A UNIQUE AND UNKNOWN BOOK OF AL-BERUNI

Ghurat-uz-Zijat or Karana Tilaka

Sayyid Samad Husain Rizvi*

(Continued from the July, 1964 issue)

2. To Find the Nakshatra:

Find out the distance of the true place of the Moon from the first point of Aries in minutes and divide it by 800, then the quotient will represent the complete Nakshatra, which normally shows the number of days; multiply the remainder by 60 and divide the product by the true daily motion of the Moon, then the quotient will be the past portion of the incomplete Nakshatra (in ghatias), which represents the time passed since the entry of the Moon in that Nakshatra.

Example:— The true place of the Moon is 153° 51' 52''; we converted it into minutes getting 2031 min. 52 sec.; divided it by 800 getting the quotient 2 complete Nakshatras and the remainder was 431 min. 52 sec.; multiplied it by 60 and divided the product by the true daily motion of the Moon 14° 16' 34'' getting the quotient 30 ghatias 15 palas, which is the time that has passed since the entry of the Moon in the third Nakshatra Krittika. (Now we deducted 431 min. 52 sec. from 800 min. getting 368 min. 8 sec.; multiplied it by 60 and divided the product by 14° 16' 34'' getting the quotient 25 ghatias 47 palas which is the remaining time of Krittika, the third Nakshatra; thus the total duration of Krittika at that time was 56 ghatias 2 palas). This is on the basis that the Moon covers it (i.e., its true daily motion) in 60 ghatias. The following table shows the Indian names of Nakshatras:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Names of Nakshatras</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ashwini</td>
</tr>
<tr>
<td>2</td>
<td>Bharani</td>
</tr>
<tr>
<td>3</td>
<td>Krittika</td>
</tr>
<tr>
<td>4</td>
<td>Rohini</td>
</tr>
<tr>
<td>5</td>
<td>Mrigashira</td>
</tr>
<tr>
<td>6</td>
<td>Ardra</td>
</tr>
<tr>
<td>7</td>
<td>Punarvasu</td>
</tr>
<tr>
<td>8</td>
<td>Pukhya</td>
</tr>
<tr>
<td>9</td>
<td>Ashlekhha</td>
</tr>
<tr>
<td>10</td>
<td>Magha</td>
</tr>
<tr>
<td>11</td>
<td>Purvaphalguni</td>
</tr>
<tr>
<td>12</td>
<td>Uttaraphalguni</td>
</tr>
</tbody>
</table>

* Mr. Sayyid Samad Hussain Rizvi, Executive Engineer, Pakistan, Scholar of Sanskrit, Hindi, Urdu, Arabic, Persian and English.
(b) **Translation of the Technical Terms:**

Nakshatra: It is the original Sanskrit term for which Beruni has used the Arabic term مَزَى القمر; its English translation is “lunar mansion,” but I have preferred to use the original Sanskrit term.

**TRUE DAILY MOTION OF THE MOON:** It is the English translation of the Arabic term یَضَدُّ القمر used by Beruni; the original Sanskrit term is Chandra-sapta-gati, or Chandra-sapta-bhukti; Beruni has Arabised the term “bhukti” as یُضَدُّ.

(c) **Elaboration of the Principle:**

The ancient Indian astronomers had divided the ecliptic into 12 signs of zodiac mainly for the path of the Sun; similarly they had divided the same ecliptic into 27 lunar mansions mainly for the path of the Moon.

Each lunar mansion or Nakshatra is supposed to have $\frac{27}{80}$ min. of the ecliptic; this distance is covered by the Moon sometimes within 60 gatis, sometimes within less than 60 gatis, and sometimes within more than 60 gatis, depending upon its true daily motion which goes on increasing and decreasing regularly according to the positions of the Moon and Chandrochha in the ecliptic. The true daily motion of the Moon can be found out by the method given in Article 5 of Chapter V; it shows the portion of the ecliptic travelled by the Moon within 60 gatis. So if we convert the true place of the Moon into minutes and divide it by 800 min. the quotient will represent the complete Nakshatras through which the Moon has already passed, and from the remainder, after division by 800 min., we can proportionately find out the time since the entry of the Moon into the incomplete Nakshatra as well as the time which it will take up to its exit from the same Nakshatra.

3. To Find the Tithi in a Month:

Deduct the true place of the Sun from the true place of the Moon; if the deduction is not possible, add 12 signs of zodiac to the true place of the Moon and then deduct the true place of the Sun from the sum. Convert the remainder into minutes and divide it by 720, then the quotient will be the complete tithis passed since the conjunction; multiply the remainder by 60 and divide the product by the difference of the true daily motions of the Moon and the Sun, then the quotient will be the past ghati, etc., of the incomplete tithi.

**Example:** The true place of the Moon is IS $3^\circ 51^\prime 52^\prime$; from it we deducted the true place of the Sun 2S $2^\circ 43^\prime 53^\prime$ getting the remainder 11S $1^\circ 7^\prime 59^\prime$ which was converted into 19867 min. 59 sec.; divided it by 720 min. getting the quotient 27 which is the number of the past tithis of the lunar month; multiplied the remainder 427.59 by 60 and divided the product by the difference of the true daily motions of the Moon and the Sun...
15° 19' 36" getting the quotient 32 ghatis 7 palas which is the past duration of the 28th tithi. (Now we deducted 427 min. 59 sec. from 720 min. getting the remainder 292 min. 1 sec.; multiplied it by 60 and divided the product by 13° 19' 36" getting the quotient 21 ghatis 55 palas which is the future duration of the 28th tithi; thus the total duration of the 28th tithi is 54 ghatis 2 palas.)

**Commentary**

(a) *Correction of the Manuscript:*

The main correction in this article is that in the original manuscript the difference of the true daily motions of the Moon and the Sun is supposed to be 12° 48' but actually it should be 13° 19' 36", because the true daily motion of the Moon is 14° 16' 34", as already mentioned in the previous article, and the true daily motion of the Sun is 5° 35' 36", as will be shown in the solved example of Article 5 of Chapter V of this book.

The following changes have been made in the manuscript:

1. I have added a few sentences in the solved example within brackets to elaborate the process of calculations.
2. I have written ب لم ب ام تب instead of ب لم ب ام تب.
3. I have written 18787 instead of 18877 instead of 18877 instead of 18877 instead of 18877 instead of 18877 instead of 18877 instead of 18877.
4. I have written 13 instead of 12.

(b) *Translation of Technical Terms:*

**Tithi:** This is the original Sanskrit term for which Beruni has used the term "يوم القمرية"; its English translation is "lunar day" or more technically "luni-solar day."

