DUP (' '),186
        db      186, 78 DUP (' '),186
        db      186, 78 DUP (' '),186
        db      186, 78 DUP (' '),186
        db      186, 78 DUP (' '),186
        db      186, 78 DUP (' '),186
        db      186, 78 DUP (' '),186
        db      186, 78 DUP (' '),186
        db      186, 78 DUP (' '),186
        db      200, 78 DUP (205),188,0
        MOV     AL,[Normal]
        MOV     [Color],AL
        POP     DX
        POP     CX
        POP     BX
        POP     AX
```

```
        RET
ENDP    DISPLAY_BOX
;
;  Display an error message on th. screen in row 5 column 3, Normal colors
;       Input  = AX pointer to ASCIIZ string in Data segment
;       Output = Carry Flag set
;       Note:   sends message to screen and wait for key to be pressed.

PROC  ERROR_MESSAGE
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     CL,[Color]              ;save assigned color
        MOV     AL,[Normal]             ;set color to normal
        MOV     [Color],AL              ;for string output
        MOV     AX,0403h                ;point row 4, col 3
        CALL    GOTOYX                  ;position cursor
        MOV     AX,BX                   ;load string pointer
        CALL    DSTR_OUT                ;display error message
        MOV     [Color],CL              ;restore assigned color
        CALL    HIDE_CUR                ;hide the cursor
        CALL    GET_CHAR                ;wait until key pressed
        STC                             ;carry flag = error
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    ERROR_MESSAGE
;
;       Play a series of notes using the 8253 timer chip to produce sound.
;       Input  AX = pointer to 16 bit data string containing
;                 frequency and duration for each pitch.
;                 data string must end with a Hex 0
;       Output None
;
PROC    SOUND
        PUSH    AX                      ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        PUSH    BP
        MOV     SI,AX                   ;place data ptr in SI
        IN      AL,61h                  ;get status port B
        OR      AL,3                    ;enable speaker and
        OUT     61h,AL                  ;timer channel 2.
        MOV     AL,0B6h                 ;initialize  channel 2
        OUT     43h,AL                  ;for mode 3
SOU1:   MOV     DX,[SI]                 ;load frequency
        CMP     DX,0                    ;is it the end of str?
        JZ      SOU3                    ;if yes exit else
```

```
        INC     SI                      ;advance ptr to
        INC     SI                      ;point to the duration
        MOV     AL,DL                     ;low lsb of frequency
        OUT     42h,AL                    ;send to latch2 port
        MOV     AL,DH                     ;low msb of frequency
        OUT     42h,AL                    ;send to latch2 port
        MOV     AH,0                      ;int function number
        INT     1Ah                     ;get BIOS timer count
        MOV     BX,DX                     ;move lsword to BX
        ADD     BX,[SI]                   ;add duration to BX
        INC     SI                      ;advance ptr to
        INC     SI                      ;point to next frequency.
SOU2:   INT     1Ah                       ;get BIOS timer count
        CMP     DX,BX                     ;is count > duration?
        JC      SOU2                    ;if not check again else
        JMP     SHORT SOU1                    ;jump to get next freq.
SOU3:   IN      AL,61h                    ;get byte from port B
        AND     AL,0FCh                   ;turn off speaker bits
        OUT     61h,AL                  ;replace byte in port B
        MOV     DX,1282                   ;default setting
        MOV     AL,DL                   ;get lsb of count
        OUT     42h,AL                  ;send to port 42h
        MOV     AL,DH                     ;get msb of count
        OUT     42h,AL                  ;send to port 42h
        POP     BP
        POP     DX                      ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    SOUND
;
;       Force the numlock key ON by turning on bit 5 in the BIOS data area
PROC    NUM_LOCK_ON
        PUSH    AX
        PUSH    DS
        XOR     AX,AX
        MOV     DS,AX
        MOV     AL,20h
        MOV     SI,417h
        OR      [SI],AL
        POP     DS
        POP     AX
        RET
ENDP    NUM_LOCK_ON
;
;
;-------Clear Display Message.
;       Input = None
;       Output = None
;
PROC    CLEAR_MESSAGE
```

```
        PUSH    AX                      ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AL,[Menu]               ;Menu color
        MOV     [Color],AL              ;set color
        MOV     AX,0206h                ;row 3; col 8
        CALL    GOTOYX                  ;position cursor
        CALL    CSTR_OUT
        db      73 DUP(20h),0
        MOV     AL,[Normal]             ;normal color
        MOV     [Color],AL              ;set color
        CALL    HIDE_CUR
        POP     DX                      ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    CLEAR_MESSAGE
;
;
;
;---- Create a Disk File using the file Handle method.
;       Input = AX = ptr ASCIIZ name of the file.
;               shared/read/write access.
;       Output = Carry flag set if a creating error or
;               File Handel in BX and a file of 0 bytes is open
;
; **** Caution: This procedure will erase and existing file. ********
;               If the two files have the same name.
;
PROC    CREATE
        MOV     DX,AX                   ;ptr to file name string
        MOV     AH,3Ch                  ;create file with handle
        XOR     CX,CX                   ;normal attributes
        INT     21h                     ;try to open file.
        JC      CT1                     ;carry = opening error
        MOV     BX,AX                   ;file handle in BX
        CLC                             ;clear carry flag
        JMP     SHORT CT4               ;return to calling prg.
CT1:    CMP     AX,0Ch                  ;Is access code wrong?
        JNZ     CT2                     ;If not skip.
        XOR     AX,AX                   ;zero AX if wrong code
CT2:    CMP     AX,6                    ;Is error code > 5 ?
        JC      CT3                     ;If not skip.
        MOV     AX,6                    ;end of error table
CT3:    MOV     [ErrCode],AL            ;save error code
        SHL     AX,1                    ;multi err code by 2
        MOV     BX,Offset OpenErr       ;open error table base
        ADD     BX,AX                   ;add err. offset to base
        MOV     AX,0107h                ;row 2, column 8
        CALL    GOTOYX                  ;position cursor
```

```
        MOV     CL,[Color]                      ;save color attribute
        MOV     AL,[Warning]                     ;get new attribute
        MOV     [Color],AL                      ;assign attri to color
        CALL    CSTR_OUT                          ;output this line to
        db      ' Error! creating ',0           ;the screen.
        MOV     AX,DX                           ;File name pointer.
        CALL    DSTR_OUT                          ;output file name.
        MOV     AX,[BX]                         ;ptr msg string to AX
        CALL    DSTR_OUT                          ;display type of error
        MOV     [Color],CL                      ;restore original attri
        STC                                     ;set carry flag
CT4:    RET
ENDP    CREATE
;
;
;-----Send a 16 bit unsigned binary number to the screen in decimal form
;               in EGA and VGA Graphics Mode 10h page 0
;       Input =  AX = binary number    CX = total number of digits
;               the number is padded with leading zeros until CX digits .
;               [color] = current attribute from data section
;       Output = None
;       Video mode:  10h  640 x 350  16 colors   row = 25 Col = 80
;
;      Note: the calling procedure must make sure that the number is CX is
;           large enough to display all the digits of the number in AX.  This
;           procedure can be used when leading zeros are needed.
;
PROC BIN_DIG_OUT    NEAR
        PUSH    AX                              ;save dividend
        PUSH    BX
        PUSH    CX                              ;save CX register
        PUSH    DX                              ;save remainder
        SUB     DX,DX                           ;zero DX register
        MOV     BX,0Ah                          ;divisor is 10
        DIV     BX                              ;AX/10; answer in AX
        DEC     CX                              ;remainder digit in DL
        JZ      @BIN                            ;if yes stop recursion
        CALL    BIN_DIG_OUT                         ;contine recursive call
@BIN:   CALL    DIGIT_OUT                           ;display digit in DL
        POP     DX                              ;previous digit to DL
        POP     CX                              ;restore CX register
        POP     BX
        POP     AX                              ;restore AX register
        RET             ;NOTE: this RET will point to @@BIN: to display
ENDP BIN_DIG_OUT        ;each digit of the recursions stored in DL register.
                        ;After all digits are displayed it will return to
                        ;the calling program.
;
;
;------Ask a yes or no question.
;       Input = None
;       Output = Carry Flag = YES
```

```
;
PROC   EXIT_YN
       PUSH   AX                          ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
       CALL   CLEAR_MESSAGE
       MOV    AL,[Warning]                 ;warning color
       MOV    [Color],AL                  ;set color
       MOV    AX,020Bh                     ;row 3/Col 12
       CALL   GOTOYX                       ;set cursor
       CALL   CSTR_OUT                     ;display warning
       db     ' Exit to DOS ?  [Y]/N ',0
       MOV    AL,[Normal]                  ;normal color
       MOV    [Color],AL                  ;set color
EX1:   CALL   HIDE_CUR
       CALL   GET_CHAR
       AND    AL,5Fh                       ;turn off bits 6 & 8
       CMP    AL,'N'                       ;is it No?
       JZ     EX4                         ;if yes exit
       CMP    AL,0Dh                       ;is it <Enter>?
       JNZ    EX2                         ;if not continue
       STC                                ;set carry flag
       JMP    SHORT EX5                       ;exit
EX2:   CMP    AL,'Y'                       ;is it Yes?
       JNZ    EX1                         ;if not get another
       STC                                ;set carry flag
       JMP    SHORT EX5                       ;exit
EX4:   CLC                                ;clear carry flag
EX5:   POP    DX                           ;restore registers
       POP    CX
       POP    BX
       POP    AX
       RET
ENDP   EXIT_YN
;
;
;-----Clear the screen and place the cursor in position 0,0
;      Input = None    Color - current [color] attribute from data section
;      Output = None   Border color is also set the same as the screen.
;      Notes: All registers saved.  25 rows and 80 columns page 0 assumed.
;
PROC CLEAR_SCREEN
       PUSH   AX                          ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
       MOV    BH,[Color]                   ;color attribute
       MOV    AX,0700h                     ;initialize window func
       SUB    CX,CX                       ;row/col = 0,0
       MOV    DX,184Fh                     ;row/col = 24,79
       INT    10h                         ;clear screen window
```

```
        MOV     BH,[Color]              ;color attribute
        MOV     CL,4                    ;shift background color
        SHR     BH,CL                   ;to the lower 4 bytes.
        MOV     AX,1001h                ;function number
        INT     10h                     ;set screen border
        MOV     AH,2h                   ;set cursor position
        MOV     BH,0                    ;page 0, row,col to DX
        MOV     DX,CX                   ;position cursor at the
        INT     10h                     ;the top left cornor.
        POP     DX                      ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    CLEAR_SCREEN
;
;
;
;------Draw a 4 line 80 column menu box.  Starting at row 0-21, column 0.
;       Input = AX = Row,Columns cursor position.  Column must be 0
;       Output = None
;       Calls  CSTR_OUT  procdeures
PROC MENU_BOX
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        XOR     AL,AL                   ;set column to 0
        CALL    GOTOYX                  ;set cursor position
        MOV     DL,[Color]              ;save original Color
        MOV     AL,[Menu]               ;clange color attribute
        MOV     [Color],AL              ;for scren output.
        CALL    CSTR_OUT                ;draw menu box
        db      201, 78 DUP (205),187   ;all except last byte.
        db      186, 78 DUP (' '),186   ;CSTRU_OUT will cause
        db      186, 78 DUP (' '),186   ;the screen to scroll
        db      200, 78 DUP (205),0     ;in row 25, col 80.
        MOV     BL,AL                   ;color to BL
        MOV     AH,09h                  ;write char funct no.
        MOV     AL,188                  ;last character of box
        MOV     BH,0                    ;page 0 assumed
        MOV     CX,1                    ;number of bytes
        INT     10h                     ;write last byte
        MOV     [Color],DL              ;restore original Color
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    MENU_BOX
;
;------Draw a 4 line 80 column menu box.  Starting at row 0-21, column 0.
```

```
;       Input = AX = Row,Columns cursor position.  Column must be 0
;       Output = None
;       Calls CSTR_OUT  procdeures
PROC  CLEAR_BOX
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     DL,[Color]                      ;save original Color
        MOV     AL,[Normal]                      ;clange color attribute
        MOV     [Color],AL                      ;for scren output.
        XOR     AL,AL                           ;set column to 0
        MOV     BL,79
        MOV     BH,AH
        ADD     BH,4
        CALL    CLEAR_WINDOW
        MOV     [Color],DL                      ;restore original Color
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP  CLEAR_BOX
;
;
; Display the DOS extended error message return
; by calling Int 21h function 59h - Get extended error information.  If the
; error code is less then 36 the error string is presented.  If the error
; number is 36 or larger the number is print to the screen.
;  Input = None     data bytes [ErrCode],[Color], and [Normal] assumed.
;  Output = Error number in [ErrCode]
;
PROC    DISPLAY_ERROR
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        PUSH    ES
        MOV     [ErrCode],AL                     ;save AL register
        CALL    CLEAR_MESSAGE
        MOV     CH,[Warning]                     ;warning color
        MOV     CL,[Color]                      ;save original color
        MOV     [Color],CH                       ;set color
        MOV     AX,0207h                         ;row 3/Col 8
        CALL    GOTOYX                           ;set cursor
;-----request extended error information
        XOR     BX,BX                           ;get extended error
        MOV     AX,5900h                         ;information  from
        INT     21h                             ;DOS system
        XOR     AH,AH                            ;zero hi byte
        CMP     AL,0                            ;was an error found?
        JZ      ERRO1                            ;If NO display message
```

