L2/07-414

Proposal to Encode Siyaq Numerals in ISO/IEC 10646

Anshuman Pandey
University of Michigan
Ann Arbor, Michigan, U.S.A.
pandey@umich.edu

December 4, 2007

Contents

Proposal Summary Form **i**

1 Introduction **1**

2 Script Attributes **2**

3 Description of the Numerals **8**
3.1 The Primary Unit . . . 8
3.2 The Tens Unit . . . 11
3.3 The Hundreds Unit . . . 12
3.4 The Thousands Unit . . . 13
3.5 The Ten Thousands Unit . . . 14
3.6 The Hundred Thousands Unit . . . 15
3.7 The Millions Unit . . . 17
3.8 Fraction and Currency Signs . . . 19
3.9 Other Signs . . . 19

4 Background **20**

5 Orthography **20**
5.1 Number System . . . 20
5.2 Ordering . . . 20
5.3 Positioning . . . 21
5.4 Shaping . . . 21

6 Technical Features **21**
6.1 Encoding Model . . . 21
6.2 Ordering . . . 24

7 References **25**

List of Figures

1 Tables showing the evolution of Siyaq forms from the original Arabic words 26
2 Table showing Siyaq forms as used in South Asia (from Platts, 1909: 60). 27
3 Table showing Siyaq forms as used in South Asia (from Barker, 1967: 356–357). 28
4 (Table showing Siyaq forms as used in South Asia from Naim, 1999: 49–50). 29
5 Table showing the Diwani number forms (from Kazem-Zadeh, 1915: Plate VII). 30
6 Table showing Diwani forms of Siyaq (from Ifrah, 2000: 544). 31
7 Tables showing Siyaq forms as used in Turkey 32
8 Table showing Siyaq forms as used in Turkey (from Ifrah, 2000: 547–548). 33
9 The Arabic sources of the Urdu Siyaq forms (from Muhazzab, 195-?: 51). 34
10 Table showing Siyaq forms as used in South Asia (from *Darsi Urdu Lughat*, 2001: 718). 34
11 Table showing Siyaq forms as used in South Asia (from Dihlavi, 1974: 363). 35
12 Table showing Siyaq forms as used in Iran (from Wollaston, 1842: 435–436). 36
13 Table showing Siyaq forms as used in Iran (from Wollaston, 1842: 437). 37
14 Table showing Siyaq forms as used in Iran (from Tisdall, 1959: 220). 37
15 Table showing Siyaq forms as used in Iran (from Ifrah, 2000: 545–546). 38
16 Table showing Siyaq forms as used in South Asia (from Stewart, 1825: Plate 7). 39
17 Table showing printed Siyaq forms as used in South Asia (from Gladwin, 1790: 2–4). 40
18 Table showing method of writing fractions in South Asian tradition (from Gladwin, 1790: 5) . . 41
19 Table showing the Arabic sources of Siyaq forms (from Gladwin, 1790: 6–7). 42
20 Turkish composite numbers 43

List of Tables

1 South Asian forms of the Siyaq numerals 3
2 Persian forms of the Siyaq numerals 4
3 Turkish forms of the Siyaq numerals 5
4 Diwani forms of the Siyaq numerals 6
5 Forms of composite numbers in the four styles 7

ISO/IEC JTC 1/SC 2/WG 2
PROPOSAL SUMMARY FORM TO ACCOMPANY SUBMISSIONS
FOR ADDITIONS TO THE REPERTOIRE OF ISO/IEC 10646[1]

Please fill all the sections A, B and C below. Please read Principles and Procedures Document (P & P) from http://www.dkuug.dk/JTC1/SC2/WG2/docs/principles.html for guidelines and details before filling this form.
Please ensure you are using the latest Form from http://www.dkuug.dk/JTC1/SC2/WG2/docs/summaryform.html.
See also http://www.dkuug.dk/JTC1/SC2/WG2/docs/roadmaps.html for latest Roadmaps.

A. Administrative

1. Title: **Proposal to Encode Siyaq Numerals in ISO/IEC 10646**
2. Requester's name: **Anshuman Pandey (pandey@umich.edu)**
3. Requester type (Member Body/Liaison/Individual contribution): **Individual contribution**
4. Submission date: **December 4, 2007**
5. Requester's reference (if applicable): **N/A**
6. Choose one of the following:
   (a) This is a complete proposal: **No**
   (b) or, More information will be provided later: **Yes**