(c) *Elaboration of the Principle:*

As already explained in the commentary of Article 2 of Chapter I, a tithi is the period during which the Moon advances through 12 deg. or 720 min. from the Sun. The duration of a tithi, just like the duration of a Nakshatra, remains always changing depending on the value of the difference of the true daily motions of the Moon and the Sun. The first fifteen tithis constitute the "Shukla Paksha" and the last fifteen tithis constitute the "Krishna Paksha." In Northern India it is customary to begin a lunar month with Krishna Paksha and to end it with Shukla Paksha; this system of reckoning is known as Purnimanta. For example, the last Paksha of the last month of a Vikrami Samvat is always the Krishna Paksha of Chaitra, and the first Paksha of the first month is always the Shukla Paksha of Chaitra in the Purnimanta system; thus a Vikrami Samvat begins with the second half of Chaitra and ends with the first half of Chaitra, so that the first half of Chaitra belongs to one Samvat and the second half of the same Chaitra belongs to the next Samvat. But in the Amanta system a lunar month begins

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with Shukla Paksha and ends with Krishna Paksha, so that the Sam begins with Shukla Paksha of Chaitra and ends with Krishna Paksha Phalguna; thus in the Amanta system there is no necessity of dividing month of Chaitra between two Samvats. In both the systems the Sam begins with the Shukla Paksha of Chaitra.

4. **To Find the Yoga in a Month:**

Convert the sum of the true places of the Sun and the Moon in minutes and divide it by 800 min., then the quotient will be the number complete Yogas; Yoga is a division of time esteemed by the Hinduists; multiply the remainder by 60 and divide the product by the true daily motions of the Sun and the Moon, then the quotient will represent the past ghatis of the current Yoga.

**Example:** The sum of the true places of the Sun and the Moon in 36° 35' 45" which is equal to 5795 min. 45 sec.; we divided it by 800 minute getting 7 complete Yogas and the remainder 195° 45'; multiplied it by 60; divided the product by the true daily motions of the Sun and Moon 15° 13' 32" getting the quotient 12 ghatis 51 palas, which is the past duration of the 8th Yoga. Now we deducted 195° 45' from 800 getting remainder 604° 15'; multiplied it by 60 and divided the product by 15° 13' 32" getting the quotient 39 ghatis 41 palas, which is the future duration of the 8th Yoga; thus the total duration of the 8th Yoga is 52 ghatis 92 palas.

The following table shows the names of the Yogas according to the (i.e., according to Hindus.):

**SL. NO. AND NAMES OF YOGAS**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Yoga</th>
<th>Sl. No.</th>
<th>Yoga</th>
<th>Sl. No.</th>
<th>Yoga</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Viskumbha</td>
<td>10</td>
<td>Ganda</td>
<td>19</td>
<td>Parigha</td>
</tr>
<tr>
<td>2</td>
<td>Priti</td>
<td>11</td>
<td>Vridhi</td>
<td>20</td>
<td>Shiva</td>
</tr>
<tr>
<td>3</td>
<td>Ayushman</td>
<td>12</td>
<td>Dhruta</td>
<td>21</td>
<td>Siddha</td>
</tr>
<tr>
<td>4</td>
<td>Saubhagy</td>
<td>13</td>
<td>Vyaghat</td>
<td>22</td>
<td>Sadhya</td>
</tr>
<tr>
<td>5</td>
<td>Shobhana</td>
<td>14</td>
<td>Harshana</td>
<td>23</td>
<td>Shubha</td>
</tr>
<tr>
<td>6</td>
<td>Atiganda</td>
<td>15</td>
<td>Vajra</td>
<td>24</td>
<td>Shukra</td>
</tr>
<tr>
<td>7</td>
<td>Sukarma</td>
<td>16</td>
<td>Siddhi</td>
<td>25</td>
<td>Brahma</td>
</tr>
<tr>
<td>8</td>
<td>Dhirita</td>
<td>17</td>
<td>Vyatiapa</td>
<td>26</td>
<td>Aindra</td>
</tr>
<tr>
<td>9</td>
<td>Shula</td>
<td>18</td>
<td>Variyana</td>
<td>27</td>
<td>Vaidhrita</td>
</tr>
</tbody>
</table>

**Commentary**

(a) *Correction of the Manuscript:*

The main correction in this article is that in the original manuscript the table of Yogas was altogether wrong; I have deleted that table Yogas and another table of Yogas has been substituted which is the corr

The name of the 15th Yoga is given here as "Lampta" but actually it is known as "Lambaka"; it is just possible that this discrepancy may be due to the mistake of the Arabic scribe. An additional name for the 18th Yoga is given as kala in the table of the Arabic manuscript, but actually this word is synonymous with 17th Yoga and therefore I have deleted it. In this table against sl. nos. 1, 4, 5, 7, 8, 11, 12, 13, 14, 19, 20, 21, 24, 27 and 28 the letter 

is written, which stands for meaning beneficent; against sl. nos. 2, 6, 9, 10, 15, 16, 17, 18 and 25 the letter 

is written, which stands for meaning maleficent; the remaining sl. nos. 3, 22, 23 and 26 are neither beneficent nor maleficent and the letter 

is written against them. Actually the sl. nos. 3, 22, 23 and 26 are controversial; according to modern astrologers, sl. nos. 3, 22 and 23 are maleficent, while sl. no. 26 is beneficent (vide sloka 24, chapter I of Muhurtta Chintamani).

From the above description it is clear that the table Yogas given in the Arabic manuscript is wrong. In fact these 28 Yogas are quite different and are independent of the sum of the true places of the Sun and the Moon; on the other hand, these Yogas are dependent on the week-day and the Nakshatra. For example, if the 9th Nakshatra falls on Sunday, it is the 9th Yoga named Vajra; if the 9th Nakshatra falls on Monday, it is the 5th Yoga named Saumya; if the 9th Nakshatra falls on Tuesday, it is the 1st Yoga named Ananda, and so on. So it is seen that on Sunday the sl. no. of Yoga is the same as the sl. no. of Nakshatra; on Monday the sl. no. of Yoga is less than the sl. no. of Nakshatra; on Tuesday the sl. no. of Yoga is less than the sl. no. of Nakshatra, and so on.

I have written instead of \[\text{instead of}\]

instead of instead of \[\text{instead of}\]

(b) Translation of the Technical Terms:--

YOGA: It is the original Sanskrit term which has been Arabised by Beruni as ऋग; its English translation can be made as "combination." Generally this term is used for two types of Yogas, one type depends on the combination of the Sun and the Moon, while the other type depends on the combination of week-day and Nakshatra. There are other types of Yogas also depending on various combinations, but they are not described here.

5. To Find the Karana in a Month:--

The sthira (i.e. fixed) Karanas occur during two particular tithis. 1 term "Karana" is used both for the day (i.e., the first half) and the nig (i.e. the second half) of a tithi. The detail of these sthira Karanas is that the second half of the tithi which precedes Amavasya, the last tithi of the month, is known as shakuni after the name of a bird which flies towards Amavasya; the first half or the day of the next tithi is known as Chatushpa which means quadruped; then the night of the same tithi is known as Na which means serpent; then the day of the next tithi is known as Kinstugh which means breaker of the process. All these four Karanas are sthira because their order with respect to Amavasya is never changed and they always occur on particular tithis of a lunar month. But the chara (i.e., movable) Karanas, which begin afterwards, occur sometimes on the day of a tithi or sometimes on the night of a tithi; they take many turns in a month and they remain mobile throughout. They are seven in number as shown below, a when the last one ends, the first one begins again.

