The Arismetic of the Edo period (1603~1867) in Japan

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— Tosei-jingoki —

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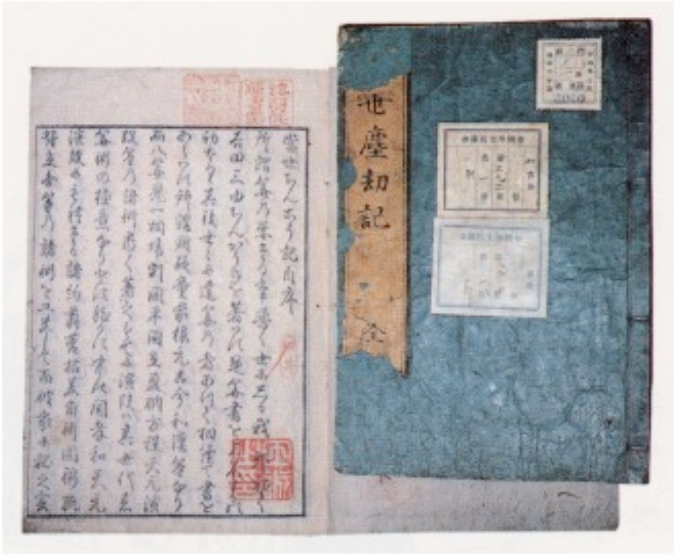
written by Yasuaki Aida

Translated by Nobuya Nakamura
Chairman of Nagano pref. WASAN Society

February, 2010



当世　塵劫記
Tosei-jingoki
(collection of the Japan Academy)

Mr. Yasuaki Aida's portrait
(collection of the Japan Academy)

Leaders of sect Saijoryu
From upper row, Mr. Yasuaki Aida, Mr. Hajime Watanabe, and Mr. Sakuma
(collection of the Japan Academy)

Translator's Preface

We have studied by using the textbook of arithmetic and mathematics of the Ministry of Education since a grade-schooler. They were all mathematics of the West. It is an European food and a European dress, so to speak.

On the other hand, there was mathematics that was called 'WASAN' in Edo period. 'WASAN' corresponds to Japanese food and to Japanese dress.

'WASAN' was mathematics of a peculiar traditional form of Japan. But we completely forget it, and have become only mathematics of the West. We do not regret becoming mathematics of the West. We regret to have forgotten 'WASAN'. 'WASAN' is a culture of Japan. The Japanese ourself has forgotten the important culture.

Mathematics was introduced to Japan from China and it did Japanese original development. It has developed to the level of equaling to mathematics of the West at the end of Edo period.

Author Mr. Yasuaki Aida of Tosei-jingoki was born in the country side. He held the ambition to become the mathematician of the top of Japan. He is a scholar who went out to Edo and devoted his life to the research of mathematics.

At that time, the sect named Seki-ryu was ruling academic circles of 'WASAN'.

He resisted Seki-ryu, and established the sect of the name of Saijo-ryu newly. And he published arithmetic book Tosei-jingoki for the people. Though it is a woodblock printing. Because there is an illustration, and the theme is chosen from the life of people in those days, it is a companionable book in the person who studies arithmetic for the first time. If you are a graduate in the high school, mathematics of Tosei-jingoki can be understood.

The Japanese has forgotten WASAN as written in the beginning. Therefore, people in the world do not know that there was peculiar mathematics in Japan.

Though the content of Tosei-jingoki is a part of mathematics and the culture in Edo period, if people's arithmetic, lives and the cultures in Edo period can be understood by this book, I am happy.

February 10 2010

The Page of Problems and Solutions

The Original 70～80

Notation

【1】 Japanese old weights and measures

(1) unit of length

1 *JŌ* =10 *SHAKU*, 1 *SHAKU*=10 *SUN*, 1 *SUN*=10 *BU*,
1 *BU*=10 *RIN*, 1 *RIN*=10 *MŌ*,
1 *RI*=36 *CHŌ*, 1 *CHO*=60 *KEN*, 1 *KEN*=6 *SHAKU*
(1 *SHAKU*≒30 ㎝, 1 *KEN* ≒1.8 m)

(2) unit of area

1 *CHŌ*=10 *TAN*, 1 *TAN*=10 *SE*, 1 *SE*=30 *BU*,
1 *BU*=1 *TSUBO*
(1 *TSUBO*≒3.3 ㎡, 1 *TAN*≒*990* ㎡)

(3) unit of volume

1 *KOKU*=10 *TO*, 1 *TO*=10 *SHŌ*, 1 *SHŌ* =10 *GŌ*,
1 *GŌ* =10 *SHAKU*
(1 *SHŌ* ≒1.8 ℓ)

(4) unit of weight

1 *KAN*=1000 *MONME*, 1 *MONME*=10 *BU*, 1 *BU*=10 *RIN*
(1 *MONME*≒3.75 g)

(5) unit of money

1 *RYŌ*=4 *BU*, 1 *BU*=250 *MON*
1 *KAN* or *KANMON*=1000 *MON*

(6) the other units

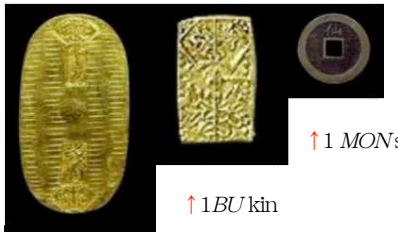
① How to count cloth 1 *PIKI*=2 *TAN*
(1 *TAN*= 1 roll)

② How to count luggage 1 *DA*=2 packages

【2】 Money system and custom in Edo period

The string was passed through the hole of 96 pieces of ! *MON*sen and it was bound to one. It is 96 pieces but it passed as 100 *MON*. This custom was called 'CHŌSEN'.