B. Technical - General

1. Choose one of the following:
   (a) This proposal is for a new script (set of characters): **Yes**
      i. Proposed name of script: **Siyaq Numerals**
   (b) The proposal is for addition of character(s) to an existing block: **No**
      i. Name of the existing block: **N/A**
2. Number of characters in proposal: **To be determined**
3. Proposed category: **B - Specialized**
4. Is a repertoire including character names provided?: **Yes**
   (a) If Yes, are the names in accordance with the "character naming guidelines" in Annex L of P&P document?: **Yes**
   (b) Are the character shapes attached in a legible form suitable for review?: **Yes**
5. Who will provide the appropriate computerized font (ordered preference: True Type, or PostScript format) for publishing the standard?: **Anshuman Pandey**; **True Type format**
   (a) If available now, identify source(s) for the font and indicate the tools used: **The letters of the digitized Siyaq Numerals font are based on normalized forms of the numerals as used in South Asia. The font was drawn by Anshuman Pandey with Metafont and converted to True Type with FontForge.**
6. References:
   (a) Are references (to other character sets, dictionaries, descriptive texts etc.) provided?: **Yes**
   (b) Are published examples of use (such as samples from newspapers, magazines, or other sources) of proposed characters attached?: **Yes**
7. Special encoding issues:
   (a) Does the proposal address other aspects of character data processing (if applicable) such as input, presentation, sorting, searching, indexing, transliteration etc. (if yes please enclose information)? **Yes; see proposal for additional details.**.
8. Additional Information: Submitters are invited to provide any additional information about Properties of the proposed Character(s) or Script that will assist in correct understanding of and correct linguistic processing of the proposed character(s) or script. Examples of such properties are: Casing information, Numeric information, Currency information, Display behaviour information such as line breaks, widths etc., Combining behaviour, Spacing behaviour, Directional behaviour, Default Collation behaviour, relevance in Mark Up contexts, Compatibility equivalence and other Unicode normalization related information. See the Unicode standard at http://www.unicode.org for such information on other scripts. Also see http://www.unicode.org/Public/UNIDATA/UCD.html and associated Unicode Technical Reports for information needed for consideration by the Unicode Technical Committee for inclusion in the Unicode Standard. **Character properties and numeric information are included.**

---

[1] Form number: N3102-F (Original 1994-10-14; Revised 1995-01, 1995-04, 1996-04, 1996-08, 1999-03, 2001-05, 2001-09, 2003-11, 2005-01, 2005-09, 2005-10, 2007-03)

C. Technical - Justification

1. Has this proposal for addition of character(s) been submitted before?: **No.**
2. Has contact been made to members of the user community (for example: National Body, user groups of the script or characters, other experts, etc.)? **Yes**
   (a) If Yes, with whom?:
      i. If Yes, available relevant documents: **N/A**
3. Information on the user community for the proposed characters (for example: size, demographics, information technology use, or publishing use) is included? **Yes**
   (a) Reference: **Specialists working with sources from Mughal India, Safavid Persian, and Ottoman Turkey.**
4. The context of use for the proposed characters (type of use; common or rare): **Common**
   (a) Reference: **Court records from Mughal and colonial India, Qajar and Safavid Persia, and Ottoman Turkey.**
5. Are the proposed characters in current use by the user community?: **The Siyaq Numerals are no longer used in South Asia, Iran, or Turkey. Specialists in South Asian, Iranian, and Turkish studies encounter the Siyaq Numerals in primary source materials.**
   (a) If Yes, where? Reference: **In the United States.**
6. After giving due considerations to the principles in the P&P document must the proposed characters be entirely in the BMP?: **No**
   (a) If Yes, is a rationale provided?: **N/A**
      i. If Yes, reference: **N/A**
7. Should the proposed characters be kept together in a contiguous range (rather than being scattered)? **Yes**
8. Can any of the proposed characters be considered a presentation form of an existing character or character sequence? **No**
   (a) If Yes, is a rationale for its inclusion provided?: **N/A**
      i. If Yes, reference: **N/A**
9. Can any of the proposed characters be encoded using a composed character sequence of either existing characters or other proposed characters? **No**
   (a) If Yes, is a rationale provided?: **N/A**
      i. If Yes, reference: **N/A**
10. Can any of the proposed character(s) be considered to be similar (in appearance or function) to an existing character? **No**
    (a) If Yes, is a rationale for its inclusion provided? **N/A**
       i. If Yes, reference: **N/A**
11. Does the proposal include use of combining characters and/or use of composite sequences? **Yes**
    (a) If Yes, is a rationale for such use provided? **Yes**
       i. If Yes, reference: **See text of proposal**
    (b) Is a list of composite sequences and their corresponding glyph images (graphic symbols) provided? **Yes**
       i. If Yes, reference: **See text of proposal**
12. Does the proposal contain characters with any special properties such as control function or similar semantics? **Yes**
    (a) If Yes, describe in detail (include attachment if necessary): **Virama**
13. Does the proposal contain any Ideographic compatibility character(s)? **No**
    (a) If Yes, is the equivalent corresponding unified ideographic character(s) identified? **N/A**
       i. If Yes, reference: **N/A**

1 Introduction

Purpose This is a proposal to encode Siyaq Numerals and other number forms associated with the Siyaq numeric notation system in the Universal Character Set (UCS) (ISO/IEC 10646).