Sl. Nos. and Names of Chara Karanas

1 Bava 2 Balava 3 Kaulava 4 Taitila 5 Gara 6 Vanija 7 Nisht

To find out the current Karana the true place of the Sun is deducted from the true place of the Moon and the remainder is to be converted into minutes and then we divide it by 360. Write the quotient separately and the remainder separately; if the quotient is zero, the current Karana is Kinstugh; similarly if the quotient is 57, 58 and 59, the current Karana is respectively Shakuni, Chatushpada and Naga; if the quotient other than the above, the current one is a chara Karana and the following method is to be used to find out the chara Karanas: We deduct 1 from the quotient and divide the remainder by 7 thus getting remainder never more than 7; count this remainder according to the above-mentioned table, then you will know the past Karanas and the next one is the current Karana.

Multiply the remainder (already obtained from the division by 360) by 7 and divide the product by the difference of the true daily motions of the Moon and the Sun, then the quotient will be the past ghati of the current Karana. Again, as a Karana is equal to half of a tithi, we double the past ghati tithis (since shukla Pratipada), deduct 1 from it and divide the remainder by 7, and count the remainder according to the above-mentioned table, then the past chara Karanas will be known. Now we take the past ghati of the current tithi and multiply these by 2; if this product is more than the total duration of the current tithi, we deduct this total duration from
the product and add 1 to the number of the past Karanas and the next Karana is taken as the current Karana. Then divide the remainder by 2 to get the past ghati of the current Karana.

Example:— From the true place of the Moon 15° 32' 45" we deducted the true place of the Sun 25° 11' 15" getting the remainder 13° 21' 30"; we converted it into minutes getting 10867' 59" and divided it by the quotient 55 and the remainder 67' 59"; from the quotient we deducted 1 getting the remainder 54 and divided it by 7 getting the remainder 5; according to this remainder we found out from the table that Gara Karana had passed and the next one, i.e., Vanja Karana, was continuing; then the remainder 67' 59" was multiplied by 60 and the product was divided by the difference of the true daily motions of the Moon and the Sun 13° 19' 36" getting the quotient 5 ghatis 6 palas which is the past duration of Vanja Karana. Now we deducted 67' 59" from 360 getting the remainder 292' 1" which was multiplied by 60 and the product was divided by the difference of the true daily motions of the Moon and the Sun 13° 19' 36" getting the quotient 21 ghatis 55 palas which was the future duration of Vanja Karana; thus the total duration of Vanja Karana was 27 ghatis 1 pala. There were 27 past tithis which we multiplied by 2 and deducted 1 from the product getting the remainder 53; we divided it by 7 getting the remainder 4 which we counted from the first Karana getting Taitila as the past Karana and Gara as the current Karana. Now we doubled the past ghati of the current tithi getting 64 ghatis 14 palas which was more than the total duration of the tithi, i.e., 54 ghatis 2 palas; therefore we deducted the total duration of the tithi from it thus getting the remainder 10 ghatis 12 palas, and also added 1 to the number of the past Karanas so that we found that actually Gara Karana had passed and Vanja Karana was continuing; we divided 10 ghatis 12 palas by 2, thus 5 ghati 6 palas was the past duration of Vanja Karana. We deducted this past duration from half of the total duration of the tithi 27 ghatis 1 pala getting 21 ghati 55 palas which was the future duration of Vanja Karana; thus the total duration of Vanja Karana was 27 ghatis 1 pala which is equal to half of the total duration of the tithi. This is what is based on the Moon and tithi, as already stated; therefore the Moon has a very important place in astronomical and astrological calculations.

Commentary

(a) Correction of the Manuscript:—

It appears that in this article Beruni has given his own method based on a wrong assumption, instead of translating literally the method of Karana Tilaka, and consequently he has committed the same mistake as he has committed in his Indica wherein he has assumed the Amavasya tithi as first tithi of Shukla Paksha, instead of assuming it the last tithi of the Krishna Paksha; he thinks that the two Karanas, Chatushpad and Naga belong to the Shukla Paksha (vide "Alberuni's India," 1910, Vol. II, pp. 197 and 198). This similar mistake further proves that the author of Ghurrat-Uz-Ziaj is no other person than Beruni (vide "Alberuni's India," 1910.

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Vol. II, p. 200). He thinks that like Amavasya begins just a the conjunction of the Sun and the Moon and lasts till the Moon reaches ahead of the Sun, but actually Amavasya is quite different from Amavasya; it actually begins when the Moon is 12° behind the Sun and ends when conjunction takes place; in fact it is the last tithi of Ananta AHAYI and the 15th tithi of Purnima lunar month. Due to his wrong assumption Beruni has given a wrong method to find out the Karana in a month, but have made necessary amendments in this article to give the correct method; the additional sentences and phrases are given by me within brackets. The following changes have been made in the manuscript.

Original in Manuscript Changed after correction

Original in Manuscript Changed after correction

(b) Translation of the Technical Terms:—

KARANA:— It is the original Sanskrit term and Beruni has used same term كن in his Arabic translation; its plural form as used by Beruni كرات. A karana is equal to half of a tithi so that in each tithi there are two karanas. The word "karana" has another meaning also which already been explained in the commentary of article 1, chapter I. J. sthira karanas Beruni has used the term كرات ثابتة which and for chara karana he has used the term كرات المتحركة; sthira means "fixed" and chara means "mobile."

(c) Elaboration of the Principle:—

A karana is equal to the duration of time taken by the Moon to advance 6' or 360' from the Sun. Therefore, if we divide the distance of the Moon from the Sun in minutes by 360, the quotient will represent the past karana of Shukla Pratipada. More technically, a karana is equal to half the duration of a tithi; there is a slight difference between half the duration of a tithi...
the duration taken by the Moon to advance 6° from the Sun, but this slight difference is usually ignored for practical purposes. In the first half of shukla Pratipada there is always the sthira Karana Kinstughna. Therefore, if we deduct “1” from the above-mentioned quotient, we get the total number of chara karanas beginning from Bava and progressing serially up to Vishiti; after Vishiti we have Bava and the same order is repeated again and again till in 8 rounds 56 Chara Karanas pass up to the first half of Krishna Chaturdashi. Then the sthira karanas begin and in the second half of the same Chaturdashi we have Shakuni Karana, in the first half of the next tithi Amavasya we have Chatuspada Karana, in the second half of Amavasya we have Naga Karana, and in the first half of the next tithi Shukla Pratipada we have Kinstughna Karana again.