```
        CMP     AL,37                   ;is code < 37 ?
        JC      ERRO1                   ;if YES display mess
        CALL    CSTR_OUT
        db      ' DOS Error Number: ',0
        CALL    BIN_OUT
        MOV     AX,37                   ;37 = unknown DOS error
ERRO1:  SHL     AX,1                      ;error number x 2
        MOV     BX,Offset ErrStr          ;pointer to table base
        ADD     BX,AX                   ;BX ptr to error ptr.
        CALL    CSTR_OUT
        db      ' DOS Error: ',0
        MOV     AX,[BX]                   ;load ptr to error str.
        CALL    DSTR_OUT                    ;send string to screen
        CALL    CSTR_OUT
        db      '  Press Any Key. ',0
        MOV     [Color],CL                ;restore original color
        CALL    HIDE_CUR
        CALL    ERR_SOUND
        CALL    GET_CHAR
        POP     ES
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    DISPLAY_ERROR
        .DATA
ErrStr  dw      Err00,Err01,Err02,Err03,Err04,Err05,Err06,Err07,Err08,Err09
        dw      Err10,Err11,Err12,Err13,Err14,Err15,Err16,Err17,Err18,Err19
        dw      Err20,Err21,Err22,Err23,Err24,Err25,Err26,Err27,Err28,Err29
        dw      Err30,Err31,Err32,Err33,Err34,Err35,Err36,Err37
Err00   db      'no error found',0
Err01   db      'function number invalid',0
Err02   db      'file not found',0
Err03   db      'path not found',0
Err04   db      'to many open files',0
Err05   db      'access denied',0
Err06   db      'handle invalid',0
Err07   db      'memory control blocks destroyed',0
Err08   db      'insufficient memory',0
Err09   db      'memory block address invalid',0
Err10   db      'environment invalid',0
Err11   db      'format invalid',0
Err12   db      'access code invalid',0
Err13   db      'data invalid',0
Err14   db      'unkown unit',0
Err15   db      'disk drive invalid',0
Err16   db      'attempted to remove current directory',0
Err17   db      'not same device',0
Err18   db      'no more files',0
Err19   db      'disk write-protected',0
Err20   db      'unkown unit',0
```

```
Err21   db      'drive not ready',0
Err22   db      'unkown command',0
Err23   db      'data error (crc)',0
Err24   db      'bad request structure length',0
Err25   db      'seek error',0
Err26   db      'unkown media type',0
Err27   db      'sector not found',0
Err28   db      'printer out of paper',0
Err29   db      'write fault',0
Err30   db      'read fault',0
Err31   db      'general failure',0
Err32   db      'sharing violation',0
Err33   db      'lock violation',0
Err34   db      'disk change invalid',0
Err35   db      'FCB unavailable',0
Err36   db      'sharing buffer exceeded',0
Err37   db      'check DOS documentation',0

        .CODE
;
;
; INT24h  Substitute critical-error handler to tell DOS to Retry or Fail errors and
; return to the calling program.  This subroutine will redirect DOS's
;attempt back to the calling program.
; Note : The Abort is converted to what DOS calls a Fail and will return
;        control back to the calling program with an error code in AL.
; INT23h Ignore the control C break command from the keyboard.
;
PROC    INTERRUPT_HANDLER
;-----install critical-error handler
        PUSH    DS
        MOV     DX,Seg INT24
        MOV     DS,DX
        MOV     DX,Offset INT24
        MOV     AX,2524h
        INT     21h
;-----install ^C error handler (ignore ^C breaks)
        MOV     DX,Seg INT23
        MOV     DS,DX
        MOV     DX,Offset INT23
        MOV     AX,2523h
        INT     21h
        POP     DS
        RET
;-----substitute interrupt 23h
PROC    INT23   FAR
        XOR     AX,AX
        IRET
ENDP    INT23
;-----substitute interrupt 23h
PROC    INT24   FAR
        PUSH    BX
```

```
        PUSH    CX
        PUSH    BX
        PUSH    SI
        PUSH    DI
        PUSH    BP
        PUSH    DS
        PUSH    ES
        MOV     DX,AX                   ;save in DX
        MOV     AX,@DATA                  ;get data segment
        MOV     DS,AX                   ;assign data segment
        MOV     CL,[Color]              ;get current attribute
        MOV     AL,[Warning]             ;get warning color
        MOV     [Color],AL              ;assign to color
        MOV     AX,0220h                ;row 4 / col 0
        CALL    GOTOYX                   ;position cursor
        CALL    CSTR_OUT                  ;send string to screen
        db      7,7,' Error: Press R to Retry or A to Abort. ',0
        CALL    HIDE_CUR
CRT1:   MOV     AH,6                     ;Dos function number
        MOV     DL,0FFh                 ;get char input from
        INT     21h                    ;the keyboard.
        JZ      CRT1                    ;If not char try again
        AND     AL,5Fh                   ;make capital letter
        MOV     AH,AL                    ;input to AH
        MOV     AL,3                    ;3 = fail the DOS call
        CMP     AH,'A'                  ;is it an Abort ?
        JZ      CRT2                   ;exit if an Abort
        MOV     AL,1                    ;1 = retry the DOS call
        CMP     AH,'R'                  ;is it a Retry ?
        JNZ     CRT1                    ;If not get new char
CRT2:   MOV     DL,AL                     ;save return code
        MOV     AL,[Menu]                ;get menu color
        MOV     [Color],AL              ;assign to color
        MOV     AX,0220h                ;row 4 / col 0
        CALL    GOTOYX                   ;position cursor
        CALL    CSTR_OUT                  ;send string to screen
        db      '                      ',0
        MOV     [Color],CL                ;assign original attri
        MOV     AX,DX                   ;restore DOS return code
        POP     ES
        POP     DS
        POP     BP
        POP     DI
        POP     SI
        POP     DX
        POP     CX
        POP     BX
        IRET
ENDP    INT24
ENDP    INTERRUPT_HANDLER
;
```

```
;
;------The Pause for set for 1/2 second.
;       Input = None
;       Output = None
PROC  PAUSE
      PUSH    AX
      PUSH    BX
      PUSH    CX
      PUSH    DX
      XOR     AX,AX                    ;Get ticks function no.
      INT     1Ah                      ;get Dos timer ticks
      MOV     BX,DX                    ;low byte ticks to BX
      ADD     BX,9                     ;9 = 1/2 second
PA1:  XOR     AX,AX                    ;Get ticks function no.
      INT     1Ah                      ;get Dos timer ticks
      CMP     BX,DX                    ;is time run out?
      JNC     PA1                      ;if not loop again
      CLC                              ;clear carry flag
      POP     DX
      POP     CX
      POP     BX
      POP     AX
      RET
ENDP  PAUSE
;
;
;------Select a Select a Key file.
;
;       Input = None
;       Output = Carry Flag if DOS Error
;       Local variables:
;        BH = hilite bar position # 1 to 14
;        BL = starting directory number # 1 to MaxFile
;
PROC    SELECT_FILE
      PUSH    AX
      PUSH    BX
      PUSH    CX
      PUSH    DX
      CALL    CLOSE_FILE               ;close any open file
      CALL    SET_TYPE                 ;POS or NEG variables
      CALL    CREATE_MEM_DIR           ;make a memory directory
      JC      SEL5                     ;exit if error
      CALL    SELECT_SCREEN            ;display select screen
      JC      SEL4                     ;no files in directory
;------display the files
      MOV     BX,[BarPos]              ;starting position
SEL0: MOV     AX,BX                    ;file variables to AX
      CALL    DISPLAY_FILES            ;files to screen
SEL1: CALL    GET_CHAR                 ;get keyboard input
      CMP     AL,1Bh                   ;is it an Esc key ?
      JNZ     SEL2                     ;if not goto next test
```

```
      JMP    SEL4                          ;Exit
SEL2: CMP    AL,0Dh                          ;is it a pick ?
      JZ     SEL3                          ;if YES exit loop
;------see if an active control key was pressed
      CALL   CONTROL_KEYS
      JC     SEL1                          ;no change get char
      JMP    SHORT SEL0                      ;redraw file window
;-----Open file, count ID's, and look for ranked data line.
SEL3: CALL   MOVE_NAME                         ;file name to data seg
      CALL   OPEN_SLDI                       ;open SLDI file
      JC     SEL5                          ;Esc = main menu
      MOV    [BarPos],BX                     ;save current position
      CALL   READ_DATE                       ;get DOS date of file
      CALL   FIND_ZERO                       ;locate 000 in data file
      JC     SEL5
SEL4: CALL   RELEASE_MEM_DIR                      ;release mem block
      CLC                                  ;clear carry flag
      JMP    SHORT SEL6
SEL5: CALL   RELEASE_MEM_DIR                      ;release mem block
      STC                                  ;error set carry flag
SEL6: POP    DX
      POP    CX
      POP    BX
      POP    AX
      RET
;
;   Adjust the highlight bar position variables in BX register
;      Input = AL = Char for the keyboard
;            BH = hilite bar position # 1 to 14
;            BL = starting directory number # 1 to MaxFile
;      Output  Carry Flag = no change in BX
;
PROC   CONTROL_KEYS
;------Is it a Down arrow ?
      CMP    AL,24                         ;is it Down arrow?
      JNZ    KYS2                          ;if not goto next test
      MOV    AX,BX                          ;get current variables
      ADD    AH,AL                         ;inc hilite bar
      CMP    [MaxFile],AH                    ;is it end of file ?
      JC     KYS10                         ;if yes Exit no changes
      CMP    BH,14                          ;is bottom of window ?
      JZ     KYS1                          ;if yes inc starting
      INC    BH                            ;else inc bar number
      JMP    SHORT KYS9                      ;exit
KYS1: INC    BL                            ;inc starting number
      JMP    SHORT KYS9                      ;display new directory
;------Is it an Up arrow ?
KYS2: CMP    AL,5                          ;is it Up arrow ?
      JNZ    KYS4                          ;if no goto next test
      CMP    BX,0101h                       ;is it begining of file ?
      STC                                  ;set carry for ret
      JZ     SHORT KYS10                     ;if yes Exit no changes
```

```
        CMP     BH,1                    ;is top of window ?
        JZ      KYS3                    ;if yes Dec starting
        DEC     BH                      ;else dec bar number
        JMP     SHORT KYS9                  ;exit
KYS3:   DEC     BL                      ;dec starting number
        JMP     SHORT KYS9                  ;display new directory
;------Is it a Home Key ?                 ;go to Top of Directroy
KYS4:   CMP     AL,1                    ;is it Home key?
        JNZ     KYS5                    ;if not goto next test
        MOV     BX,0101h                ;set top of file
        JMP     SHORT KYS9                  ;display new directory
;------Is it a End Key ?                  ;go Bottom of Directory
KYS5:   CMP     Al,6                    ;is it End key ?
        JNZ     KYS7                    ;if not goto next test
        MOV     AH,[MaxFile]                ;get number of files
        CMP     AH,15                   ;are # of files > 14 ?
        JNC     KYS6                    ;if yes jump to lastpage
        MOV     BL,1                    ;starting position
        MOV     BH,AH                   ;hilite last entry.
        JMP     SHORT KYS9
KYS6:   SUB     AH,13                       ;maxfiles-13 = starting
        MOV     BL,AH                   ;store in BL
        MOV     BH,14                   ;hilite bottom of window
        JMP     SHORT KYS9                  ;display directory
;------Is it the PageUp Key ?
KYS7:   CMP     AL,18                       ;is it the pageup key ?
        JNZ     KYS8                    ;if goto next test
        MOV     AH,BL                   ;starting # to AL
        SUB     AH,14                   ;subtract 14 = pageup
        MOV     AL,1                    ;char for homekey
        JLE     KYS4                    ;no goto homekey
        MOV     BL,AH                   ;change page
        JMP     SHORT KYS9                  ;display new page
;------Is it the PageDn Key ?
KYS8:   CMP     AL,3                        ;is it the pagedn key ?
        STC                             ;set carry flag for ret
        JNZ     KYS10                   ;if goto next test
        MOV     AH,BL                   ;starting # to AL
        MOV     AL,[MaxFile]                ;number of dir files
        SUB     AL,14                   ;ptr to top of lastpage
        ADD     AH,14                   ;page = page + 1
        CMP     AL,AH                   ;is this the lastpage?
        MOV     AL,6                    ;char for End key
        JLE     KYS5                    ;if yes goto End
        MOV     BL,AH                   ;else go Page + 1
KYS9:   CLC
KYS10:  RET
ENDP    CONTROL_KEYS
;
;------Display Files in Memory Directory
;       Input   AL = starting directory number (1 to MaxFile)
;               AH = hilite bar number (1 to 14)
```

