TRIBHUVAN UNIVERSITY

INSTITUTE OF SCIENCE AND TECHNOLOGY

Final Examination 2076

Candidates are required to give their answer in their own words as far as practicable.
Attempt ALL questions.

Group A   [5 × 3 = 15]

1. What is compilation? Explain different types of qualifier that are available in c programming with an example.

2. Explain about if, else if and switch statement with syntax and flowchart.

3. List the benefits of function. How recursive function call is different than normal function call.

4. What is pointer? Explain about malloc and calloc library function used for dynamic memory allocation.

5. What is structure and how it different than union? Explain self-referential structure with syntax.

Group B   [5 × 6 = 30]

6. Write a program to check whether a given year is leap year, century year or normal year.

7. Write a program to calculate the value of $e^x = 1 + \frac{x}{1} + \frac{x^2}{2!} + \frac{x^3}{3!} + \ ...$ correct up to 4 decimal places.

8. Write a program to input two matrixes using the concept of pointer. The program must use matrix add function to add the matrixes and display the result in the main function.

OR

Write a program which uses a function that takes n number of strings as an argument and sort them in alphabetical order. Display the result in the calling function.

9. Write a program that uses structure to read employee_id, name, age and salary of n employee. Sort them on the basis of salary by passing structure to function.

OR

Construct a structure named TIME consisting hour, minutes and seconds as member variable. Input two data of type TIME in main () function. Use a function diff Time () to find difference of that two time and display the result in main function.

10. Write a program, taking care of all possible error conditions that may occur, to open a new file, read name, and roll number, address and date of birth of students until the user says "no". After reading the data, write it to the file then display the content of the file.

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TRIBHUVAN UNIVERSITY

INSTITUTE OF SCIENCE AND TECHNOLOGY

Final Examination 2076

Subject: **Communication Skill II**
Course No: **MSEN 151**
Level: **B. Math. Sc. /I Year /II Semester**

Full Marks: 45
Pass Marks: 18
Time: 2hrs

Candidates are required to give their answer in their own words as far as practicable.
Attempt ALL questions.

Group A [5 × 3 = 15]

1. The speaker curses his luck in *Eight O'Clock*. Why?

2. Why does Moorehead call the gorilla "a most forgiving ape"?

3. Is *Ballad of the Landlord* a protest poem? Explain the implied irony.

4. What are the reasons to write memos?

5. Define report. Briefly describe the types of reports.

Group B [5 × 6 = 30]

6. What makes the plot of *Sorry, Wrong Number* capture the reader's undivided attention?

   OR

   Who is the scapegoat in the story *The Lottery*? State the significance of the fact that the original box has been lost and many parts of the ritual have been forgotten.

7. Elizabeth Coatsworth says: The artist "must strive to understand the Buddha before he could paint him." How does the artist go about trying to understand the Buddha? Have you ever tried to understand something or someone through a similar method?

   OR

   Kingston, in *Girlhood Among Ghosts*, describes times when she was embarrassed or "tongue-tied" because the Chinese say, "a ready tongue is an evil". Describe a time when you were afraid to speak. Include descriptions of your feelings before, during, and after the incident.

8. Explain the following chanting:
   To the most pure Buddha, mighty ocean of mercy,
   Seer of knowledge absolute, pure, supreme,
   Of the world's sin and suffering the Destroyer-
   Solemnly to the Buddha I bow in homage. (*Chandalika*)

9. Use **APA** format to document the following information in a work-cited list:
   Book title: Monsoon
   Author: Subin Bhattarai
   Publisher: Fineprint
   Publish Year: 2016
   City/place: Kathmandu

10. Prepare an incident report on any topic like your car has broken down, or the water heater broke, or you or an accident of any sort.

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TRIBHUVAN UNIVERSITY

INSTITUTE OF SCIENCE AND TECHNOLOGY

Final Examination 2076

Subject: **Linear Algebra with Applications I**
Course No: **MSMT 152**
Level: **B. Math. Sc. /I Year /II Semester**

Full Marks: 45
Pass Marks: 18
Time: 2hrs

Candidates are required to give their answer in their own words as far as practicable.
Attempt ALL questions.