As will be seen from the above description, the calculation of tithi and karana is so complicated that Beruni appears to have been confused in describing the method of finding out the karana in a month. Even Dr. Gorakh Prasad of Allahabad University seems to have a very vague idea of karana when he gives a general rule that “The first half of Pratipada is named as Balaua, the second half is named as Kaulava.” (vide, his Hindi book Bharatiya Jyotisha ka Itkhasa, chapter 18, page 266). This statement of Dr. Gorakh Prasad is true only for the Pratipada of Krishna Paksha and not for Shukla Paksha, because the first half of Shukla Pratipada is known as Kinstughna and its second half is known as Bava. So, when the eminent Hindu scholars of today are confused in karanas, we should forgive Beruni for his confusion in this matter. Perhaps due to similar erroneous statements of Hindu scholars of his time, Beruni could not understand clearly the difference between the Amanuta and Purnimanta systems of lunar months, as is evident from his Indica, especially from the description of months and festivals in chapters 35, and 76.

An important point to note here is that Beruni has assumed the duration of a tithi to be always equal to 60 ghatis approximately, but in actual fact the average duration of a tithi is 57 ghatis 38 palas; it can be a bit more or a bit less depending on the difference of the true daily motions of the Moon and the Sun. The correct duration of a tithi can be found out in ghatis if we divide 2592000° by the difference of the true daily motions of the Moon and the Sun in seconds. This correct value should be used and not 60 ghatis, as suggested by Beruni; I have corrected the manuscript accordingly, because I am sure that in the original Sanskrit book the same method must have been given which is also given by Beruni in his Indica (vide “Alberuni’s India,” 1910, Vol. II, page 195). In the solved example given by Beruni the difference of true daily motions of the Moon and the Sun should be taken as 13° 19' 36” so that if we divide 2592000° by 47976°, we get 54 ghatis 2 palas which is the total duration of the current tithi. If we deduct 54 ghatis 2 palas from 64 ghatis 14 palas (which is double the past duration of the current tithi), we get 10 ghatis 12 palas; half of it is 5 ghatis 6 palas which is the correct time that has elapsed since the beginning of the current karana (and NOT 4 ghatis 55 palas as roughly calculated by Beruni).

IV

Relating to the Mean Places of the Planets

1. To Find the Mean Place of Mars:

Add 218\frac{1}{2} to the Ahargana and divide the sum by 687, then the quotient will represent the number of revolutions which we do not require; for remainder find out signs, etc., according to the method already described to keep the result in memory. Now consider the ahargana again and divide by 8719, then the quotient will be minutes and will be added to the kept in memory; deduct 24 minutes from this sum, then the remainder will be the mean place of Mars (for the midnight which follows the in question).

Example:- We added 218\frac{1}{2} to the Ahargana getting 21832\frac{1}{2}; divide it by 687 getting the quotient 31 revolutions which were ignored; from remainder we obtained 95° 10’ 36’ 41” which we kept in memory. No divided the Ahargana by 8719 getting the quotient 2 min. 29 sec. which added to the result already kept in memory getting 95° 10’ 39’ 10”; if we deducted 24 min. getting the remainder 95° 39’ 40’ which is the place of Mars (for the midnight which follows the day in question).

Commentary

(a) Correction of the Manuscript:-

In this article only one minor correction is made and that is that I written 8719 instead of 8718; this error of the manuscript seems to be the mistake of the original Sanskrit scribe.

(b) Translation of Technical Terms:-

It has already been explained in the past.

(c) Elaboration of the Principle:-

The formula for calculating the mean place of Mars as given in article is shown below where “A” stands for Ahargana:

\[ \frac{A + 218\frac{1}{2}}{687} \text{ rev.}\ + \frac{A}{8719} \text{ min.}\ = 2\frac{1}{2} \text{ min.} \]

The general form of this formula is given below, where X, Y, Z and I constants:

\[ \frac{A+Z}{X} \text{ rev.}\ + \frac{A}{Y} \text{ min.}\ = D \text{ min.} \]

If we ignore the kshepakas Z and D, and put A equal to 157797828, w the revolutions in a Chaturyuga or a Mahayuga; now we will see how
formula has been derived by the author of Karana Tilaka:
\[
\frac{1577917828}{687} \text{ rev.} + \frac{1577917828}{8719 \times 21600} \text{ rev.}
= 2296832.621 \text{ rev.} + 8.379 \text{ rev.} = 2296832 \text{ rev.}
\]
It shows that the number of revolutions of Mars in a Chaturyuga as adopted in Karana Tilaka are exactly in accordance with Surya Siddhanta (vide chapter I, sloka 30). Now, the motion of the mean place of Mars in one day is 2296832\(\frac{\text{rev.}}{1577917828}\). If we select the numerator of a simplified fraction as "1", we can find out its denominator "X" in the following way:
\[
\frac{1}{X} = \frac{2296832}{1577917828}, \text{ or } X = \frac{1577917828}{2296832} = 686 \times \frac{2291076}{2296832},
\]
the fraction being equal to more than half can be taken as "1" so that X = 686. In order to compensate for this approximation error we can have another fraction giving the result in minutes and having its numerator "1"; then its denominator Y can be found out in the following way:
\[
\frac{1}{21600} \text{Y} = \frac{2296832}{1577917828} \text{ rev.} - \frac{1}{687} \text{ rev.} = \frac{5756}{1084.029547836} \text{ rev.}
\]
or Y = \frac{1084029547836}{124095636} = 8718 \times 124329600
\]
the fraction being more than half can be taken as "1" so that Y = 8719. Beruni has given 8718 instead of 8719 but I have corrected this figure in the manuscript accordingly.

Now to find out the kshepakas Z and D, we calculate the mean place of Mars in the beginning of 888 Shakakala as follows:
\[
\frac{148550 \times 2296832}{1577917828} \text{ rev.} = 2162 \times \frac{50166688}{1577917828} \text{ rev.}
\]
Ignoring the complete revolutions we have an incomplete revolution in the beginning of 888 Shakakala, and in order to incorporate this partial revolution we can find out the kshepaka Z so that,
\[
Z = \frac{50166688}{687}, \text{ or } Z = \frac{687 \times 50166688}{1577917828} = 2184 - \frac{127969762}{1577917828}
\]
So if we take Z = 2184, we should deduct the following figure from the result in order to compensate for the negative fraction, and call this value D, so that,
\[
D = \frac{127969762}{1577917828 \times 687} \text{ rev.} = \frac{127969762 \times 21600}{1577917828 \times 687} \text{ min.}
\]

2. To Find the Sheeghrochcha of Mercury:

Multiply the Ahargana by 9000 and from the product deduct 33626; divide the remainder by 791727, then the quotient will be the revolution which we do not require from the remainder find out the signs, etc., and keep the result in memory. Now divide the Ahargana by 10000, then the quotient will be minutes, etc., deduct it from the result kept in memory, then the remainder will be the sheeghrochcha of Mercury (for the midnight which follows the day in question).

Example:—We multiplied the ahargana by 9000 getting the product 104556000; from it we deducted 336262 getting the remainder 9418973 which we divided by 791727 getting the quotient 245 revolutions which we ignored; from the remainder we obtained 35° 8' 29'' 56″, which we kept in memory. Now we divided the Ahargana by 10000 getting the quotient 2' 9'' which we deducted from the result kept in memory getting the remainder 35° 8' 27'' 47', which is the sheeghrochcha of Mercury (for the midnight which follows the day in question).