```
;       Output  a 14 line of file names to the screen.
;       Note:  local variables:         AH = non hilite color attribute
;              BX = row/col             DH = hilite bar color attribute
;              CX = loop counter        DL = reverse hilite bar number (14 to 1)
;       Note: the hilite bar counter stored in DL is reversed from 1 to 14
;             into 14 to 1 so it can be compaired to the loop counter in
;             CX to select the correct row to hilite.
;
PROC    DISPLAY_FILES
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     DL,15                           ;convert 1 to 14 into
        SUB     DL,AH                           ;14 to 1
        MOV     AH,[Menu]                         ;normal attribute
        MOV     [Color],AH                      ;set default color
        MOV     DH,[Warning]                      ;hilite bar attirbute
        MOV     BX,0520h                        ;row 6/ col 32
        MOV     CX,14                           ;number of rows
DIS0:   CMP     DL,CL                             ;is this the hilite bar
        JNZ     DIS1                            ;< > 0 = no color change
        MOV     [Color],DH                        ;if yes color = warning
DIS1:   CALL    DIR_STR                           ;display one file name
        CMP     DL,CL                           ;is the the hilite bar
        JNZ     DIS2                            ;< > 0 = no color change
        MOV     [Color],AH                        ;if yes color = menu
DIS2:   INC     BH                              ;ptr to next row
        INC     AL                              ;ptr to next dir entry
        LOOP    DIS0                              ;loop 14 times
        CALL    HIDE_CUR
        CLC                                     ;clear carry flag
DIS3:   POP     DX                                ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    DISPLAY_FILES
;
;-----Move Selected file Name from memory block to FileNa in data segment.
;       Input   BL = starting directory number (1 to MaxFile)
;               BH = hilite bar number (1 to 14)
;       Output  an ASCIIZ file name string in FileNa in the data section.
;
PROC    MOVE_NAME
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AX,BX                           ;memblk ptr to AX
        ADD     AL,AH                           ;start dir no + hilite
        DEC     AL                              ;minus 1 = memblk recno
```

```
        XOR     AH,AH                   ;convert 16 bit number
        MOV     CL,4                    ;shift counter
        SHL     AX,CL                   ;2^4 = times 16
        INC     AX                      ;skip 2 leading spaces
        INC     AX
        MOV     SI,AX                   ;memblk offset to SI
        MOV     DI,Offset FileNa        ;destination offset
        MOV     AX,DS                   ;assign ES to the
        MOV     ES,AX                   ;data section
        MOV     AX,[DirSeg]             ;memblk base ptr
        MOV     DS,AX                   ;assign memblk to DS
        CLD                             ;auto inc SI & DI
MOV0:   MOV     AL,[SI]                 ;get first byte
        CMP     AL,'.'                  ;is beginning of type?
        JZ      MOV1                    ;exit loop if yes
        MOVSB                           ;move byte
        JMP     SHORT MOV0              ;loop until beg of type
MOV1:   MOV     AX,ES                   ;restore DS to
        MOV     DS,AX                   ;point to the data seg
        MOV     CX,5                    ;number byte to move
        MOV     SI,Offset FilTyp        ;point to 5 byte string
        REP     MOVSB                   ;move type to FileNa
        CLC                             ;clear carry flag
        POP     DX                      ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    MOVE_NAME
;
;------Display the Select a file screen.
;       Input = None
;       Output = Carry Flag if no FIL files in current directory
;
PROC    SELECT_SCREEN
        PUSH    AX                      ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        XOR     AX,AX                   ;row 0,column 0
        CALL    MENU_BOX                ;draw menu box
        MOV     AX,010Bh                ;row 1,column 4
        CALL    GOTOYX
        MOV     CL,[Color]              ;save current color attr
        MOV     AL,[Menu]               ;set color = menu
        MOV     [Color],AL
        CALL    CSTR_OUT
        db      'Use the ',24,' and ',25,' arrow keys to highlight the '
        db      'desired data file.',0
        MOV     AX,020Fh                ;row 2,column 7
        CALL    GOTOYX
        CALL    CSTR_OUT
```

```
        db      'Press the <Enter> key to select the highlighted file.',0
        MOV     AL,[Normal]                     ;set Color
        MOV     [Color],AL
        CALL    CLEAR_TITLE
        MOV     AX,0406h
        CALL    GOTOYX
        CALL    CSTR_OUT
        db      'Directory Path :  ',0
        MOV     AX,Offset Path
        CALL    DSTR_OUT
        MOV     AX,1500h                        ;row 21,column 0
        CALL    MENU_BOX                          ;draw menu box
        MOV     AL,[Menu]                       ;set color = menu
        MOV     [Color],AL
        MOV     AX,1606h                        ;row 23,column 5
        CALL    GOTOYX
        CALL    CSTR_OUT
        db      'Press the <Esc> key to return to the menu without '
        db      'selecting a file.',0
        MOV     AX,1709h                        ;row 23,column 5
        CALL    GOTOYX
        CALL    CSTR_OUT
        db      'The current directory contains: ',0
        XOR     AX,AX                           ;zero AX register
        MOV     AL,[Maxfile]                    ;load number FIL files
        CMP     AL,1                            ;is it only one ?
        JZ      CEE1                            ;is yes singular text
        CMP     AL,0                            ;is it zero ?
        JZ      CEE2                            ;if yes display error
        CALL    BIN_OUT                           ;else display number
        CALL    CSTR_OUT                          ;of files.
        db      " files with a type of '",0
        JMP     CEE4
CEE1:   CALL    CSTR_OUT                          ;singular text mess.
        db      "1 file with a type of '",0
        JMP     CEE4
CEE2:   CALL    CSTR_OUT                          ;zero files statement
        db      "no files with a type of '",0
        MOV     AX,Offset FilTyp
        CALL    DSTR_OUT
        CALL    CSTR_OUT
        db      "'.",0
        MOV     AL,[Warning]                    ;warning color
        MOV     [Color],AL                      ;set color
        MOV     AX,0506h                        ;row 5 Col 7
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      ' No ',0
        MOV     AX,Offset FilTyp
        CALL    DSTR_OUT
        CALL    CSTR_OUT
        db      ' files found in directory!  Press Any Key for '
```

```
      db     'previous Menu. ',0
      CALL   HIDE_CUR
      CALL   GET_CHAR                    ;wait for keyboard key
      MOV    [Color],CL                  ;restore original Color
      STC                                ;set carry flag
      JMP    SHORT CEE5                  ;exit no files found
;-----draw background boxes and key discriptions
CEE4: MOV    AX,Offset FITyp
      CALL   DSTR_OUT
      CALL   CSTR_OUT
      db     '.',0
      CALL   SELECT_WINDOW
CEE5: POP    DX                          ;restore registers
      POP    CX
      POP    BX
      POP    AX
      RET
;--- draw file diplay windows and key instructions
;     Input = None
;     Output = None
PROC  SELECT_WINDOW
      MOV    AL,[Normal]                 ;set Color
      MOV    [Color],AL
      MOV    AX,0804h                    ;row 8 column 4
      CALL   GOTOYX
      CALL   CSTR_OUT
      db     "<Up Arrow> = Move Up
      db     "<Down Arrow> = Move Down",0
      MOV    AX,0A04h                    ;row 10,column 4
      CALL   GOTOYX
      CALL   CSTR_OUT
      db     "<PageUp> = Scroll Up
      db     "<Home> = First File.",0
      MOV    AX,0C04h                    ;row 12,column 4
      CALL   GOTOYX
      CALL   CSTR_OUT
      db     "<PageDn> = Scroll Down
      db     "<End> =  Last File.",0
;-----draw display windows
      MOV    AL,[System]
      MOV    [Color],AL
      MOV    AX,0621h
      MOV    BX,1332h
      CALL   CLEAR_WINDOW
      MOV    AL,[Menu]
      MOV    [Color],AL
      MOV    AX,051Fh
      MOV    BX,1230h
      CALL   CLEAR_WINDOW
      CALL   HIDE_CUR
      MOV    [Color],CL                  ;restore original Color
      CLC                                ;clear carry flag
```

```
    RET
ENDP   SELECT_WINDOW
ENDP   SELECT_SCREEN
ENDP   SELECT_FILE
;


;
; Create a directory of the FeedBack files in memory.
;    Input = None
;    Output = Carry flag if DOS error,  AL = FFh is to many files
;    [DirSeg] = Starting segment address of memory block.
;    [MaxFile] = total number of FeedBack files.
;
PROC   CREATE_MEM_DIR
    PUSH   BX
    PUSH   CX
    PUSH   DX
    PUSH   ES
    CALL   RELEASE_MEM_DIR
    JNC    CRE0                          ;continue if no error
    JMP    CRE9                          ;exit on DOS error
CRE0:  CALL   COUNT_FILES                      ;how many SLDI files?
    CMP    AX,251                        ;is files found < 251 ?
    JNC    CRE1                          ;if no display err mess
    MOV    [MaxFile],AL                   ;save number of files
    JMP    CRE2                          ;if yes OK! continue
CRE1:  MOV    AX,030Bh                       ;row 3 / col 1
    CALL   GOTOYX                         ;position cursor
    CALL   CSTR_OUT                        ;string to screen
    db     'There are to more than 250 SLD files in this directory.',0
    MOV    AX,0511h                       ;row 3 / col 1
    CALL   GOTOYX                         ;position cursor
    CALL   CSTR_OUT                        ;string to screen
    db     'Please move some of them to another directory.',0
    MOV    AX,071Ah                       ;row 3 / col 1
    CALL   GOTOYX                         ;position cursor
    CALL   CSTR_OUT                        ;string to screen
    db     'Press Any Key to Exit to DOS.',0
    CALL   HIDE_CUR                        ;hide cursor
    CALL   GET_CHAR                        ;wait for keypressed
    MOV    AL,0FFh                        ;to many files marker
    JMP    CRE8                          ;exit to many files
CRE2:  CMP    AL,0                          ;were any files found ?
    JZ     CRE8                          ;if no files Exit
CRE3:  CALL   GET_DIR_BLK                      ;allocate memory blk
    JC     CRE9
    CALL   MAKE_DIR
    JC     CRE9
    CALL   SHELL_SORT
CRE8:  CLC                                ;clear carry flag
CRE9:  POP    ES
```

```
        POP     DX                              ;restore registers
        POP     CX
        POP     BX
        RET
ENDP    CREATE_MEM_DIR
;
;
;  Make a directory of FeedBack files in memory block [DirSeg]
;  Each entry is 16 bytes.  Format: 2 spaces + File Name + padding spaces = 16
;       Input = [DirSeg] and [Search] in data section
;       Output = None
PROC    MAKE_DIR
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        PUSH    DS
        PUSH    ES
        MOV     AX,DS
        MOV     ES,AX
        CMP     WORD [DirSeg],0                 ;is memblk allocated ?
        STC                                     ;set carry if error
        JZ      COP4                            ;if no memblk EXIT
;------find first match
        XOR     BX,BX                           ;zero file counter
        MOV     AX,4E00h                        ;find a first file
        XOR     CX,CX                           ;ordinary files only
        MOV     DX,Offset Search                ;ptr file name ASCIIZ
        INT     21h                             ;do the first search
        JC      COP4                            ;if no match exit
;------set up ES and DS segment registers
        MOV     AH,62h                          ;get the current PSP
        INT     21h                             ;segment address.
        JC      COP4                            ;exit on error
        MOV     AX,[DirSeg]                     ;ptr to base of memblk
        MOV     ES,AX                           ;ES set to memory blk
        MOV     DS,AX                           ;DS set to memory blk
;------set directory entry 0 = a blank ASCII string (16 spaces)
        MOV     AX,2020h                        ;two spaces in ASCII
        MOV     DI,2                            ;distination ptr
        MOV     SI,0                            ;source ptr
        MOV     CX,7                            ;loop counter
        MOV     [SI],AX                         ;place 1st 2 bytes
        CLD                                     ;auto inc SI & DI
        REP     MOVSW                           ;place next 14 bytes
;------copy directory entries loop
        MOV     DS,BX                           ;DS set to PSP
;------place leading 2 spaces
COP0:   MOV     AX,2020h                        ;two ASCII spaces
        MOV     [ES:DI],AX                      ;place in directory
        INC     DI                              ;advance directory ptr
        INC     DI
```

```
;------move one file name                    ;80h = DTA; 1Eh = offset
      MOV    SI,9Eh                          ;DTA + offset = 9Eh          MOV    CX,12
            ;max length of Name
      MOV    CX,12                           ;max file name length
COP1: MOV    AL,[SI]                           ;load byte to be moved
      CMP    AL,0                            ;is it end of string ?
      JZ     COP2                            ;if end exit loop
      CLD                                   ;auto inc SI & DI
      MOVSB
      LOOP   COP1                              ;copy file name
;------pad end of file name with spaces.
COP2: ADD    CX,2                              ;number of bytes
      MOV    AL,20h                          ;space to AL
COP3: MOV    [ES:DI],AL                          ;place space in dir
      INC    DI                              ;ptr to next byte
      LOOP   COP3                              ;loop until CX = 0
;------find next match
      MOV    AX,4F00h                          ;fine next file function
      INT    21h                             ;do next search
      JNC    COP0                              ;loop until all found
      CLC                                   ;clear carry flag
COP4: POP    ES
      POP    DS
      POP    DX                               ;restore registers
      POP    CX
      POP    BX
      POP    AX
      RET
ENDP  MAKE_DIR
;
;------ Allocate memory block for the Director of files ([MaxFile]+2 paragraphs)
;     Input = None
;     Output = Carry flag set if memory block is not available.
;            Index file seg address stored in [DirSeg]
;     Note:  The binary SEARCH procedure needs a blank record before
;            the memory index records. The number of pargraphs
;            needed is [MaxFile] + 1.
;
PROC  GET_DIR_BLK
      PUSH   AX                               ;save registers
      PUSH   BX
      PUSH   CX
      PUSH   DX
MEM1: MOV    BL,[MaxFile]                          ;get number of files
      XOR    BH,BH                           ;zero high byte
      INC    BX                              ;get an extra paragraph
      MOV    AH,48h                            ;allocate men function
      INT    21h                             ;request memory block
      JC     MEM2                              ;jump if memory error.
      MOV    [DirSeg],AX                       ;base address of seg
      JMP    SHORT MEM3                           ;normal exit of proc.
MEM2: MOV    CL,[Color]                           ;save original color
```