Group A [5 × 3 = 15]

1. Prove that every square matrix can be uniquely expressed as the sum of a symmetric and a skew-symmetric matrix.

2. The prices of commodities X, Y, Z are respectively x, y, z rupees per unit. Mr. A purchases 4 units of z and sells 3 units of X and 5 units of Y. Mr. B purchases 3 units of Y and sells 2 units of x and 1 unit of Z. Mr. C purchases 1 units of X and sells 4 units of Y and 6 units of Z. In the process A, B and C earn zero profit, Rs. 5,000 and Rs. 13,000 respectively. Find the prices per unit of the three commodities by using determinant method.

3. What are the criteria for a subset of a vector space V from a subspace W over the field F? Show that the set of all vectors of the form $\{(x, y, z): x + y + 2z = 0\}$ is a subspace of R^3.

4. Let $T: R^3 \to R^3$ be a linear transformation defined by $T(x, y, z) = (x, y, x - 2y)$. Find the basis and dimension of Kernel T and Image T by taking the standard basis and hence verify that dim V = dim (KerT) + dim (Im T).

5. Find the orthogonal projection of the vectors $u = (-3, -3, 8, 9)$ on the subspace of R^4 spanned by the vectors $u_1 = (3, 1, 0, 1)$, $u_2 = (1, 2, 1, 1)$ and $u_3 = (-1, 0, 2, -1)$. Also find the error.

Group B [5 × 6 = 30]

6. Define idempotent, nilpotent and involutory matrix. What are elementary row operations? Use it to solve $3x + 4y + 5z = 18$, $2x - y + 8z = 13$ and $5x - 2y - 7z = 20$.

7. Define ortho-symmetric determinant. Using properties of determinant prove that

$$\begin{vmatrix} a^2+1 & ab & ac & ad \\ ab & b^2+1 & bc & bd \\ ac & bc & c^2+1 & cd \\ ad & bd & cd & d^2+1 \end{vmatrix} = 1 + a^2 + b^2 + c^2 + d^2.$$

8. What are the requirements for a set S in a vector space V to be a basis for V. Show that the set of vectors $(1, 1, 1)$, $(1, -1, 1)$, $(2, 0, 3)$ form a basis of R^3. Also find the coordinates of $(1, 3, 2)$ with respect to this ordered basis.

OR

Let $T: V \to W$ be a map between vector spaces. Explain what it means for T to be a linear. When it is operator? Show that the inverse of a linear transformation is linear. Also find the matrix representation of a linear map $F: R^2 \to R^2$ given by $F(x, y) = (2x - 5y), (3x+y)$ relative to the basis $u_1 = (2, 1)$ and $u_2 = (3, 2)$.

9. Let P and Q be two vectors in R^n with usual dot product. State and prove triangle inequality and orthogonal property. Define scalar and vector projection of a vector into another vector. Determine the scalar and vector projection of $(4, -1, 3)$ onto the vector $(1, 2, 3)$.

10. State Gram-Schmidt Process. Extend the given orthogonal set $\{(3, -1, 1, 0), (1, -1, -4, 1)\}$ of vectors to an orthogonal basis of R^4.

OR

Define orthogonal and orthonormal set of vectors. Show that a set of non zero orthogonal vectors are linearly independent. Also prove that every finite dimensional non zero vector space has an orthogonal basis.

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TRIBHUVAN UNIVERSITY

INSTITUTE OF SCIENCE AND TECHNOLOGY
Final Examination 2076

Subject: **Statistics and Data Analysis I**
Course No: **MSST 151**
Level: **B. Math. Sc. /1 Year /II Semester**

Full Marks: 45
Pass Marks: 18
Time: 2hrs

Candidates are required to give their answer in their own words as far as practicable.

Attempt ALL questions.

Group A   [5 × 3 = 15]

1. Define mutually exclusive event with an example. A, B and C shoot to hit a target. If A hits the target 4 times in 7 trials, B hits it 3 times in 5 trials and C hits it 2 times in 3 trials. What is the probability that the target is hit by at least 2 persons?