Commentary

(a) Correction of the Manuscript:—

No correction of the manuscript is required except a slip of the pen in the Arabic scribe which has been corrected by me and I have changed the original figure א""א... to read א""א... which is the correct figure. In the solved example a missing phrase has been inserted by me with brackets.

(b) Translation of the Technical Terms:—

Sheeghrochcha of Mercury:—This term can also be written Budha-sheeghrochcha or simply Budchochcha just like Chandrochcha, but
have preferred to write it as sheehrochcha of Mercury; Beruni has used the term سرعة عقرب for the original Sanskrit term Budha-sheehrochcha.

(c) **Elaboration of the Principle:**

The formula for calculating the sheehrochcha of Mercury as given in this article is shown below where A stands for Ahargana:

\[
\frac{9000 A - 336262}{791727} \quad \text{rev.} = \frac{A}{10060} \quad \text{min.}
\]

The general form of this formula can be taken as follows where X, Y and Z are constants:

\[
\frac{9000 A - Z}{X} \quad \text{rev.} = \frac{A}{Y} \quad \text{min.}
\]

Now we will see how this formula has been derived by the author of Karana Tilaka. If we ignore the kshepaka Z and put A equal to 1577917828, we get the revolutions in a Chaturyuga or Mahayuga,

\[
\frac{9000 \times 1577917828}{791727} \quad \text{rev.} = \frac{1577917828}{10060} = 17937060 \quad \text{rev.}
\]

This value exactly tallies with the value given in Surya Siddhanta (vide., chapter I, soka 31).

Now the mean daily motion of the sheehrochcha of Mercury is 17937060 rev., and if we select a numerator 9000 for a simplified fraction, we can find out its denominator X in the following way,

\[
X = \frac{17937060}{9000} = 19749380 \quad \text{or} \quad X = \frac{17937060 - 9000}{17937060} = 0.9749380
\]

The fraction being less than half is ignored so that we have \( X = 1793727 \). But to compensate for the above error of approximation we can find out another fraction giving the result in minutes and having its numerator as 1; then its denominator Y can be found out in the following way:

\[
1 \times 9000 = 17937060 \quad \text{or} \quad Y = \frac{17937060 - 9000}{17937060} = 0.5749380 \times 21600 = 1249280148208956
\]

or Y = 1249280148208956

\[\frac{5749380 \times 21600}{10059} = 8705336956\]

The fraction being more than half is taken as 1, so that Y = 10060. Now to find out the kshepaka Z we calculate the sheehrochcha of Mercury in the beginning of 888 Shakkala as follows:

\[
\frac{148507 \times 17937060}{1577917828} \quad \text{rev.} = 16886 \quad \frac{90745812}{1577917828} \quad \text{rev.} = 16887 \quad \text{rev.}
\]

\[
\frac{670172016}{1577917828} \quad \text{rev.}
\]

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**GHURRAT-UZZIJAT OR KARANA TILAKA**

The negative fraction shows the value of the sheehrochcha of Mercury the beginning of 888 Shakkala. Therefore the value of Z can be found as follows:

\[
Z = \frac{670172016}{1577917828} \quad \text{or} \quad Z = \frac{791727 \times 670172016}{1577917828} = 336261 \quad \frac{1052950524}{1577917828}
\]

The fraction being more than half is taken as 1, so that \( Z = 3362 \) (negative). If we want to have a positive value of Z, we can use the figure (791727 - 3362) = 455465; but the author of Karana Tilaka has used the negative kshepaka, because it is smaller than the positive one and is easier for calculations. In the solved example we have calculated the sheehrochcha of Mercury as 3 S 8' 27" 47"; if we calculate the same directly by the method of Surya Siddhanta, we get a bit more accurate value 3 S 8' 27" 49".

3. **To Find the Mean Place of Jupiter:**

Multiply the Ahargana by 100 and from the product deduct 47898; divide the remainder by 43392, then the quotient will be the complete revolution which we do not require; from the remainder find out signs, etc., and keep the result in memory. Now, divide the Ahargana by 22200, then the quotient will be seconds which is to be deducted from the result kept in memory; the remainder will be the mean place of Jupiter (for the midnight which follows the day in question).

**Example:** We multiplied the Ahargana by 100 getting the product 2164160 from it we deducted 47898 getting the remainder 2113052; divided it by 43392 getting the quotient 4 revolutions which were ignored; from the remainder we got 10S 16' 14" 35" which we kept in memory. Now we divided the Ahargana by 22200 getting the quotient 1; deducted it from the result kept in memory getting the remainder 10 S 16' 14" 34"; this is the mean place of Jupiter (for the midnight which follows the day in question).

**Commentary**

(a) **Correction of the Manuscript:**

I have made one major correction in the text of this article and have changed the figure 703 to read as 730 which is the correct value; I have also changed the figure 1867 to read as 1887 which is the correct value. Due to these two changes the figures of the solved example have also been changed as shown in the following table. The justification of these corrections will be given afterwards.

<table>
<thead>
<tr>
<th>Original in Manuscript</th>
<th>Changed after correction</th>
<th>Original in Manuscript</th>
<th>Changed after correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>47898</td>
<td>47898</td>
<td>336261</td>
<td>336261</td>
</tr>
<tr>
<td>455465</td>
<td>455465</td>
<td>1052950524</td>
<td>1052950524</td>
</tr>
<tr>
<td>3 S 8' 27&quot; 47&quot;</td>
<td>3 S 8' 27&quot; 49&quot;</td>
<td>3 S 8' 27&quot; 49&quot;</td>
<td>3 S 8' 27&quot; 49&quot;</td>
</tr>
</tbody>
</table>

I have also made one correction in the text of this article and have changed the figure 791727 to read as 791727 which is the correct value. Due to these two changes the figures of the solved example have also been changed as shown in the following table. The justification of these corrections will be given afterwards.
which is absurd, because we should always have "complete" revolutions in Chaturyuga; moreover, these complete revolutions should also be divisible by 4.

Now to find out the kshetrapaka Z we calculate the mean place of Jupiter in the beginning of 888 Shakkaka as follows:

\[
\frac{1485507 \times 364220}{1577917828} \quad \text{rev.} = 342 \quad \frac{1403462344}{1577917828} \quad \text{rev.} = 343 \quad \frac{174455464}{1577917828} \quad \text{rev.} = 344 \quad \frac{1577917828}{1577917828} \quad \text{rev.} = 345
\]

The negative fraction shows the value of the mean place of Jupiter in the beginning of 888 Shakkaka and the corresponding value of Z can be found out as follows:

\[
Z = \frac{174455464}{1577917828} \quad \text{or } Z = \frac{433232 \times 174455464}{1577917828} = 47898 \quad \frac{581454104}{1577917828}
\]

The fraction being less than half is ignored so that we have \( Z = 47898 \); b) Beruni has given this value as 47897 which is incorrect and I have corrected it now; the reason for this mistake is not understood clearly. We have just seen that the figure 2207 given by Beruni is wrong; another proof of it is that if we assume 2207 to be correct, the revolutions in Chaturyuga come to be 362410.5031067, and the corresponding value of Z comes to 48101, instead of 47898. In the solved example we have calculated the mean place of Jupiter as 10s 16° 14’ 34”; if we calculate the same directly by the method of Surya Siddhanta, we get a bit more accurate value 10s 16° 14’ 32’.