```
        MOV     AL,[Warning]                    ;warning color
        MOV     [Color],AL                      ;set color
        MOV     AX,0101h                        ;row 1/Col 1
        CALL    GOTOYX                          ;position cursor
        CALL    CSTR_OUT                        ;send string to screen
        db      ' Not enough memory for the directory of files. '
        db      'Press Any Key to Continue. ', 0
        MOV     [Color],CL                      ;restore original color
        CALL    HIDE_CUR                        ;hide cursor off screen
        CALL    GET_CHAR                        ;wait for key is pressed
        STC                                     ;set carry flag = error
MEM3:   POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    GET_DIR_BLK
;
;
;------ Adjust the DOS memory block size allocation to the minimum amount.
;       Input = None
;       Output = Carry flag set if memory block error.
;       Note:   Assumes the programs memory is in a single block
;               and the stack segment is at the end of the program.
;
PROC    RELEASE_MEM
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        PUSH    ES
        MOV     AX,STACKSIZE                    ;current stack size
        MOV     CL,4                            ;convert to paragraphs
        SHR     AX,CL                           ;divide by 2^4 or 16
        INC     AX                              ;round up 2 paragraphs
        INC     AX                              ;to protect top of stack
        MOV     CX,AX                           ;save in register CX
        MOV     AX,SS                           ;get stack seg address
        ADD     CX,AX                           ;ptr to end of stack
        MOV     AH,62h                          ;get the current PSP
        INT     21h                             ;segment address.
        JC      REL0                            ;exit on error
        MOV     ES,BX                           ;ptr to current PSP
        SUB     CX,BX                           ;program size in
        MOV     BX,CX                           ;paragraphs to BX.
        MOV     AH,4Ah                          ;release mem function
        INT     21h                             ;release previous block.
REL0:   POP     ES                              ;restore registers
        POP     DX
        POP     CX
        POP     BX
        POP     AX
```

```
        RET
ENDP    RELEASE_MEM
;
;  Count the number of FeedBack data files in the currect directory
;       Input = None
;       Output = AX = total number of FeedBack files found.
;       assumed any file ending with a .SLD ext is a FeedBack data file.
;       When the file is opened the data will be validated.
;
PROC    COUNT_FILES
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AX,DS
        MOV     ES,AX
;-----copy Path to [Search]
        MOV     SI,Offset Path              ;source offsmt
        MOV     DI,Offset Search             ;destination offset
        CLD                                 ;auto inc DI and SI
COU1:   MOVSB                                ;copy one byte
        CMP     BYTE PTR [SI],0              ;is next char = 0
        JNZ     COU1                        ;copy bytes
;-----place "\" after path name
        MOV     AL,'\'
        MOV     [DI],AL
        INC     DI
;-----copy search name to end of path
        MOV     SI,Offset SearNa -           ;source ptr
        MOV     CX,13                       ;number of bytes
        CLD                                 ;auto inc SI & DI
        REP     MOVSB                        ;copy all 13 bytes
;-----search for key files
        XOR     BX,BX                       ;zero file counter
        MOV     AX,4E00h                     ;find a first file
        XOR     CX,CX                       ;ordinary files only
        MOV     DX,Offset Search             ;ptr file name ASCIIZ
        INT     21h                         ;do the first search
        JC      COU6                        ;if no match exit
COU5:   INC     BX                           ;found:increase counter
        MOV     AX,4F00h                     ;fine next file function
        INT     21h                         ;do next search
        JNC     COU5                        ;loop until not found
COU6:   MOV     AX,BX                        ;file count to AX
        CLC                                 ;clear carry flag
        POP     DX                          ;restore registers
        POP     CX
        POP     BX
        RET
ENDP    COUNT_FILES
;
;-----Fill the name field with 13 spaces in the data section.
;       Input = AX = pointer to field
```

```
;     Output = None
;
PROC   CLEAR_FIELD
       PUSH   AX                          ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
       MOV    BX,AX                       ;ptr to field.
       MOV    AX,DS                       ;Make ES = DS
       MOV    ES,AX
       MOV    CX,12                       ;restore length of str
       MOV    AL,' '                      ;place a space in first
       MOV    [BX],AL                     ;byte of [Input] string.
       MOV    DI,BX                       ;DI = pointer to next
       INC    DI                          ;byte of string
       MOV    SI,BX                       ;SI = pointer to str
       CLD                                ;auto inc DI and SI
       REP    MOVSB                       ;fill str with spaces
       POP    DX                          ;restore registers
       POP    CX
       POP    BX
       POP    AX
       RET
ENDP   CLEAR_FIELD
;
;
;
;-----Sort the Memory Index Records.
;
;     Input = expects the 16 byte index records to be located at address
;             pointer [IdxSeg] and the number of record to be [MaxRec]
;     Output = None
;     Note: this routine reassigns the DS and ES registers to point to the
;          Index File in memory.  Record 0 is not sorted.  The sort is
;          from record 1 to MaxRec.  A blank record in record 0 is needed
;          for an ASCII string when performing a binary search.
;          The memory index record length is 16 bytes.
;          The sort is based on the first 10 bytes.
;
;     This sort is based on the following TPASCAL procedure:
;     PROCEDURE Sort;          {A Shell Sort}
;     VAR
;       Gap,J : Integer;
;       Temp : string[13];
;       TempNo : Integer;
;     Begin
;       Gap := MaxRec Div 2;
;       While gap > 0  Do
;       Begin
;         For I := (Gap + 1) to MaxRec Do
;         Begin
;           J := I-Gap;
```

```
;            While J > 0 Do
;            Begin
;              If A[J] > A[J+Gap] then
;              Begin
;                Temp := A[J];
;                A[J] := A[J+Gap];
;                A[J+Gap] := Temp;
;                J := J-Gap;
;              End
;                Else J := 0;
;              End;
;          End;
;          Gap := Gap DIV 2;
;        End;
;      End;
;      The follow registers hold the above variables:
;      AX = Gap;  BX = J;  CX = I;  DX = MaxRec; and  BP = temp storage
;
PROC   SHELL_SORT
       PUSH   AX                          ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
       PUSH   DS
       PUSH   ES
       PUSH   BP
       MOV    DL,[MaxFile]                 ;store MaxRec in DX
       XOR    DH,DH                       ;zero high byte
       MOV    AX,[DirSeg]                  ;get index base segment
       MOV    DS,AX                       ;reassign the  DS & ES
       MOV    ES,AX                       ;to ptr to the index.
       MOV    AX,DX                       ;Gap = MaxRec
       SHR    AX,1                        ;Gap = Gap Div by 2
SHEL1: CMP    AX,0                           ;when Gap = 0 exit.
       JLE    SHEL4                       ;exit if < = 0
       MOV    CX,AX                        ;I is stored in CX
       INC    CX                          ;I = Gap + 1
SHEL2: MOV    BX,CX                            ;J in BX
       SUB    BX,AX                       ;J = I - Gap
       JZ     SHEL3                       ;skip if J = 0
       JC     SHEL3                       ;skip if J is < 0.
       CALL   COMPARE_SWAP                        ;repeat until J = 0
SHEL3: INC    CX                           ;I = I + 1
       CMP    DX,CX                        ;Is I < or = MaxRec
       JNC    SHEL2                        ;If yes then loop.
       SHR    AX,1                        ;Gap = Gap Div by 2
       JMP    SHORT SHEL1
SHEL4: POP    BP                             ;restore registers
       POP    ES
       POP    DS
       POP    DX
       POP    CX
```

```
        POP     BX
        POP     AX
        RET                                     ;sort is complete.
;
;-------Compare and swap Index strings if needed.
;       Note: This is a subroutine of SHELL_SORT.  The index file record
;             length is 16 bytes.  The sort is made on the first 6 bytes.
;
;       Input = AX = Gap;  BX = J;   DS & ES point to the base of index file.
;       Output = AX = Gap; CX = I; and DX = MaxRec are returned on changed.
;              BX = J is discarded.
;
PROC    COMPARE_SWAP
        PUSH    AX                              ;save registers
        PUSH    CX
        PUSH    DX
        MOV     DX,AX                           ;save Gap in DX
;       Compare the first six bytes of each index record
COMP1:  MOV     BP,BX                               ;save J in BP
        ADD     AX,BX                           ;AX = J + Gap
        MOV     CL,4                            ;shift counter
        SHL     AX,CL                           ;ptr to J+Gap in mem
        SHL     BX,CL                           ;ptr to J in mem
        CLD                                     ;auto-inc SI, DI
        MOV     DI,AX                           ;offset of J + Gap
        MOV     SI,BX                           ;offset of J
        MOV     CX,10                           ;byte counter
        REPE    CMPSB                             ;compare strings
        JLE     COMP3                           ;exit if < or =.
;       Swap the 16 bytes of index record if string A > string A+Gap
        MOV     DI,AX                           ;offset of J + Gap
        MOV     SI,BX                           ;offset of J
        MOV     CX,8                            ;word counter
COMP2:  MOV     AX,[SI]                             ;read word each str.
        MOV     BX,[DI]
        MOV     [SI],BX                         ;write word each str.
        MOV     [DI],AX
        INC     DI                              ;point to next word
        INC     DI
        INC     SI                              ;point to next word
        INC     SI
        LOOP    COMP2                             ;loop five times
        MOV     AX,DX                           ;restore gap to AX
        MOV     BX,BP                           ;restore J to BX
        SUB     BX,AX                           ;J = J - gap
        JZ      COMP3                           ;exit if J = 0.
        JNC     COMP1                             ;continue if J > 0.
COMP3:  POP     DX                                ;restore registers
        POP     CX
        POP     AX
        RET                                     ;return to Shell_Sort
ENDP    COMPARE_SWAP
```

```
ENDP   SHELL_SORT
;
;------Send a 16 byte memory directory entry to the Screen
;     Input =  AL = DirFile number  (0 to Maxfile) 0 = blank directory entry
;              BX = row /col
;              [MaxFile] = the number of directory entries in the memory dir
;              [DirSeg] = segment address of the base of the memory directory
;     Output = ASCIIZ string sent to the screen
;
PROC DIR_STR
     PUSH   AX                          ;save registers
     PUSH   BX
     PUSH   CX
     PUSH   DX
;------compute dirfile offset
     XOR    AH,AH                        ;AX = DirFile number
     CMP    [MaxFile],AL                  ;is DirFile # OK ?
     JNC    DIR0                        ;If in bounds jump
     MOV    AL,AH                        ;else make blank file
DIR0:  MOV    CL,4                        :shift 4 = times 16
     SHL    AX,CL                       ;multi by 16
     MOV    SI,AX                       ;ASCIIZ message ptr SI
     MOV    AX,BX                        ;row/col to AX
     CALL   GOTOYX                        ;position cursor
     MOV    DI,Offset Input              ;ptr to input string
     MOV    AX,DS                        ;place data seg
     MOV    ES,AX                        ;in the ES register.
     MOV    AX,[DirSeg]                   ;place the memory blk
     MOV    DS,AX                        ;seg in DS.
     MOV    CX,8                        ;8 words = 16 bytes
     CLD
     REP    MOVSW
     MOV    AX,ES                        ;restore reg DS to
     MOV    DS,AX                        ;point to data segment.
     XOR    AL,AL                       ;place zero in string
     MOV    [DI],AL                     ;as EndOfString marker
     MOV    AX,Offset Input               ;ptr to input string
     CALL   DSTR_OUT                      ;send name to the screen
     POP    DX
     POP    CX
     POP    BX
     POP    AX
     RET
ENDP   DIR_STR
;
;     Input = none
;     Output = none
PROC   PRINT_WAIT_MESS
     PUSH   AX
     PUSH   BX
     PUSH   CX
     PUSH   DX
```