2. As a part of the evaluation of a possible acquisition, a New York City conglomerate has collected this sales information

Product	Average annual price 1993	1995	Total dollar value (thousands) 1993
Calculator	$27	$20	$150
Radios	30	42	900
Portable TVs	157	145	1370

   Calculate the unweighted average of relative price index using 1993 as the base period. Also calculate the weighted average of relative price index using the dollar value for each product in 1993 as the appropriate set of weights and 1993 as the base year.

3. Suppose a continuous random variable X has the density function $f(x) = c (10-x)^2$; $0 < x < 1$. Find
   a) value of constant c   b) P $(1<x<2)$ c) E(X) and V(X).

4. In a sample of 120 persons in a village, 76 persons were administered a new drug for preventing influenza out of whom, 24 persons were attacked by influenza. Amongst those not administered the new drug, 12 persons were not attacked by influenza. Prepare appropriate contingency table and calculate the Pearson's coefficient of contingency and interpret the result.

5. Obtain the moving averages for the following data, also plot the actual data and trend line by using the method of 4 yearly moving averages.

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Sales	12	18	26	32	40	60	76	94	100	108

Group B   [5 × 6 = 30]

6. An auto insurance company charges younger drivers a higher premium than it does older drivers because younger drivers as a group tend to have more accidents. The company has three age groups: Group A includes those under 25 years old, 25% of all its policyholders. Group B includes those 25-39 years old, 40% of all its policyholders, Group C includes those 40 years old and older. Company records show that in any given one-year period 11% of its Group A policyholders have an accident. The percentage for groups B and C are 15% and 12% respectively.

   a) What percent of the company's policyholders are expected to have an accident during the next 12 months?

   b) Suppose Mr. X has just had a car accident. If he is one the company's policyholders, what is the probability that he is under 25?

The southeast regional manager of General Express, a private parcel delivery firm is worried about the likelihood of strikes by some of his employees. He has learned that the probability of a strike by his pilots is 0.75 and the probability of a strike by his drivers is 0.65. Further, he knows that if the drivers' strike; there is a 90 percent chance that the pilots will strike in sympathy.

   c)   What is the probability of both groups striking?
   d)   If the pilots strike, what is the probability that the drivers will strike in sympathy?

7.   Given the random variable X with density function $f(x) = 1$ for $0<x<1$. Find the probability density function of $Y = -2logx$. A random variable X is defined to be the difference between the higher value and the lower value when two dice are thrown. If they have the same value, X is defined to be zero. Find $E(2X+10)$, $E(X^2)$ and $Var(5X+3)$.

8.   The research farm believes that the job satisfaction of employees in business firm is mainly due to working experience and income. The firm has assessed the satisfaction of five employees of the business firm and found the following information regarding satisfaction score, working experience and annual income.

Job satisfaction	10	5	10	4	8
Experience (in years)	16	13	21	10	13
Annual income(Rs. 100,000)	3	6	4	5	3

   a)   Estimate the equation to predict the job satisfaction from experience and annual income.
   b)   Predict the job satisfaction of an employee who has spent 18 years on job and has annual income of Rs 800,000.
   c)   Compute standard error of the estimate and interpret its meaning.
   d)   How much variation in job satisfaction can be explained by experience and annual income?

<div align="center">OR</div>

A developer of food for pigs would like to determine what relationship exists among the age of a pig when it starts receiving a newly developed food supplement, the initial weight of the pig and the amount of weight it gains in a 1 week period with the food supplement. The following information is the result of a study of eight piglets.

Piglet number	1	2	3	4	5	6	7	8
Initial weight (pounds)	39	52	49	46	61	35	25	55
Initial age (weeks)	8	6	7	12	9	6	7	4
Weight gain	7	6	8	10	9	5	3	4

   a)   Calculate the least squares equation that best describe these three variables.
   b)   How much might we expect a pig to gain in a week with the food supplement if it were 9 weeks old and weighed 48 pounds?
   c)   Compute standard error of the estimate and interpret its meaning.
   d)   Obtain coefficient of multiple determination and interpret the result.

9.   David Curl Builders has collected quarterly data on the number of homes it has started during the last 4 years.

Quarter/Year	I	II	III	Iv
1991	8	10	7	5
1992	9	10	7	6
1993	10	11	7	6
1994	10	12	8	7

Calculate the seasonal indices for each quarter using ratio to moving average method assuming multiplicative model.