4. To Find the Sheekhrochcha of Venus:

Multiply the Ahargana by 600 and to the product add 14862; divide the sum by 134819, then the quotient will be revolutions which we require; from the remainder find out signs, etc., and keep the result in memory. Now divide the Ahargana by 9980, then the quotient will be minutes, which is to be deducted from the result kept in memory; the remainder is the mean place of Jupiter (for the midnight which follows the day in question).

Example:— We multiplied the Ahargana by 600 getting the product 12968400; to it we added 14862 getting 12983262 which we divided by 1348 getting the quotient 96 revolutions which we do not require; from the remainder we got 3S 18° 30’ 49” which we kept in memory; then we divided the Ahargana by 9980 getting the quotient 2’ 10” which we deducted from the result kept in memory getting the remainder 3S 18° 28’ 39” which is the Sheekhrochcha of Venus (for midnight which follows the day in question).

Commentary

(a) Correction of the Manuscript:—
No correction is required in this Article.

(b) Translation of the Technical terms:—
Sheekhrochcha of Venus— This term can also be written as Shukr
sheghrochcha or simply Shukrochcha, but I have preferred to write it as sheghrochcha of Venus; Beruni has used the term سرقة الزهرة for the original Sanskrit term Shukra-sheghrochcha.

(c) **Elaboration of the Principle:**

The formula for calculating the sheghrochcha of Venus as given in this Article is shown below where $A$ stands for Ahargana:

$$
\frac{600A + 14862}{134819} \text{ rev.} - \frac{A}{9000} \text{ min.}
$$

The general form of this formula can be taken as follows where $X$, $Y$, and $Z$ are constants:

$$
\frac{600A + Z}{X} \text{ rev.} - \frac{A}{Y} \text{ min.}
$$

Now we will see how this formula has been derived by the author of “Karana Tilaka.” If we ignore the Isekapaka $Z$ and put $A$ equal to $157791782$, we get the revolutions in a Chaturyuga or a Mahayuga,

$$
\frac{600 \times 157791782}{134819} \text{ rev.} - \frac{157791782}{9980 \times 21600} \text{ rev.} = \frac{7022376}{157791782} \text{ rev.}
$$

This value exactly tallies with the value given in Surya Siddhanta (vide, Chapter I, sloka 32).

Now the daily mean motion of sheghrochcha of Venus is $\frac{7022376}{157791782} \text{ rev.}$, and if we select a numerator $600$ for a simplified fraction, we can find out its denominator $X$ in the following way:

$$
X = \frac{7022376}{157791782} \times 600 = \frac{134819}{96856}
$$

The fraction being less than half is ignored so that we have $X = 134819$. But to compensate for the above error of approximation we can find out another fraction giving the result in minutes and having its numerator as $1$; then its denominator $Y$ can be found out as follows:

$$
Y = \frac{1}{21600} \times \frac{600}{157791782} = \frac{21273303663132}{96856}
$$

The fraction being more than half may be taken as $1$, so that $Y = 9980$. Now to find out the Isekapaka $Z$ we calculate the sheghrochcha of Venus in the beginning of 888 Shakkakala as follows,

$$
\frac{1485507 \times 7022376}{157791782} \text{ rev.} = 6611 \frac{173943274}{157791782} \text{ rev.}
$$

The fraction shows the value of the sheghrochcha of Venus in the beginning of 888 Shakkakala. Therefore the value of $Z$ can be found out as follows:

$$
Z = \frac{173943274}{157791782}, \text{ or } Z = \frac{134819 \times 173943274}{157791782} = \frac{1482084048}{157791782}
$$

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**GHURRAT-UZ-ZIJAT OR KARANA TILAKA**

The fraction being more than half is taken as $1$, so that we have $Z = 14861$

In the solved example we have calculated the sheghrochcha of Venus as $3S 18^\circ 28' 30''$; if we calculate the same directly by the method of Surya Siddhanta, we get a bit more accurate value $3S 18^\circ 28' 38''$.

5. **To Find the Mean Place of Saturn:**

Multiply the Ahargana by $4$ and from the product deduct $678$; divid the remainder by $43063$, then the quotient will be the revolutions which we do not require; from the remainder find out signs, etc., and keep the result in memory. Now divide the Ahargana by $3876$, then the quotient will be seconds; deduct it from the result kept in memory, then the remainder will be the mean place of Saturn (for the midnight which follows the day in question).

**Example** – We multiplied the Ahargana by $4$ getting $86456$; from we deducted $678$ getting $85778$; divided it by $43063$ getting the quotient $1$ revolution which we ignored; from the remainder we got $11S 27^\circ 5'$; which were kept in memory. Now we divided the Ahargana by $3876$ getting the quotient $6$ which we deducted from the result kept in memory getting the remainder $11S 27^\circ 5'$, which is the mean place of the Saturn (for the midnight which follows the day in question).

**Commentary**

(a) **Correction of the Manuscript:**

In the text of this article only two main corrections are made by me.

I have corrected the figure $7684$ to read as $6784$, and the figure $3879$ to read as $3876$. This error appears either due to the mistake of the original Sanskrit scribe or due to some misunderstanding on the part of Beruni. The figure of the solved example have also been corrected by me as follows:

Original in manuscript | Changed in manuscript | Original in manuscript | Changed in manuscript
--- | --- | --- | ---
7684 | 6784 | 3879 | 3876

(b) **Translation of the Technical Terms:**

No new terms have been translated in this article.

(c) **Elaboration of the Principle:**

The formula for calculating the mean place of Saturn as given in this article is shown below where $A$ stands for Ahargana,

$$
\frac{4A-6784}{43063} \text{ rev.} = \frac{A}{3879} \text{ sec.}
$$
The general form of this formula can be taken as follows where \( X \), \( Y \) and \( Z \) are constants,

\[
\frac{4A - Z}{X} \text{ rev.} - \frac{A}{Y} \text{ sec.}
\]

Now we will see how this formula has been derived by the author of “Karana Tilaka.” If we ignore the kshpaka \( Z \) and put \( A \) equal to 1577917828, we get the revolutions in a Chaturyuga or Mahayuga,

\[
\frac{4 \times 1577917828}{43063} \text{ rev.} - \frac{1577917828}{3879 \times 1296000} \text{ sec.} = 146568 \text{ rev.}
\]

This value exactly tallies with the value given in Surya Siddhanta (vide chapter I, sloka 32).