```
;----please wait message to screen.
      CALL   CLEAR_MESSAGE
      MOV    CL,[Color]                    ;save original attri
      MOV    AL,[Warning]                   ;warning color
      MOV    [Color],AL                    ;set color
      MOV    AX,020Bh                       ;row 3/Col 12
      CALL   GOTOYX                         ;set cursor
      CALL   CSTR_OUT                       ;display warning
      db     ' Please wait .....    Reading data file: ',0
      MOV    AX, Offset FileNa
      CALL   DSTR_OUT
      CALL   CSTR_OUT
      db     ' ',0
      MOV    [Color],CL                    ;restore original attri
      CALL   HIDE_CUR
      CLC
      POP    DX
      POP    CX
      POP    BX
      POP    AX
      RET
ENDP   PRINT_WAIT_MESS
;
; Release the memory directory and variable blocks.
;     Input = None
;     Output = Carry flag if DOS error
;     [DirSeg] = Starting segment address of directory block.
;     [VarSeg] = starting segment address for variable block.
;     [MaxFile] = total number of FeedBack files.
;
PROC   RELEASE_MEM_DIR
      PUSH   BX
      PUSH   CX
      PUSH   DX
      PUSH   ES
      XOR    AX,AX                          ;zero AX
      CMP    [DirSeg],AX                    ;is DirSeg assigned?
      JZ     REL2                           ;if not assigned go on
;----release assigned memory block
      MOV    AX,[DirSeg]                    ;get memory segment
      MOV    ES,AX                          ;place in ES register
      MOV    AX,4900h                       ;release funcdtion no
      INT    21h                            ;release memory block
      JC     REL2                           ;if No error continue
;----initialize variables
      MOV    AX,0101h                       ;set barposition to
      MOV    [BarPos],AX                    ;start = 1 hilight = 1
      XOR    AX,AX                          ;zero to register
      MOV    [DirSeg],AX                    ;set memory bock to 0
      MOV    [MaxFile],AL                   ;set maxfiles to 0
      CLC                                   ;clear carry flag
REL2:  POP    ES
```

```
        POP     DX                      ;restore registers
        POP     CX
        POP     BX
        RET
ENDP    RELEASE_MEM_DIR
;
;
;-------Read the files DOS date to the [Date] string
;       Input = None
;       Output = files date to [Date]
;
PROC    READ_DATE
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     BX,[FileHd]             ;load file handle
        CMP     BX,0                    ;is a file open
        JZ      DOS2                    ;if not exit
        MOV     AX,5700h                ;get date stamp funct.
        INT     21h                     ;get stamp
        JC      DOS2                    ;if DOS error Exit
        MOV     BX,DX                   ;composite to get day
        AND     BX,01Fh                 ;isolate day
        MOV     CL,5                    ;shift counter
        SHR     DX,CL                   ;month to bits 0 to 3
        MOV     AX,DX                   ;composite to get month
        AND     AX,0Fh                  ;isolate month
        MOV     CL,4                    ;shift counter
        SHR     DX,CL                   ;year to bits 0 to 5
        AND     DX,03Fh                 ;isolate year
        ADD     DX,80                   ;add base year
        MOV     CX,BX                   ;store day in CX
;-------convert to ASCII                ;AX=Mon,CX=day,DX=year
        MOV     BX,Offset Date          ;ptr to Date string
        CALL    CONVERT_ASCII           ;place month in string
        MOV     AX,CX                   ;day of month to AX
        MOV     BX,Offset Date + 3      ;ptr to day section
        CALL    CONVERT_ASCII           ;place day in Date str
        MOV     AX,DX                   ;place year in AX
        MOV     BX,Offset Date + 6      ;ptr to year section
        CALL    CONVERT_ASCII           ;place year in Date str
DOS2:   CLC                             ;clear carry flag
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
;
;-------Convert hex number into 2 digit ASCII number.
;       Input = AX = hex number
;               BX = ptr in [Date]
```

```
;       Output =  two byte number into [Date] string
;
PROC    CONVERT_ASCII
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        CMP     AX,100                  ;Is it a 2 digit number?
        JC      COV1                    ;If yes continue else
        XOR     AX,AX                   ;set number to 00
COV1:   MOV     CL,10                   ;divisor
        DIV     CL                      ;AX/10
        OR      AX,3030h                ;convert to ASCII
COV2:   MOV     [BX],AX                 ;place in Date string
        CLC                             ;clear carry flag
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    CONVERT_ASCII
ENDP    READ_DATE
;

;------Set search file name variables for file type .NEG or .POS
;       Input =  AX = none
;       Output =  Adjust the following strings [FilTyp], [FileNa] and [SearNa]
;
PROC    SET_TYPE
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AX,DS                   ;set ES = DS
        MOV     ES,AX
        MOV     BX,Offset Postyp        ;ptr to Positive string
        CMP     BYTE PTR [Report],0     ;is it a POS report?
        JZ      STT1                    ;If YES goto STT1
        MOV     BX,Offset Negtyp        ;If NO ptr to NEG string
STT1:   MOV     DX,2                    ;save byte counter
        CLD                             ;auto inc SI & DI
        MOV     DI,Offset FilTyp        ;destination pointer
        MOV     SI,BX                   ;source pointer
        MOV     CX,DX                   ;loop counter = 2
        REP     MOVSW                   ;move two Words
;clear carry flag
        MOV     DI,Offset FileNa + 8    ;destination pointer
        MOV     SI,BX                   ;source pointer
        MOV     CX,DX                   ;loop counter = 2
        REP     MOVSW                   ;move two Words
;clear carry flag
        MOV     DI,Offset SearNa + 8    ;destination pointer
```

```
        MOV     SI,BX                   ;source pointer
        MOV     CX,DX                   ;loop counter = 2
        REP     MOVSW                   ;move two Words
;clear carry flag
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    SET_TYPE
;
;
;
;-----Count number of ID's and find '000' ID number in data file.
;       Input = assumes '000' ID number is after all ID data lines.
;       Output = [Ranked] = True if '000' found.
;
PROC    FIND_ZERO
        PUSH    AX                      ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AX,DS                   ;assign ES = DS
        MOV     ES,AX
        XOR     AX,AX
        MOV     [MaxNo],AX              ;set No of ID's = 0
        MOV     [Ranked],AL             ;set [Ranked] = FALSE
        MOV     [EOF],AL                ;set EndOfFile = FALSE
        CALL    GOTO_TOP                ;file ptr to BegOfFile
        JC      FZR8                    ;exit on DOS error
;-----set default ID string to ASCII zeros
        MOV     BX,Offset ID            ;ptr to string to edit
        MOV     DI,BX                   ;ptr to string to fill
        MOV     AX,3030h                ;ASCII zeros
        MOV     [DI],AX                 ;place 1st two bytes
        XOR     AH,AH                   ;zero = end of string
        INC     DI                      ;advance string ptr
        INC     DI
        MOV     [DI],AX                 ;ASCII 0 and hex 0
;-----locate ID number in the data file
        CALL    PRINT_WAIT_MESS             ;inform user of search
        XOR     BX,BX                   ;ID counter = 0
FZR1:   CALL    READ_LINE                   ;1 line from data file
        JNC     FZR2                    ;not EndOfFile
        MOV     AL,0FFH                 ;mark EndOfFile true
        MOV     [EOF],AL                ;<> 0 = True
FZR2:   MOV     CX,3                    ;loop counter
        MOV     DI,Offset ID            ;ptr to ID number
        MOV     SI,Offset FileBuf       ;ptr to data file line
        CLD                             ;auto inc DI and SI
        REPZ    CMPSB                   ;are the bytes = ?
        JNZ     FZR3                    ;If NO goto next test
```

```
        CALL    COPY_PERCNT                     ;read in ranking var
        JMP     SHORT FZR5                      ;do not count '000'
;-----is this an ID data line
FZR3:   MOV     SI,Offset FIlBuf                ;ptr to data file line
        MOV     CX,3                            ;loop counter
FZR4:   MOV     AL,[SI]                         ;get first byte
        CMP     AL,'0'                          ;is it < ASCII 0
        JC      FZR5                            ;If Yes read next line
        CMP     AL,':'                          ;is it a digit?
        JNC     FZR5                            ;If No read next line
        INC     SI                              ;point to next type
        LOOP    FZR4                            ;check next byte
        INC     BX                              ;YES it is an ID number
;-----is this the last line ?
FZR5:   XOR     AL,AL                           ;zero AX register
        CMP     AL,[EOF]                        ;is EndOfFile TRUE?
        JZ      FZR1                            ;False = get next line
        MOV     [MaxNo],BX                      ;save number of ID's
        CLC                                     ;clear cf = found
FZR8:   POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    FIND_ZERO
;

;-----Copy PerCnt variables from data buffer to PerCnt variable string.
;       Input =  assumed 000 data in buffer in binary byte numbers
;       Output =  PerCnt variables set  (60 bytes max)
;
PROC    COPY_PERCNT
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AL,0FFH                         ;true marker
        MOV     [Ranked],AL                     ;mark [ranked] TRUE
        MOV     CX,192                          ;max no of variables
        MOV     BX,Offset FIlBuf + 3            ;beyond 000
        MOV     SI,Offset PerCnt + 5            ;ptr to PerCnt variables
GES1:   MOV     AL,[BX]                         ;read word
        CMP     AL,0                            ;is this EndOfString?
        JZ      GES5                            ;If YES then stop loop
        CMP     AL,' '                          ;is it a space ?
        JZ      GES2                            ;If NO check range else
;-----is value an ASC II digit ? 0 - 9
        CMP     AL,'0'                          ;is value < ASCII 0
        JC      GES3                            ;If Yes then error
        CMP     AL,':'                          ;is value a digit ?
        JNC     GES3                            ;If NO then error
;-----save digit in PerCnt variable
```

```
        MOV     [SI],AL                         ;save value
        INC     SI                              ;ptr to next variable
GES2:   INC     BX                              ;next byte in buffer
        LOOP    GES1                            ;loop until CX = 0
        DEC     SI
;-----were 80 two byte ASCII variables found?
;     20 var per dim and 4 dim = 80 two digit variables or 160 bytes
GES5:   MOV     AX,SI                           ;get var pointer
        MOV     BX,Offset PerCnt + 5            ;starting position
        SUB     AX,BX                           ;AX = bytes found
        CMP     AX,160                          ;is the length correct
        JZ      GES4                            ;Z = Normal exit else
GES3:   CALL    COPY_ERR                        ;error message
GES4:   CLC
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    COPY_PERCNT
;
;
;       Input = none
;       Output = none
PROC    COPY_ERR
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AL,[Warning]                    ;warning color
        MOV     CL,[Color]                      ;save original color
        MOV     [Color],AL                      ;set color
        MOV     AX,0207h                        ;row 3/Col 8
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      " Line '000' is incorrect length for 4 "
        db      'diminsions.  Press Any Key. ',0
        MOV     [Color],CL                      ;restore original color
        CALL    ERR_SOUND
        CALL    HIDE_CUR
        CALL    GET_CHAR
        CALL    CLEAR_PERCNT                    ;zero percentile var.
        XOR     AL,AL
        MOV     [Ranked],AL                     ;mark file unranked
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    COPY_ERR
;
```

```
      .CODE
;
;-----Open the answer SLD file for use by the FeedBack program
;     Input =  name of file in [FileNa]
;     Output = Carry flag set = critical DOS error.
;
PROC   OPEN_SLDI
       PUSH   BX
       PUSH   CX
       PUSH   DX
       PUSH   ES
       CALL   CLOSE_FILE                    ;close any open files
;-----locate end of search string
       MOV    AX,DS
       MOV    ES,AX
       MOV    CX,68                        ;max length of string
       MOV    BX,Offset Search               ;ptr to first byte
       MOV    AL,0                         ;looking for EndOfStr
KE1:   INC    BX                           ;ptr to next byte
       CMP    [BX],AL                       ;if this it ?
       JZ     KE2                          ;continue! I found it.
       LOOP   KE1                           ;if NO look at next byte
       STC
       JMP    SHORT KE9                       ;if no match exit
;-----backup until finding the last \
KE2:   MOV    CX,12
       MOV    AL,'\'
       DEC    BX
       CMP    [BX],AL
       JZ     KE3
       LOOP   KE2
       STC
       JMP    SHORT KE9                       ;if no match exit
;-----copy file name to end of path
KE3:   INC    BX
       MOV    DI,BX                        ;destination ptr
       MOV    SI,Offset FileNa               ;source ptr
       MOV    CX,13                        ;number of bytes
       CLD                                 ;auto inc SI & DI
       REP    MOVSB                           ;copy all 13 bytes
;-----open file and save file handle
       MOV    AX,Offset Search                ;ptr to path + file name
       CALL   OPEN                          ;open key file
       JC     KE9                           ;goto main menu on error
       MOV    [FileHd],BX                    ;save data.fil handle
;-----set disk drive of open file
       XOR    AX,AX                         ;zero to [DiskDr] =
       MOV    [FileDr],AL                   ;default drive
       MOV    BX,Offset Search                ;ptr to path + filename
       MOV    AX,[BX]                       ;get first two bytes
       CMP    AH,':'                        ;is a drive given?
       JNZ    KE8                           ;if NO will use default
```