It was 1 *RYŌ*=4 *BU*, 1 *BU*=250 *MON* in the money system, but it was actually exchanged in the rate of gold coin 1 *RYŌ* ≒ silver 60 *MONME*≒4000 *MON*.



↑1 *MON*sen

↑1*BU* kin

↑1*RYŌ* koban

1 *RYŌ*=4 *BU*, 1 *BU*=250 *MON*

【3】　JŌICHIJYUTSU

Two element simple equation $mx - ny = 1$ (m and n are natural numbers, $m < n$) . The method of obtaining the integer solution of this equation is called JŌICHIJYUTSU.

(example)　Find the solution of a minimum natural number of the next equation　　$19x - 27y = 1$.

(how to solve)

	left	right	
	1 9	2 7	
(a_3) 2……	1 6	1 9	……1 (a_2)
	3	8	
(a_5) 1……	2	6	……2 (a_4)
	1	2	

When the left becomes one, stop it.

Putting　　$p_0 = 0$ and $p_1 = 1$

$p_2 = p_0 + p_1 a_2 = 1$

$p_3 = p_1 + p_2 a_3 = 3$

$p_4 = p_2 + p_3 a_4 = 7$

$p_5 = p_3 + p_4 a_5 = 10$

$\therefore \quad x = p_5 = 10, \qquad y = 7$

The Author's Preface

The importance of arithmetic is known well. Mr. Mitsuyoshi (光由) Yoshida (吉田) wrote「Jingoki」(塵劫記) at the first time in Japan. It is the first publication as the book on arithmetic.

After that, the many books were published by excellent persons , and continuously.

They are 「Sanpo-ketsugisho」(算法闕疑抄), 「Domo-sanpo」(童蒙算法), 「Sanpo-kongenki」(算法根源記), 「Kokon-sanpoki」(古今算法記), 「Wakan-sanpo」(和漢算法) etc.

The content of those books are division, ratio, square root and cube root, excess and deficiency calculation, equation, algebra etc. Especially, algebra was a secret of arithmetic.

However, afterwards, Mr. Takakazu (孝和) Seki (関) invented numeral coefficient equation and sequence, method of indeterminate equation, method of requesting coefficient of high-dimensional function, length concerning regular polygon, circle and globular etc. He was concealing them. Since then, his pupils published「Katsuyo-Sanpo」(括要算法) and「Shuki-Sanpo」(拾算法) etc. Especially, after 「Seiyo-Sanpo」(精要算法) was published, his sect has spread to a Japanese inside very much.

At that time, Mr. Mitsuyoshi (光由) Yoshida (吉田) was called an excellent mathematician, but the first arithmetic is rudimentary. Arithmetic advances every year. The advancement is because an excellent mathematician appeared one after another every year.

I am not originally an excellent scholar. Though there were feelings that study, it was not possible to study under the master. Because I had studied by myself, mathematics was not able to be acquired enough. I became being able to solve an equation at last recently. Therefore, I wrote as child's play, named the title of a book Tosei-jingoki, and published it.

Though the computational method of this book has not been known to the world yet, like Mr. Yoshida's Jingoki, it is likely to become child's play several years later.

Even though my book becomes child's play too,I am prepared to accept them, because mathematics shall rapidly develop.

When we see the published book, there is often seen the incompleteness of the problem, or the mistake of solution.

Ancients do not understand the origin of mathematics. They thought four arithmetical operations to be important and they liked useless calculation. When others' mistakes are discovered by chance, they take up them and write the book about the mistakes. And, the mistake is found again in the book.

Mistake of myself does not notice though others' mistakes can be pointed out. This is because the understanding of mathematics is not complete.

It is said that there is a secret about mathematics in each sect. But there is no secret that should be concealed to mathematics.

There must be a mistake even in the book that an excellent mathematician wrote and this cannot be avoided.

Arithmetic is deep, there is no limit. Therefore, including roundabout solution cannot be avoided. The seniors mistook because the truth of how to solve was not examined. It is a cause not to have verified whether the answer is correct.

Recently, the mistake has decreased because the scholars examine the truth or not about the answer.

However, I cannot assert to be no mistake in the answer at all. I am wishing you to correct them if you discovered any small mistakes.

Amen !

Autumn, Tenmei 4 (1784)

Mathematician in Edo　　Yasuaki Aida