Now the mean daily motion of the Saturn is 146568 \( \frac{\text{rev.}}{\text{day}} \) and if we select a numerator 4 for a simplified fraction, we can find out its denominator \( X \) in the following way:

\[
\frac{4}{146568} = \frac{3879}{1296000} , \text{ or } X = \frac{4 \times 1577917828}{3879} = 43063 \frac{13528}{146568}
\]

The fraction being less than half is ignored, so that we have \( X = 43063 \). But to compensate for the above error of approximation we can find out another fraction giving the result in seconds and having its numerator as 1; then its denominator \( Y \) can be found out in the following way:

\[
\frac{1}{1296000} = \frac{43063}{146568} , \text{ or } Y = \frac{67949875427164}{1296000 \times 13528} = 3875 \frac{12259427164}{1753228800}
\]

The fraction being more than half can be taken as \( I \), so that we have \( Y = 3875 \). Beruni has given this value as 3879 due to some misunderstanding, and now I have corrected this figure to read as 3876.

Now to find out the kshpaka \( Z \) we calculate the mean place of the Saturn in the beginning of 888 Shakakala as follows:

\[
\frac{1485507 \times 146568}{1577917828} = 137 \frac{1553047504}{1577917828} = 138 - 24870288 \]

The negative fraction shows the value of the mean place of Saturn in the beginning of 888 Shahakala. Therefore the value of \( Z \) can be found out as follows:

\[
\frac{43063}{1577917828} , \text{ or } Z = \frac{43068 \times 24870288}{1577917828} = 678 \frac{1160924760}{1577917828}
\]

The fraction being more than half could have been taken as \( I \), but due to the small denominator 43063, the author of “Karana Tilaka” has taken a more accurate value of this fraction as,

\[
\frac{1}{1 + \frac{1}{2 + \ldots}}
\]

so that we have \( Z = 678 \frac{1}{4} \); the error due to this approximation is plus 2’ as Beruni has given this value as 768, which is clearly an error of interchange of two digits 6 and 7.

In the solved example we have calculated the mean place of the Satu as 11S 27° 5’ 1”; if we calculate the same directly by the method of Sur Siddhanta, we get a slightly more accurate value 11S 27° 4’ 59”.

(N.B.) The readers will note that the mean places of all the planets (except Chandrochha and Rahu) as calculated by the method of Karana Tila are approximately the same as calculated directly by the method of Sur Siddhanta; therefore we can definitely say that “Karana Tilaka” is based on Surya Siddhanta. There is a slight doubt in the case of the Moon, because the kshpaka \( i.e. 180 \) given in the original manuscript differs from the correct kshpaka \( i.e. \frac{17}{12} \) calculated in accordance with Surya Siddhanta; the difference between these two kshpakas is equal to 37 sec. approx., as already explained in the commentary of article 2, chapter II. Although I have corrected the kshpaka given in the original manuscript, yet there can be a remote possibility that the author of “Karana Tilaka” might have introduced a very small “beeja” (i.e. correction) equal to minus 37 sec. based on personal observations. Ganesh Devagya, the author of “Graha Laghava” has also mentioned a similar “beeja” for the Moon equal to minus 9 min. 1442 Shakakala (vide “Graha Laghava,” chapter I, sloka 16). Such correction however, have no bearing on the basic principles of a karana book.

In the beginning of the 16th century A.D. the planetary revolutions in Chaturyuga were further modified by the author of Makaranda Sarani. For example, the revolutions of Chandrochha and Rahu, according to Old Surya Siddhanta as well as Khandakhadyaka, are 488219 and 232226, respectively according to modern Surya Siddhanta, these are 488203 and 232238, respectively, according to Karana Tilaka, these are 488211 and 232234, respectively and according to Makaranda Sarani, these are 488193 and 232242, respectively. The following table will give an idea of similar modifications according to five different authorities:

<table>
<thead>
<tr>
<th>Planets</th>
<th>Old Suryasiddhanta and Khandakhadyaka</th>
<th>Modern Surya-Siddhanta of Karana Tilaka</th>
<th>Makaranda Sarani</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td>4320000</td>
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<td>4320000</td>
</tr>
<tr>
<td>Moon</td>
<td>57753336</td>
<td>57753336</td>
<td>57753336</td>
</tr>
<tr>
<td>Mars</td>
<td>2296824</td>
<td>2296832</td>
<td>2296832</td>
</tr>
<tr>
<td>Sheehrochha</td>
<td>17937000</td>
<td>17937060</td>
<td>17937044</td>
</tr>
<tr>
<td>of Mercury</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jupiter</td>
<td>364220</td>
<td>364220</td>
<td>364212</td>
</tr>
</tbody>
</table>

“Revolution in a Chaturyuga”
(3) معرفة أمزاج القمر:

أجل بعد مقوم القمر في أول الجزء، كل دقيق وقعته على 70. في إخراج أمزاج تامة قعود
قمام الأيام وما في فضرة فيه 0. واتمشى على مقوم القمر في إخراج ما مقعد من يوم ذلك
الليل كله مدة كأن القمر في مقره النهاري.

مثال:

أن مقوم القمر يتأهب نتيجة يكون دقيقاً، أن ينب في مقعده على 70. في إخراج
من الجزء الثالث 0. ويتم فيه إخراج ليلة منها، وهي دقيق ما مقعد من النهار.
فإن للذين مر 70. في نقاطه، في 0. واتمشى على مقام القمر في إخراج ما
هذا الكمية من الليل كأن القمر في مقره النهاري.

(4) معرفة السماوات من الجوانب:

إجمال جميع مقومات الدين كاملة مختلفاً ونظامها على 70. في إخراج ما مقعد من السماوات
وهي نوبة الروحاني من الدين وما في فضرة فيه 0. واتمشى على مجموع بقيق
من مقاعدين في رؤية السماوات من الجوانب.

مثال:

أن مقوم الدين مرتين في دائرة واحدة، ثم ينب في مقعده على 70. في إخراج ما
من السماوات، ويتم فيه إخراج ليلة منها، وهو دقيق ما في بقيق من السماوات.
فإن للذين مر 70. في نقاطه، في 0. واتمشى على مقام القمر في إخراج ما
هذا الكمية من الليل كأن القمر في مقره النهاري.

(5) معرفة الكواكب في السماء:

أن مدة يوم القمر من شهر:

نص وضع الكواكب في السماء لم يقف في 0. في إخراج ما مقعد من السماء، ويرجى لم مشاق
مقدم السماء من إخلال كل ما فيه دقيق واقعها على 0. في إخراج الأضواء المتبعة في السماء.
ومن ذلك من ذلك الإخراج وما في فضرة فيه 0. واتمشى على مقام القمر في إخراج ما
هذا الكمية من الليل كأن القمر في مقره النهاري.

ملاحظات:

1- ان مقوم القمر 70.2376
2- ان مقام الشمس 70.2238
3- ان مقام الزهرة 0.1666
4- ان مقام المشتري 0.1666
5- ان مقام فيυ 70.2238
6- ان مقام فيυ 70.2238
7- ان مقام ما 70.2238
8- ان مقام حور 0.1666
9- ان مقام أسبايب 0.1666
10- ان مقام القمر 70.2238

ويمكن للذين مر 0. في نقاطه، في 0. واتمشى على مقام القمر في إخراج ما
هذا الكمية من الليل كأن القمر في مقره النهاري.
الباب الرابع

في استخراج أوسط الكواكب الخمسة

معركة استخراج وسط المرخ:

ورد على الأصل 386، ونصف اسم البلغ 386، في حجة إدوارد لاUnchecked إليها واستخراج وج ونهاية نافذة كأقدم ذكره واحتفظها تم بعد الأصل نافذة 386، في حجة داقيقها، و على ما حذفت تم استخراج من الجلدة دقيقها ونصف في وسط المرخ (لصف الجلدة النهار الصوب).