```
      SUB    AL,64                          ;convert to hex value
      JC     KE8                           ;if error continue
      MOV    [FileDr],AL                    ;save drive of file
KE8:  CLC                                   ;clear carry flag
KE9:  POP    ES
      POP    DX
      POP    CX
      POP    BX
      RET
ENDP  OPEN_SLDI
;
;
;---- Close the data files used by the Trial program
;     Input = None
;     Output = None  (message displayed and carry flag set on error)
;            File handle stored in [FileHd]
;     Note:   Major registers saved.
;
PROC  CLOSE_FILE
      PUSH   BX
      PUSH   CX
      PUSH   DX
      XOR    AX,AX                          ;zero to AX
      MOV    BX,[FileHd]                    ;file handle
      CMP    BX,AX                          ;Is the file open?
      JZ     CLO2                           ;exit if file closed.
      CALL   CLEAR_PERCNT                       ;set percentiles = 0
      MOV    [FileHd],AX                    ;set file handle to 0
      MOV    [MaxNo],AX                     ;set total ID's to 0
      MOV    [Ranked],AL                    ;set ranked FALSE
      MOV    [FileDr],AL                    ;set file diskdrive = 0
      MOV    [EOF],AL                       ;set EOF = FALSE
      MOV    AH,3Eh                         ;close file function no
      INT    21h                            ;close data file
      JNC    CLO2                           ;exit if successful.
CLO1: MOV    AL,[Warning]                       ;warning color
      MOV    [Color],AL                     ;set color
      MOV    AX,0207h                       ;row 2/Col 12
      CALL   GOTOYX                         ;set cursor
      CALL   CSTR_OUT                       ;display warning
      db     ' Error closing data file.  Press Any Key to Continue. ',0
      MOV    AL,[Normal]                    ;normal color
      MOV    [Color],AL                     ;set color
      CALL   HIDE_CUR
      CALL   ERR_SOUND
      CALL   GET_CHAR
      STC                                   ;set carry flag for ret
CLO2: POP    DX                             ;restore registers
      POP    CX
      POP    BX
      RET
ENDP  CLOSE_FILE
```

```
;
;
;-----Check to make sure a feedback file is in the directory.
;     Input = None
;     Output = Carry Flag if no file is open.
;
PROC   IS_SLD
       PUSH   AX                          ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
       XOR    AX,AX                       ;zero to AX register
       CMP    [MaxFile],AL                ;were data files found?
       JZ     DT1                         ;0 means NO files
       JMP    DT2                         ;exit if found
DT1:   MOV    CL,[Color]
       MOV    AL,[Warning]                ;warning color
       MOV    [Color],AL                  ;set color
       MOV    AX,020Bh                    ;row 3/Col 12
       CALL   GOTOYX                      ;set cursor
       CALL   CSTR_OUT                    ;display warning
       db     ' No key files found in directory!  Press Any Key '
       db     'to Continue. ',0
       MOV    [Color],CL                  ;restore original color
       CALL   HIDE_CUR
       CALL   GET_CHAR
       STC                                ;set carry flag
DT2:   POP    DX                          ;restore registers
       POP    CX
       POP    BX
       POP    AX
       RET
ENDP   IS_SLD

;
;-----Inform the user the file is being opened.
;     Input = None
;     Output = None
;
PROC   READ_MESS
       PUSH   AX
       PUSH   CX
       MOV    CL,[Color]                  ;save orig. color attr
       MOV    AL,[Warning]                ;warning color
       MOV    [Color],AL                  ;set color
       MOV    AX,0209h                    ;row 3/Col 12
       CALL   GOTOYX                      ;set cursor
       CALL   CSTR_OUT                    ;display warning
       db     '  Reading File  ',0
       MOV    [Color],CL                  ;restore orig. color att
       CALL   HIDE_CUR
       POP    CX
```

```
        POP     AX
        RET
ENDP    READ_MESS
;
;
;-----Clear the second line of the meu box
;       Input = None
;       Output = None
;
PROC    CLEAR_MESS
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     CL,[Color]                      ;save orig. color attr
        MOV     AL,[Menu]                       ;set menu color
        MOV     [Color],AL                      ;change color attribute
        MOV     AX,0207h                        ;row 2 and column 7
        MOV     BX,024Eh                        ;row 2 and column 78
        CALL    CLEAR_WINDOW                        ;clear out old message.
        MOV     AX,020Fh                        ;row 2,column 7
        CALL    GOTOYX
        CALL    CSTR_OUT
        db      'Press the <Enter> key to open the highlighted file.',0
        MOV     [Color],CL                      ;restore orig.color attr
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    CLEAR_MESS
;
;
;-----Read a line from the data file into the 128 byte memory buffer.
;       Input =  file handle in [FileHd]
;       Output = sets [EOF] < > 0 when EndOfFile is reached.
;               Carry flag = file closes or file ptr already at EndOfFile.
;       NOTES:
;       Carrage returns are convert to hex 0.
;       Only the lower set ASCII characters are placed in the buffer.
;       No control codes etc.
;       Only the first 192 bytes of the line are saved in the buffer but the
;       procedure will keep reading until EndOfFile or an 0Dh is reached.
;
PROC    READ_LINE
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        PUSH    SI
        XOR     AX,AX
        MOV     SI,Offset FilBuf                ;mark position in buffer
```

```
        MOV     BP,Offset FilBuf + 191          ;mark end of buffer
        MOV     BX,[FileHd]                     ;file handle
        CMP     BX,AX                           ;is a file open?
        JZ      REE2                            ;if not Exit
        CMP     [EOF],AL                        ;is ptr at endoffile
        JNZ     REE2                            ;if yes Exit
;-----read 1  byte from data file
        MOV     CX,1                                    ;read 1 byte
REE1:   MOV     AX,3F00h                        ;read file function no
        MOV     DX,SI                           ;buffer ptr to DX
        INT     21h                             ;get byte
        JC      REE3                            ;end of file?
        CMP     AX,CX                                   ;did it read a byte?
        JNZ     REE3                            ;if no then EndOfFile
        MOV     AL,[SI]                         ;get char in AL
        CMP     AL,0Dh                                  ;is it the endofline ?
        JZ      REE4                            ;if YES exit
        CMP     AL,128                          ;is 8th bit on?
        JNC     REE1                            ;if yes read next char
        CMP     AL,32                                   ;is it a control char?
        JC      REE1                            ;if yes read next char
        CMP     BP,SI                           ;is buffer full ?
        JC      REE1                            ;if yes read until 0Dh
        INC     SI                              ;if no advance buffer
        JMP     SHORT REE1                              ;ptr & get another char
REE2:   STC                                     ;set carry flag
        JMP     SHORT REE5                              ;exit finished file.
REE3:   MOV     AL,0FFh                                 ;non zero = end of file
        MOV     [EOF],AL                        ;mark endoffile true
REE4:   XOR     AL,AL                           ;place endofline
        MOV     [SI],AL                         ;in data file buffer
        CLC                                     ;clear carry flag
REE5:   POP     SI
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    READ_LINE
;
;
;Place the file pointer at the begining of the open file.
;       Input = none
;       Output = Carry flag = error
PROC    GOTO_TOP
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        XOR     AX,AX                           ;zero register
        MOV     BX,[FileHd]                     ;is a file open ?
        CMP     AX,BX                           ;if not then exit
```

```
        JNZ     TOP1                    ;If open goto next test
        STC                             ;else set error flag
        JMP     SHORT TOP2                      ;exit on error
;-----place file point to the beginning of the file
TOP1:   MOV     CX,AX                           ;set offset = 0
        MOV     DX,AX                   ;set offset = 0
        MOV     AX,4200h                ;set file pointer no.
        INT     21h                     ;set to beg. of file
        JC      TOP2                    ;exit if error.
        XOR     AL,AL                   ;zerp to register
        MOV     [EOF],AL                ;set EndOfFile = False
        CLC
TOP2:   POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    GOTO_TOP
;
;Checks [FileDr] to make sure there is room for number of bytes in AX
;       Input = [AX] = number to bytes needed
;               assumes [FileDr] is pointing the desired drive
;                       0 = default, 1 = A, 2 = B, etc
;       Output = Carry flag = if not enough room
PROC    IS_FULL
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        PUSH    BP
        MOV     BP,AX                   ;save bytes needed
        MOV     DL,[FileDr]             ;get file drive no.
        MOV     AX,3600h                ;disk space function
        INT     21h                     ;get disk space
        CMP     AX,0FFFFh               ;is drive valid?
        JZ      ISF3                    ;If NO exit error
        CMP     BX,BP                   ;avail cluster > bytes
        JNC     ISF4                    ;yes OK! lots of room
        MUL     BX                      ;get available sectors
        CMP     DX,BP                   ;is avail sectors/65000
        JNC     ISF4                    ;greater then bytes ?
        CMP     AX,BP                   ;is avail sectors> bytes
        JNC     ISF4                    ;If Yes lots of room
        MUL     CX                      ;get available bytes
        CMP     DX,BP                   ;is avail bytes/65000
        JNC     ISF4                    ;greater then bytes ?
        CMP     AX,BP                   ;is avail bytes > bytes
        JNC     ISF4                    ;If YES exit OK!
        CALL    FULL_ERR                ;else inform user
ISF3:   STC
        JMP     SHORT ISF5
ISF4:   CLC
```

```
ISF5:  POP    BP
       POP    DX
       POP    CX
       POP    BX
       POP    AX
       RET
;
;      Input = none
;      Output = none
PROC   FULL_ERR
       CALL   CLEAR_MESSAGE
       MOV    AL,[Warning]                    ;warning color
       MOV    CL,[Color]                      ;save original color
       MOV    [Color],AL                      ;set color
       MOV    AX,0209h                        ;row 3/Col 8
       CALL   GOTOYX                          ;set cursor
       CALL   CSTR_OUT                        ;display warning
       db     ' Not enough Disk Space to save the rankings.'
       db     '  Press Any Key. ',0
       MOV    [Color],CL                      ;restore original color
       CALL   HIDE_CUR
       CALL   ERR_SOUND
       CALL   GET_CHAR
       RET
ENDP   FULL_ERR
ENDP   IS_FULL
;
       .CODE
PROC   GET_PATH
       PUSH   AX
       PUSH   BX
       PUSH   CX
       PUSH   DX
       CMP    BYTE PTR [Path],0               ;Is the Path empty
       JNZ    GEP1                            ;If NO then display Path
;------get default drive                      ;If YES get default path
       MOV    AH,19h                          ;default function
       INT    21h                             ;get default drive
       ADD    AL,65                           ;convert to cap letter
       MOV    AH,':'                          ;place ':' in path
       MOV    SI,Offset Path                  ;ptr to [Path] string
       MOV    [SI],AX                         ;place drive letter
       INC    SI                              ;in path.
       INC    SI                              ;ptr to 3rd byte
       MOV    AL,'\'                          ;place backslash in
       MOV    [SI],AL                         ;3rd byte of string
       INC    SI                              ;point to 4th byte
;------get default path
       MOV    AH,47h                          ;get current path
       MOV    DL,0                            ;on default drive
       INT    21h                             ;get path
GEP1:  CALL   EDIT_PATH
```

```
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    GET_PATH

;
;       Input = last path entered or default path in [Path]
;       Output = current path in Input
;
PROC    EDIT_PATH
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     BX,DS
        MOV     ES,BX
        CALL    PATH_TO_INPUT                   ;move Path str to Input
        CALL    PATH_MESS_TOP
        CALL    PATH_MESS_BTM                   ;edit message
EDT1:   MOV     AX,0106h
        CALL    PATH_EDITOR                     ;edit this field
        JC      EDT2                            ;exit on <Esc> key
        CALL    CHECK_PATH                      ;if valid save path
        JC      EDT1                            ;if Not valid loop
        JMP     SHORT EDT3                      ;exit path OK!
EDT2:   CALL    MENU_INSTRU                     ;draw bottom box
        STC                                     ;carry flag = Esc key
EDT3:   POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    EDIT_PATH
;

PROC    PATH_MESS_TOP
        PUSH    AX
        PUSH    CX
        XOR     AX,AX
        CALL    MENU_BOX
        MOV     CL,[Color]
        MOV     AX,0206h
        CALL    GOTOYX
        MOV     AL,[Menu]
        MOV     [Color],AL
        CALL    CSTR_OUT
        db      'Enter the directory path.',0
        MOV     [Color],CL
        POP     CX
        POP     AX
```

```
        RET
ENDP    PATH_MESS_TOP
;
;
;-----remove all but letters from the field and convert into and ASCIIZ string
;       Input = None
;       Output = None
;       Note: fields are 14 bytes long but the last byte is always a hex 0
;             therefore the name fields can only have 13 letters.
PROC    FILTER_FIELD
        PUSH    AX
        PUSH    BX                              ;save original str ptr
        PUSH    CX
        PUSH    DX
        MOV     BX, Offset Input                  ;pointer to input str
        MOV     CX,12                           ;string length - 1
TRI1:   MOV     AL,'A'                          ;is character less than
        CMP     [BX],AL                         ;the letter "A" ?
        JNC     TRI3                            ;If yes remove character
TRI2:   CALL    DELETE_CHAR                             ;shift string left
        DEC     BX                              ;check same byte again
        JMP     SHORT TRI4
TRI3:   MOV     AL,'Z'                          ;is character greater
        CMP     AL,[BX]                         ;than letter "Z" ?
        JC      TRI2                            ;If yes remove character
TRI4:   INC     BX                              ;ptr to next byte
        LOOP    TRI1                            ;check next byte
;-----convert trailing spaces to hex 0.
        MOV     CX,13                           ;loop counter
        MOV     BX,Offset Input + 12                ;ptr to LastByte
        MOV     AX,20h                          ;AH = hex 0  AL = space
TRI5:   CMP     AL,[BX]                           ;is char a <space> ?
        JNZ     TRI6                            ;If no exit.
        MOV     [BX],AH                           ;mark as end of string
        DEC     BX                              ;ptr to last byte
        LOOP    TRI5                            ;loop until beg of str
TRI6:   POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
;------ delete a character at the cursor
PROC    DELETE_CHAR
        PUSH    AX
        PUSH    BX                              ;save original str ptr
DEP1:   MOV     AX,[BX]                             ;read ptr BX and BX+1
        CMP     AH,0                            ;Is it the end of str?
        JZ      DEP2                            ;If yes then done.
        MOV     [BX],AH                           ;place BX+1 in BX
        INC     BX                              ;point to next byte
        JMP     SHORT DEP1                          ;loop until end of str.
DEP2:   MOV     AH,' '                            ;place a <space> at
```