<div align="center">OR</div>

Fit a straight line trend using method of least square for the following sales (in '000' Rs) distribution of ABC company.

Year	2001	2002	2003	2004	2005	2006	2007
Sales (in'000 Rs.)	10	13	15	20	10	8	7

a) Estimate the likely sales for the year 2010.
b) Obtain trend eliminated values assuming multiplicative model of time series.
c) Do these figures show decreasing trend? If yes, what is the monthly decreasing in sales?
d) What components will assume to be left if trend is eliminated?

10. A random variable X has an exponential distribution with probability density function

$f(x) = 2e^{-2x}$; x>0. Determine the quartiles of the distribution. The following table gives the changes in the price and the consumption (quantity) of certain major constituents of the basket of the labor class.

Commodity	Unit	1989		1990	
		Price	Quantity	Price	Quantity
Wheat	Quintals	1000	10	1100	6
Rice	Quintals	1500	15	1700	18
Cloth	Meters	50	50	40	30

If the average wage of a labor was Rs. 1200 per month in 1989, what should be the average wage per worker per month in 1990 so that the standard of living of the workers does not fall below the 1989?

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Subject: **Calculus with Analytical Geometry II**   *Full Marks*: 45
Course No: MSMT 151   *Pass Marks*: 18
Level: B. Math. Sc. /I Year /II Semester   *Time*: 2hrs

Candidates are required to give their answer in their own words as far as practicable.
Attempt ALL questions.

Group A   [5 × 3 = 15]

1. Evaluate by using the rule of differentiation under the sign of integration $\int_0^\infty \dfrac{\ln(1+a^2x^2)}{1+b^2x^2}dx$.

2. Given the demand function $p_d = 300 - x$ and the supply function $p_s = x + 100$, where x is the number of units. Find the difference between consumer's and producer's surplus at the equilibrium market price.

3. Find the exact length of the curve $x = 3\cos t - \cos 3t$, $y = 3\sin t - \sin 3t$, $0 \le t \le \pi$.

4. State the Comparison Test. Use it to determine whether the series $\displaystyle\sum_{n=1}^{\infty} \dfrac{5}{2n^2 + 4n + 3}$ converges or diverges.

5. Evaluate the iterated integral $\displaystyle\int_0^{\pi/2}\int_0^y\int_0^x \cos(x+y+z)\,dz\,dx\,dy$.

Group B   [5 × 6 = 30]

6. Define Beta and Gamma function. Use it to prove $\displaystyle\int_0^{\frac{\pi}{6}} \cos^2 6\theta \sin^4 3\theta\, d\theta = \dfrac{7\pi}{192}$.

7. Evaluate $\displaystyle\int \dfrac{3x+2}{x^3 - 2x^2 + x - 2}\,dx$. State and prove Trapezoidal rule for approximate integration. Write an error bounds formula for Trapezoidal rule.

8. If f is continuous on [a, b], then prove that length of the curve $y = f(x)$, $a \le x \le b$ is $L = \int_a^b \sqrt{1 + \left(\dfrac{dy}{dx}\right)^2}\,dx$. Also find the length of the arc of the parabola $y^2 = x$ from (0, 0) to (1, 1).

9. For the cardioids $r = 1+\sin\theta$, find the slope of the tangent line when $\theta = \pi/3$. Also find the points on the cardioids where the tangent line is horizontal or vertical.

OR

Find the foci and asymptotes of the hyperbola the conic $9x^2 - 16y^2 = 144$ and sketch its graph. Find the area of the region that lies inside the circle $r = 3\sin\theta$ and outside the cardioid $r = 1 + \sin\theta$.

10. Find the domain of the Bessel Function of order O defined by $J_o(x) = \displaystyle\sum_{n=0}^{\infty} \dfrac{(-1)^n x^{2n}}{2^{2n}(n!)^2}$. Find a power series representation for $\ln(1+x)$ and its radius of convergence.

OR

Write an expression for the nth degree Taylor's polynomial of f centered at a. Find the Taylor series and Taylor's polynomial generated by the function $f(x) = \cos x$ at $x = 0$. Also find the radius of convergence and interval of convergence of the series.

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