مثال زمالة، ونصف فصايل 3823 ونصف قبضة على 387، في حجة. ورار اللانف، وما أي طريقة تمه أن تم فلما الأصل على 386، في حجة قد حسب كله اه مرفوعة نصف ظهرية لذات نصف دقيقها ونصف في وسط بيفي لونه ذلك.

طق المرخ (لصف الجلدة بعد النهار الصوب).

(3) معركة استخراج سرعة عطارد:

أضرب الأصل في 387، ونصف اسم البلغ 387، واسم البلد بالبلد 976، في نصف الياء استخراج البروج ومالا يد ما أي في واحتفظها تم الأصل على 386، في حجة كنوا لتم دقيقها و ogłو ونهاية مرفوعة نصف ظهرية لذات نصف دقيقها ونصف في وسط بيفي لونه ذلك.

مثال زمالة، ونصف فصايل 3823 ونصف قبضة على 387، في حجة. ورار اللانف، وما أي طريقة تمه أن تم فلما الأصل على 386، في حجة قد حسب كله اه مرفوعة نصف ظهرية لذات نصف دقيقها ونصف في وسط بيفي لونه ذلك.

(3) معركة استخراج وسط المشتر: 

أضرب الأصل في 386، ونصف اسم بلغ 386، واسم البلد بالبلد 976، في حجة إدوارد.
ملاحظات:

(1) معرفة استخراج سرعة الزهرة:

أضرب الأصل في ٠٠ وزدعلمااجتمع١٤٨٩٢٠ واقمه على ١٣٤٥٨١٩ فيخرج إدوار
من واشتهر البروج وما يلوه ما يبيت واحتفظاً ثم أقسم الأصل على ١٤٨٩٢٠ فيخرج ذائك
وما بدنهما فاقسمهما ثم عدك أي زهرة (نصف الليل الذي بعد الظهر الصباح).

مثال: الأضنة الأصل في ٠٠ فصار ١٤٨٩٤٢٠ وزدعت عليه ١٤٨٩٢٠ ١٠ قسمه على ١٤٨٩٢٠ تخرج الإدوار الطروحة ٩٠ (والمدفوع ج. ي. لي) مثلي ج. ي. فقسنا الأصل
على ١٤٨٩٢٠ تخرج ها ها ب. ي. فقسنا من المدفوعين ج. ي. ج. ك. لثبي وذاك سرعة الزهرة
(نصف الليل الذي بعد الظهر الصباح).

(2) معرفة استخراج وسط زحل:

أضرب الأصل في ٠٠ وزدعلمااجتمع١٤٧٨٥٢٠ وقمه ما يبيت على ١٣٤٥٨٠٠ فيخرج إدوار
من واشتهر البروج وما يلوه من البق واحتفظاً ثم أقسم الأصل على ١٣٤٥٨٠٠ فيخرج توافي
ينقسموا ثم عي. أي وسط زحل (نصف الليل الذي بعد الظهر الصباح).

مثال: ما ضرعتنا الأصل في ٠٠ فصار ١٤٨٥٨٠٠ وزدعت عليه ١٣٤٥٨٠٠ فقسناه
على ١٣٤٥٨٠٠ تخرج دو. وا. وما يبي ك. ر. نه حفظاً فقسنا الأصل على ١٣٤٥٨٠٠ تخرج ها ها
ويه فقسناه حفظاً فبي. ك. ر. نه وذاك وسط زحل (نصف الليل الذي بعد الظهر الصباح).

(3) معرفة استخراج سرعة الغروب:

أضرب الأصل في ٠٠ وزدعلمااجتمع١٤٨٩٣٢٠ واقمه على ١٣٤٥٨١٩ فيخرج إدوار
من واشتهر البروج وما يلوه ما يبيت واحتفظاً ثم أقسم الأصل على ١٣٤٥٨١٩ فيخرج ذائك
وما بدنهما فاقسمهما ثم عدك أي زهرة (نصف الليل الذي بعد الظهر الصباح).

مثال: الأضنة الأصل في ٠٠ فصار ١٤٨٩٣٢٠ وزدعت عليه ١٤٨٩٣٢٠ ١٠ قسمه على ١٤٨٩٣٢٠ تخرج الإدوار الطروحة ٩٠ (والمدفوع ج. ي. لي) مثلي ج. ي. فقسنا الأصل
على ١٤٨٩٣٢٠ تخرج ها ها ب. ي. فقسنا من المدفوعين ج. ي. ج. ك. لثبي وذاك سرعة الزهرة
(نصف الليل الذي بعد الظهر الصباح).

(4) معرفة الدوام:

أضرب الأصل في ٠٠ وزدعلمااجتمع١٤٨٩٣٢٠ واقمه على ١٣٤٥٨١٩ فيخرج إدوار
من واشتهر البروج وما يلوه ما يبيت واحتفظاً ثم أقسم الأصل على ١٣٤٥٨١٩ فيخرج ذائك
وما بدنهما فاقسمهما ثم عدك أي زهرة (نصف الليل الذي بعد الظهر الصباح).

مثال: الأضنة الأصل في ٠٠ فصار ١٤٨٩٣٢٠ وزدعت عليه ١٤٨٩٣٢٠ ١٠ قسمه على ١٤٨٩٣٢٠ تخرج الإدوار الطروحة ٩٠ (والمدفوع ج. ي. لي) مثلي ج. ي. فقسنا الأصل
على ١٤٨٩٣٢٠ تخرج ها ها ب. ي. فقسنا من المدفوعين ج. ي. ج. ك. لثبي وذاك سرعة الزهرة
(نصف الليل الذي بعد الظهر الصباح).

(5) معرفة الدوام:

أضرب الأصل في ٠٠ وزدعلمااجتمع١٤٨٩٣٢٠ واقمه على ١٣٤٥٨١٩ فيخرج إدوار
من واشتهر البروج وما يلوه ما يبيت واحتفظاً ثم أقسم الأصل على ١٣٤٥٨١٩ فيخرج ذائي
ويه حفظاً فبي. ك. ر. نه وذاك وسط زحل (نصف الليل الذي بعد الظهر الصباح).

مثال: ما ضرعتنا الأصل في ٠٠ فصار ١٤٨٥٨٠٠ وزدعت عليه ١٣٤٥٨٠٠ فقسناه
على ١٣٤٥٨٠٠ تخرج دو. وا. وما يبي ك. ر. نه حفظاً فقسنا الأصل على ١٣٤٥٨٠٠ تخرج ها ها
ويه فقسناه حفظاً فبي. ك. ر. نه وذاك وسط زحل (نصف الليل الذي بعد الظهر الصباح).