```
        MOV     [BX],AH                         ;end of the string.
        POP     BX                              ;restore original ptr
        POP     AX
        RET
ENDP    DELETE_CHAR
ENDP    FILTER_FIELD
;
;-----Instructions for entering the path name.
;       Input = None
;       Output = None
;
PROC    PATH_MESS_BTM
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AX,1500h                        ;row 21,column 0
        CALL    MENU_BOX                        ;draw menu box
        MOV     AX,160Ah                        ;row 22,column 13
        CALL    GOTOYX
        MOV     AL,[Color]                      ;get current color
        MOV     CL,AL                           ;store in CL
        MOV     AL,[Menu]                       ;set color = menu
        MOV     [Color],AL
        CALL    CSTR_OUT
        db      'Type the complete path name for the directory to be searched.',0
        MOV     AX,1708h                        ;row 23,column 13
        CALL    GOTOYX
        CALL    CSTR_OUT
        db      'Press the <Enter> key to continue or the <Esc> key for '
        db      'the Menu.',0
        MOV     [Color],CL                      ;restore orig. color
        POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    PATH_MESS_BTM
;
;
;-----Copy path ASCIIZ string in [Path] to [Input].
;       Input = none
;       Output = none
;       AX-DX register saved.
;
PROC    PATH_TO_INPUT
        PUSH    AX
        PUSH    BX                              ;save registers
        PUSH    CX
        PUSH    DX
;-----fill [input] with 68 spaces
        MOV     AX,DS                           ;Make ES = DS
```

```
        MOV     ES,AX
        MOV     CX,67                   ;max number of chars
        MOV     BX,Offset Input         ;pointer to ASCIIZ str
        MOV     AL,' '                  ;space Al register
        MOV     [BX],AL                 ;0 to first byte of str
        MOV     DI,BX                   ;DI = pointer to next
        INC     DI                      ;byte of string
        MOV     SI,BX                   ;SI = pointer to str
        CLD                             ;auto inc DI and SI
        REP     MOVSB                   ;fill string with 0's
;-----copy current [path] to [Input]
        MOV     DI,Offset Input         ;destination offset
        MOV     SI,Offset Path          ;source offset
        CLD                             ;auto inc DI and SI
EDT0:   MOVSB                           ;copy one byte
        CMP     BYTE PTR [SI],0         ;is next char = 0
        JNZ     EDT0
        CLC
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    PATH_TO_INPUT
;
;----- Get an ASCIIZ string input from the keyboard.
;       Input = AX = Row/Column position on the screen
;               [Input] must contain the string to be edited before
;               calling this subroutine.
;               [Insert] < > 0 places the editor in the insert mode.
;       Output = AL = Exit 'Char'
;               ASCIIZ string at [Input] in the data section.
;               BX-DX register saved
;       Note: the follow register hold the following local variables.
;               AL = Input Character
;               BX = ptr in [Input] string
;               CX = Row/Col cursor position
;               DX = Starting Row/Col position
;
PROC    PATH_EDITOR
        PUSH    BX                      ;save registers
        PUSH    CX
        PUSH    DX
        MOV     DX,AX                   ;save row/column in DX
        CALL    GOTOYX                  ;set cursor position
        MOV     BX,Offset Input         ;ptr to [Input] str.
        MOV     AX,BX                   ;[Input] ptr to AX
        CALL    DSTR_OUT                ;Display blanks
;-----fine first space in string
        MOV     SI,0                    ;zero to SI
PATA:   INC     SI                      ;ptr to next char
        CMP     SI,67                   ;stop if no spaces
```

```
        JZ      PATB                    ;safty value
        CMP     BYTE PTR [BX + SI],' '      ;is this a space ?
        JNZ     PATA                    ;if NO check next char
PATB:   MOV     CX,SI                   ;offset to CX
        ADD     CX,DX                   ;row/column ptr to CX
        ADD     BX,SI                   ;advance BX pointer
;------beginning of input loop
        CALL    PATH_INSERT                 ;display insert status.
PAT0:   MOV     AX,CX                   ;cursor position to AX
        CALL    GOTOYX                  ;set cursor position
        CALL    GET_TEXT
;------Return key
        CMP     AL,0Dh                  ;is it a <return> ?
        JZ      PAT10                   ;if yes exit.
;------is it any other control character?
        CMP     AL,1Bh                  ;is it a control char?
        JNC     PAT5                    ;jmp = not control char
        CALL    PATH_CONTROL_CHAR           ;handel control char
        JMP     SHORT PAT0              ;get next character
;------is it the <Esc> key ?
PAT5:   STC                             ;set carry flag
        JZ      PAT11                   ;exit on <Esc> key
;------filter unwanted characters
        CALL    CHAR_FILTER
        JC      PAT0                    ;carry flag = not char
;------check the insert mode
PAT7:   MOV     AH,[Insert]             ;get Insert flag
        CMP     AH,0                    ;is insert OFF? = 0
        JZ      PAT8                    ;skip if turned off
        CALL    SHIFT_STR_RT            ;move rest of str right
;------place the character in the [Input] string.
PAT8:   MOV     [BX],AL                 ;place char in [Input]
        MOV     AX,BX                   ;prt rest of string
        CALL    DSTR_OUT                ;display string from
;------see if 'end of string' is true.
        XOR     AH,AH
        CMP     AH,[BX+1]               ;is 'end of string' ?
        JZ      PAT0                    ;yes=do not move cursor
        INC     BX                      ;advance [Input] ptr.
        INC     CX                      ;advance cursor
        JMP     PAT0                    ;if not continue input.
PAT10:  CLC                             ;clear carry flag
PAT11:  POP     DX
        POP     CX
        POP     BX
        RET
;
;------Display the status of the [Insert] flag to screen.
;       Input = None
;       Output = None
;       AX - DX registers saved
PROC    PATH_INSERT
```

```
      PUSH    AX                        ;save registers
      PUSH    BX
      PUSH    CX
      PUSH    DX
      MOV     DL,[Color]                 ;save current color
      MOV     AL,[HiLite]               ;set color for insert
      MOV     [Color],AL                 ;string.
      MOV     AX,0420h                   ;row  col
      CALL    GOTOYX                      ;set cursor
      XOR     AX,AX                     ;zero AX
      ADD     AL,[Insert]               ;get Insert flag
      JNZ     PAH1                      ;<> 0 = Insert mode
      CALL    CSTR_OUT                     ;clear insert from
      db      '        ',0             ;the screen.
      JMP     SHORT PAH2                   ;exit.
PAH1: CALL    CSTR_OUT                     ;send the following
      db      '<Insert On>',0              ;string to the screen
PAH2: MOV     [Color],DL                   ;restore current color.
      POP     DX                        ;restore registers
      POP     CX
      POP     BX
      POP     AX
      RET
ENDP  PATH_INSERT
;
;-----Check Control Characters
;       Input AL = Control Character
;            BX = ptr in [Input] string
;            CX = Row/Col cursor position
;            DX = Starting Row/Col position
;       OutPut jumps back to get another character.
PROC  PATH_CONTROL_CHAR
;-----Backspace key
      CMP     AL,08h                    ;is it a Backspace key
      JNZ     CNN0                      ;if not continue.
      CALL    BACKSPACE                    ;del char left of cur.
;-----Insert key
CNN0: CMP     AL,16h                       ;is it the Insert key?
      JNZ     CNN1                      ;if not continue.
      PUSH    AX                        ;save Char
      XOR     AX,AX                     ;zero AX
      ADD     AL,[Insert]               ;get Insert flag
      JZ      CNN0A                     ;if zero jump
      MOV     AL,AH                      ;make flag = 0
      JMP     SHORT CNN0B                   ;replace flag
CNN0A: DEC    AL                        ;make flag = FFh
CNN0B: MOV    [Insert],AL                ;replace flag
      CALL    PATH_INSERT                  ;display insert status.
      POP     AX                        ;restore Char
;-----Home key
CNN1: CMP     AL,1h                        ;is it the Home key?
      JNZ     CNN2                      ;if not continue.
```

```
        MOV     BX,Offset Input
        MOV     CX,DX
;-------End key
CNN2:   CMP     AL,6h                   ;Is it the End key?
        JNZ     CNN3                    ;If not continue.
        CALL    END_STR
;-------Delete key
CNN3:   CMP     AL,07h                  ;Is it the delete key?
        JNZ     CNN4                    ;If not continue.
        CALL    DELETE                  ;delete char at cursor.
;-------left arrow key
CNN4:   CMP     AL,13h                  ;Is it a left arrow key
        JNZ     CNN6                    ;If not continue.
        CMP     CX,DX                   ;beginnig of the string?
        JZ      CNN6                    ;yes = beg. of line
        DEC     BX                      ;so loop will continue.
        DEC     CX
;-------right arrow key
CNN6:   CMP     AL,4                    ;Is it Rt Arrow key?
        JNZ     CNN8                    ;If not jump.
        XOR     AH,AH
        CMP     BYTE PTR [BX+1],0       ;Is 'end of string' ?
        JZ      CNN8                    ;If = 0 no right
        INC     BX                      ;advance pointer
        INC     CX
CNN8:   RET
ENDP    PATH_CONTROL_CHAR
;
;-------move cursor to end of string
PROC    END_STR
        PUSH    AX
CON2A:  MOV     AX,[BX]                 ;check for end of str.
        CMP     AH,0                    ;zero = end of string
        JZ      CON2B                   ;ret on end of string
        INC     BX                      ;advance pointer
        INC     CX                      ;advance cursor
        JMP     SHORT CON2A
CON2B:  POP     AX
        RET
ENDP    END_STR
;
; -------insert a character at the cursor.
PROC    SHIFT_STR_RT
        PUSH    AX                      ;save new character
        PUSH    BX                      ;save str pointer
        MOV     AL,[BX]                 ;load char to be moved
        INC     BX                      ;ptr to the next char
SHI1:   MOV     AH,[BX]                 ;load next char.
        CMP     AH,0                    ;Is it the end of str?
        JZ      SHI2                    ;If yes then Exit.
        MOV     [BX],AL                 ;last char in the str.
        MOV     AL,AH                   ;next char to last char
```

```
        INC     BX                      ;ptr for new next char
        JMP     SHORT SHI1              ;loop until end of str.
SHI2:   POP     BX                      ;restore str pointer
        POP     AX                      ;restore original ptr
        RET
ENDP    SHIFT_STR_RT
;
;------ delete a character at the cursor
PROC    DELETE
        PUSH    AX
        PUSH    BX                      ;save original str ptr
DEL1:   MOV     AX,[BX]                 ;read ptr BX and BX+1
        CMP     AH,0                    ;Is it the end of str?
        JZ      DEL2                    ;If yes then done.
        MOV     [BX],AH                 ;place BX+1 in BX
        INC     BX                      ;point to next byte
        JMP     SHORT DEL1              ;loop until end of str.
DEL2:   MOV     AH,' '                  ;place a <space> at
        MOV     [BX],AH                 ;end of the string.
        POP     BX                      ;restore original ptr
        MOV     AX,BX                   ;str pointer to AX
        CALL    DSTR_OUT                ;display string
        POP     AX
        RET
ENDP    DELETE
;
;------ delete a character to the left of the cursor
PROC    BACKSPACE
        PUSH    AX
        MOV     AX,Offset Input         ;is the cursor at the
        CMP     AX,BX                   ;beginnig of the string?
        JZ      BA3                     ;If yes ignor backspace
        DEC     BX                      ;line pointer left
        DEC     CX                      ;cursor left
        PUSH    BX                      ;save original str ptr
BA1:    MOV     AX,[BX]                 ;read ptr BX and BX+1
        CMP     AH,0                    ;Is it the end of str?
        JZ      BA2                     ;If yes then done.
        MOV     [BX],AH                 ;place BX+1 in BX
        INC     BX                      ;point to next byte
        JMP     SHORT BA1               ;loop until end of str.
BA2:    MOV     AH,' '                  ;move <space> to AH
        MOV     [BX],AH                 ;place in last position
        POP     BX                      ;restore original ptr
        MOV     AX,CX                   ;row/column to AX
        CALL    GOTOYX                  ;set cursor position
        MOV     AX,BX                   ;str pointer to AX
        CALL    DSTR_OUT                ;display string
BA3:    POP     AX
        RET
ENDP    BACKSPACE
;
```

```
;------Filter out unwanted ASCII characters and capitalize letters
;       Input = Char in AL
;       Output = Carry Flag = not a good character. get another!
PROC    CHAR_FILTER
        AND     AL,7Fh                          ;make 0 - 127 ASCII.
        CMP     AL,' '                          ;is it a control char?
        JC      CHAR1                           ;If yes, get next char.
        CMP     AL,'a'                          ;is char a small letter
        JC      CHAR0                           ;If not, Ok continue.
        AND     AL,0DFh                         ;change to capital char
CHAR0:  CLC                                     ;clear carry flag
CHAR1:  RET
ENDP    CHAR_FILTER
ENDP    PATH_EDITOR
;
;
;------Check [Input] to see if the path is Ok!
;       Input = AX = Assumed [Input] hold a Path
;       Output = Carry flag is not a valid path name
;       AX-DX register saved.
;
PROC    CHECK_PATH
        PUSH    AX
        PUSH    BX                              ;save registers
        PUSH    CX
        PUSH    DX
        MOV     AX,DS                           ;Make ES = DS
        MOV     ES,AX
;------remove all leading spaces
        MOV     BX,Offset Input                 ;ptr to Input string
CHE0:   CMP     BYTE PTR [BX],' '               ;is leading space ?
        JNZ     CHE1                            ;If NO continue
        MOV     CX,68                           ;else remove space
        MOV     DI,BX                           ;offset to 1st byte
        MOV     SI,BX
        INC     SI                              ;offset to 2nd byte
        CLD                                     ;auto inc DI and SI
        REP     MOVSB                           ;shift line left
        JMP     SHORT CHE0                      ;check for leading space
;------convert first ASCII space to a hex zero EndofStr marker
CHE1:   MOV     CX,68                           ;max string length
        MOV     BX,Offset Input - 1
CHE2:   INC     BX
        CMP     BYTE PTR [BX],' '               ;is it a space?
        JC      CHE4                            ;exit if char < ' '
        LOOPNZ  CHE2                            ;is NO loop
;------remove trailing back slash
        DEC     BX                              ;ptr to last char
        CMP     BYTE PTR [BX],'\'               ;is it a back slash ?
        JZ      CHE3                            ;If Yes remove from str
        INC     BX                              ;If NO leave in str
;------place : after drive name?
```

```
CHE3:  MOV    AX,BX                    ;ptr in str to ax
       SUB    AX,Offset Input          ;string length in AX
       JZ     CHE4                     ;If OK! goto next test
       CMP    AX,3                     ;is less than 3?
       JNC    CHE4                     ;If NO goto next test
       MOV    AX,003Ah                 ;3Ah = ':'
       MOV    BX,Offset Input + 1      ;ptr to 2nd byte
       MOV    [BX],AX
       INC    BX
CHE4:  MOV    [BX],CH                  ;mark EndofStg = 0
;-----Is the path valid
       CALL   IS_PATH                  ;is path valid ?
       JNC    CHE5                     ;NOT carry = OK!
       CALL   PATH_ERROR               ;display error message
       STC                             ;set cf = error
       JMP    SHORT CHE7
;-----save valid path string in [Path]
CHE5:  MOV    SI,Offset Input          ;source offset
       MOV    DI,Offset Path           ;destination offset
       CLD                             ;auto inc DI and SI
CHE6:  MOVSB                           ;copy one byte
       CMP    BYTE PTR [SI],0          ;is next char = 0
       JNZ    CHE6                     ;copy bytes
       XOR    AL,AL
       MOV    [DI],AL                  ;zero = EndOfString
       CLC                             ;clear carry flag
CHE7:  POP    DX
       POP    CX
       POP    BX
       POP    AX
       RET
;
;-----Is this a Valid path?
;      Input = ASCIIZ drive/directory string in [Input]
;      Output = carry flag in not a valid path
;      AX - DX registers saved
PROC   IS_PATH
       PUSH   AX                       ;save registers
       PUSH   BX
       PUSH   CX
       PUSH   DX
;-----copy string to [Search]
       MOV    SI,Offset Input          ;source offset
       MOV    DI,Offset Search         ;destination offset
       CLD                             ;auto inc DI and SI
ISP1:  MOVSB                           ;copy one byte
       CMP    BYTE PTR [SI],0          ;is next char = 0
       JNZ    ISP1                     ;copy bytes
;-----place \*.* at end of string
       MOV    AX,'*\'
       MOV    [DI],AX
       INC    DI
```

```
        INC     DI
        MOV     AX,'*.'
        MOV     [DI],AX
        INC     DI
        INC     DI
        XOR     AX,AX
        MOV     [DI],AX
;-------see if path is OK!
        MOV     DX,Offset Search                ;ptr to ASCIIZ string
        MOV     AX,4E00h                        ;Find function no.
        MOV     CX,0010h                        ;directory search
        INT     21h                             ;do search
        CMP     AL,3                            ;is path BAD ?
        CLC                                     ;clear carry flag
        JNZ     ISP2                            ;OK! if not 3
        STC                                     ;set error flag
ISP2:   POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    IS_PATH
;
;-------Display Path error message.
;       Input = None
;       Output = None
;       AX - DX registers saved
PROC    PATH_ERROR
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AL,' '                          ;replace hex 0 with
        MOV     [BX],AL                         ;a space
        MOV     CL,[Color]                      ;save current color
        MOV     AL,[Warning]                    ;warning color
        MOV     [Color],AL                      ;set color
        MOV     AX,0222h                        ;row 5 Col 7
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      ' Error: Invalid path.  Press Any Key. ',0
        CALL    HIDE_CUR
        CALL    ERR_SOUND
        CALL    GET_CHAR                        ;wait for keyboard key
        MOV     AL,[Menu]                       ;menu color
        MOV     [Color],AL                      ;set color
        MOV     AX,0222h                        ;row 5 Col 7
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;clear warning
        db      '                               ',0
        MOV     [Color],CL                      ;restore original Color
        POP     DX                              ;restore registers
```

```
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    PATH_ERROR
ENDP    CHECK_PATH
;

        .CODE
; Draw the title screen and input the users name.
;       Input = None
;       Output = None
;
PROC    GET_ID
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     BX,DS
        MOV     ES,BX
        XOR     AX,AX
        CALL    MENU_BOX
        CALL    ID_MESSAGE
ID0:    MOV     AL,[Menu]
        MOV     [Color],AL
        MOV     AX,0115h
        CALL    GOTOYX
        CALL    CSTR_OUT
        db      'Please enter the ID number: ',0
;-----set color or Edit session
        MOV     AL,[Normal]
        MOV     [Color],AL
;-----set default ID string to ASCII zeros
        MOV     BX,Offset ID                    ;ptr to string to edit
        MOV     DI,BX                           ;ptr to string to fill
        MOV     AX,3030h                        ;ASCII zeros
        MOV     [DI],AX                         ;place 1st two bytes
        XOR     AH,AH                           ;zero = end of string
        INC     DI                              ;advance string ptr
        INC     DI
        MOV     [DI],AX                         ;ASCII 0 and hex 0
;-----edit ID string
        MOV     AX,0132h                        ;row/col position
        CALL    NUMBER_EDITOR                   ;edit this field
ID8:    POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    GET_ID
;
;------ Get an ASCIIZ string input from the keyboard.
```

```
;     Input = AX = Row/Column position on the screen
;           [ID] must contain the string to be edited before
;           calling this subroutine.
;     OutPut = ASCIIZ string at [ID] in the data section.
;           BX-DX register saved
;     Note: the follow register hold the following local variables.
;           AL = Input Character
;           BX = ptr in [ID] string
;           CX = Row/Col cursor position
;           DX = Starting Row/Col position
;  IMPORTANT: IS_ZERO traps searches for "000". This is not a valid ID#.
;           The 000 line contains the files constant variables.
;           [25%]  [Mean]  [75%] for each dimension.
;
PROC   NUMBER_EDITOR
       PUSH   BX                          ;save registers
       PUSH   CX
       PUSH   DX
       PUSH   DS
       PUSH   ES
       MOV    DX,AX                       ;save row/column in DX
       CALL   GOTOYX                        ;set cursor position
       MOV    BX,Offset ID                ;ptr to [ID] str.
       MOV    AX,BX                       ;[ID] ptr to AX
       CALL   DSTR_OUT                      ;Display zeros
       MOV    CX,DX                       ;row/column ptr to CX
;------beginning of input loop
NUE0:  MOV    AX,CX                          ;cursor position to AX
       CALL   GOTOYX                       ;set cursor position
       CALL   GET_CHAR                      ;wait for keybd input
;------Return key
       CMP    AL,0Dh                      ;Is it a <return> ?
       JNZ    NUE3                        ;If NO goto next test
       CALL   IS_ZERO                       ;Is the ID number 0?
       JMP    SHORT NUE11                      ;cf = Yes DoNot search
;------Is it any other control character?
NUE3:  CMP    AL,1Bh                         ;Is it a control char?
       JNC    NUE7                        ;jmp = not control char
;------check for Backspace key
       CMP    AL,08h                      ;Is it a Backspace key
       JNZ    NUE4                        ;If not continue.
       MOV    AL,13h                      ;convert to left arrow.
;------left arrow key
NUE4:  CMP    AL,13h                         ;Is it a left arrow key
       JNZ    NUE5                        ;If not continue.
       CMP    CX,DX                        ;beginnig of the string?
       JZ     NUE5                        ;yes = beg. of line
       DEC    BX                          ;so loop will continue.
       DEC    CX
;------right arrow key
NUE5:  CMP    AL,4                           ;Is it Rt Arrow key?
       JNZ    NUE6                        ;If not jump.
```

```
        PUSH    AX                      ;save char
        MOV     AX,[BX]                  ;check for end of str.
        CMP     AH,0                    ;zero = end of string
        POP     AX                      ;restore char
        JZ      NUE6                    ;if = 0 no right
        INC     BX                      ;advance pointer
        INC     CX
NUE6:   JMP     SHORT NUE0                      ;get next character
;------Is it the <Esc> key ?
NUE7:   STC                             ;set carry flag
        JZ      NUE11                   ;exit on <Esc> key
;------filter unwanted characters
        CMP     AL,30h                  ;Is it < ASCII 0 ?
        JC      NUE0                    ;if YES get another.
        CMP     AL,3Ah                   ;is it an ASCII digit?
        JNC     NUE0                    ;clear cf = not digit
;------place the character in the [ID] string.
NUE8:   MOV     [BX],AL                     ;place char in [ID]
        MOV     AX,BX                   ;row/col to AX
        CALL    DSTR_OUT                   ;display string from
;------see if 'end of string' is true.
        XOR     AH,AH
        CMP     AH,[BX+1]                  ;Is 'end of string' ?
        JZ      NUE0                    ;yes=do not move cursor
        INC     BX                      ;advance [ID] ptr.
        INC     CX                      ;advance cursor
        JMP     NUE0                     ;if not continue input.
NUE10:  CLC                              ;clear carry flag
NUE11:  POP     ES
        POP     DS
        POP     DX
        POP     CX
        POP     BX
        RET
ENDP    NUMBER_EDITOR
;
;------Is the ID Number = 000.
;       Input = ASCII ID string in [ID]
;       Output = Carry Flag = Yes
;
PROC    IS_ZERO
        PUSH    AX                      ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     BX,Offset ID
        MOV     CX,3                    ;loop counter
        MOV     AL,30h                   ;ASCII zero value
ISZ1:   CMP     [BX],AL                    ;is byte = 0?
        JNZ     ISZ2                    ;not zero OK! exit
        INC     BX                      ;ptr to next byte
        LOOP    ISZ1                     ;look at next byte
```

```
        CALL    ZERO_MESS                       ;NO zero ID numbers
        STC                                     ;Exit on ID Error
        JMP     SHORT ISZ3                      ;exit error no search
        CALL    ZERO_MESS                       ;inform user NO 0 ID's
ISZ2:   CLC                                     ;OK! ID number
ISZ3:   POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
;
;       Input = none
;       Output = none
PROC    ZERO_MESS
        PUSH    AX
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     CL,[Color]                      ;store original Color
        MOV     AL,[Warning]                    ;warning color
        MOV     [Color],AL                      ;set color
        MOV     AX,0109h                        ;row 3/Col 12
        CALL    GOTOYX                          ;set cursor
        CALL    CSTR_OUT                        ;display warning
        db      " A valid ID numbers must be larger than '000'.  Press Any "
        db      'Key. ',0
        MOV     [Color],CL                      ;restore original color
        CALL    HIDE_CUR
        CALL    ERR_SOUND
        CALL    GET_CHAR
        CLC                                     ;clear cf = continue
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    ZERO_MESS
ENDP    IS_ZERO
;
;
;-----Instructions for entering the users ID number.
;       Input = None
;       Output = None
;
PROC    ID_MESSAGE
        PUSH    AX                              ;save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        MOV     AX,1500h                        ;row 21,column 0
        CALL    MENU_BOX                        ;draw menu box
        MOV     AX,160Ch                        ;row 22,column 13
```

```
        CALL    GOTOYX
        MOV     AL,[Color]                      ;get current color
        MOV     CL,AL                           ;store in CL
        MOV     AL,[Menu]                         ;set color = menu
        MOV     [Color],AL
        CALL    CSTR_OUT
        db      'Type the ID Number and press the <Enter> key to continue',0
        MOV     AX,170Ch                        ;row 23,column 13
        CALL    GOTOYX
        CALL    CSTR_OUT
        db      ' or press the <Esc> key to return to the Main Menu.',0
        MOV     AX,0207h                        ;row 23,column 13
        CALL    GOTOYX
        CALL    CSTR_OUT
        db      'A valid ID# must contains three numerical digits.  '
        db      'Example: 1 = 001',0
        MOV     [Color],CL                      ;restore orig. color
        POP     DX                              ;restore registers
        POP     CX
        POP     BX
        POP     AX
        RET
ENDP    ID_MESSAGE
;
```