Description The Siyaq Numerals are a specialized set of characters that supplemented the Arabic script. They originated from the practice of writing numbers using the Arabic names for numbers. The orthography changed over time by introducing abbreviations and calligraphic features in writing the names, resulting in distinct characters that are monograms of the original Arabic words. The degree of stylistic innovation masks the relationship between the Siyaq Numerals and the words from which they are derived. The numerals are not simply presentation forms of the original words; they cannot be produced from the sequences of Arabic letters used to write the words or from the standard ligatures of these letters.

The Siyaq Numerals represent numbers of the decimal system. The Siyaq system has numerals for the primary units and their magnitudes in the tens, hundreds, thousands, and higher decimal orders. Composite numbers are represented by writing the primary numerals in combination with other numerals.

The typology of Siyaq Numerals is based on a simple pattern. The forms of the primary numerals are used to produce forms of the different magnitudes of the decimal orders. The root form of the primary numeral is joined to a distinct terminal or marker that characterizes each decimal order. The general exceptions to this pattern are the forms of numerals for the magnitudes of 10 and 20, which, while also derived from the Arabic names for the respective numbers, follow a different naming convention.

The Siyaq Numerals are written right-to-left in the regular manner of the Arabic script, unlike the left-to-right directionality of the Arabic-Indic digits. The exception is composite numbers of the primary and tens units, which are transposed on account of the manner of expressing these numbers in Arabic.

The Siyaq Numerals were used in Iran, Turkey, the Arabian Peninsula, and South Asia for administration and finance. The largest number of documents containing Siyaq Numerals are accounting records in Ottoman Turkish. While several source documents containing Siyaq Numerals are extant, the numerals are no longer used. However, scholars working with such materials would benefit from the encoding of Siyaq Numerals in the UCS.

The appearance of the numerals differ slightly across the South Asian (Table 1), Persian (Table 2), Turkish (Table 3), and Diwani (Table 4) styles. But, despite the differences in graphical appearance and presentation, the typology of the numerals is fairly uniform. The principles governing Siyaq orthography in the four traditions is also quite similar. The exception is the representation of decimal orders above the hundred thousands, whose orthography is influenced by local number systems.

The Siyaq Numerals of the four traditions are typologically and semantically similar. For this reason, the forms of the numerals should be unified in the UCS.

Justification for Encoding The existence of the Siyaq Numerals as elements of a distinct numeric notation system, the existence of orthographic and presentation rules specific to the system (the behavior of the primary numerals in composite numbers), the property issues (numeric values), and the stylistic distinctions from ordinary Arabic ligatures and the original Arabic words for the numbers, constitute sufficient distinctness for the separate encoding of the Siyaq Numerals in the UCS.

2 Script Attributes

Name The name of the block is "Siyaq Numerals." The name is derived from the Arabic سِيَاقْ *siyāq*, meaning "order." The numerals and the associated numeric notation system were known in Iran as سیاق *siyāq* and in Turkey as سِيَاقَات *siyāqāt*. The system was known in South Asia as رقم *raqm*, from the Arabic "account." In the Arabian Peninsula, they were called دیوانی *dīwānī* numerals. The term *siyāq* is more widely recognized than the others. It is, therefore, recommended as the name of the block.

Classification The Siyaq numerals may be categorized as elements of a "Category B.1" (specialized) script, as per the criteria specified in ISO/IEC JTC 1/SC 2/WG 2 N3002.[1]

Allocation The Siyaq numerals are tentatively allocated in the Supplementary Multilingual Plane (SMP) (Plane 1) at the range U+10E80..U+10EFF in the block named "Persian Siyaq Numerals." Given the recommendation to unify the South Asian, Persian, Turkish, and Diwani styles, the block should be renamed "Siyaq Numerals" to establish its generic nature.

Unification The Siyaq Numerals of the four traditions are typologically and semantically similar. For this reason, the forms of the numerals should be unified in the UCS. The presentation distinctions for the four traditions should be considered a matter of font design and controlled at the font level.

Characters Proposed The number of characters required to adequately represent the numerals is dependent upon the encoding model. Depending upon the encoding model, the characters proposed could consist of the entire set of individual Siyaq Numerals for each magnitude of the primary units of each decimal order, or the characters could consist of the numerals of the primary unit and primitive marks for other units. See the discussion on the encoding model below. Since unification of the South Asian, Persian, Turkish, and Diwani forms is proposed, the forms of the Siyaq Numerals has also not been determined.

[1] International Organization for Standardization, 2005: 4.

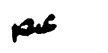
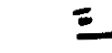
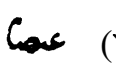
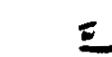
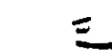
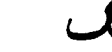
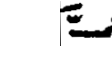
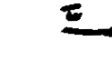
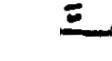
	*x*1	*x*10	*x*100	*x*1,000	*x*10,000	*x*100,000
1						
2						
3						
4						
5						
6						
7						
8						
9						

Table 1: South Asian forms of the Siyaq numerals

	*x*1	*x*10	*x*100	*x*1,000	*x*10,000	*x*100,000
1						
2						
3						
4						
5						
6						
7						
8						
9						

Table 2: Persian forms of the Siyaq numerals

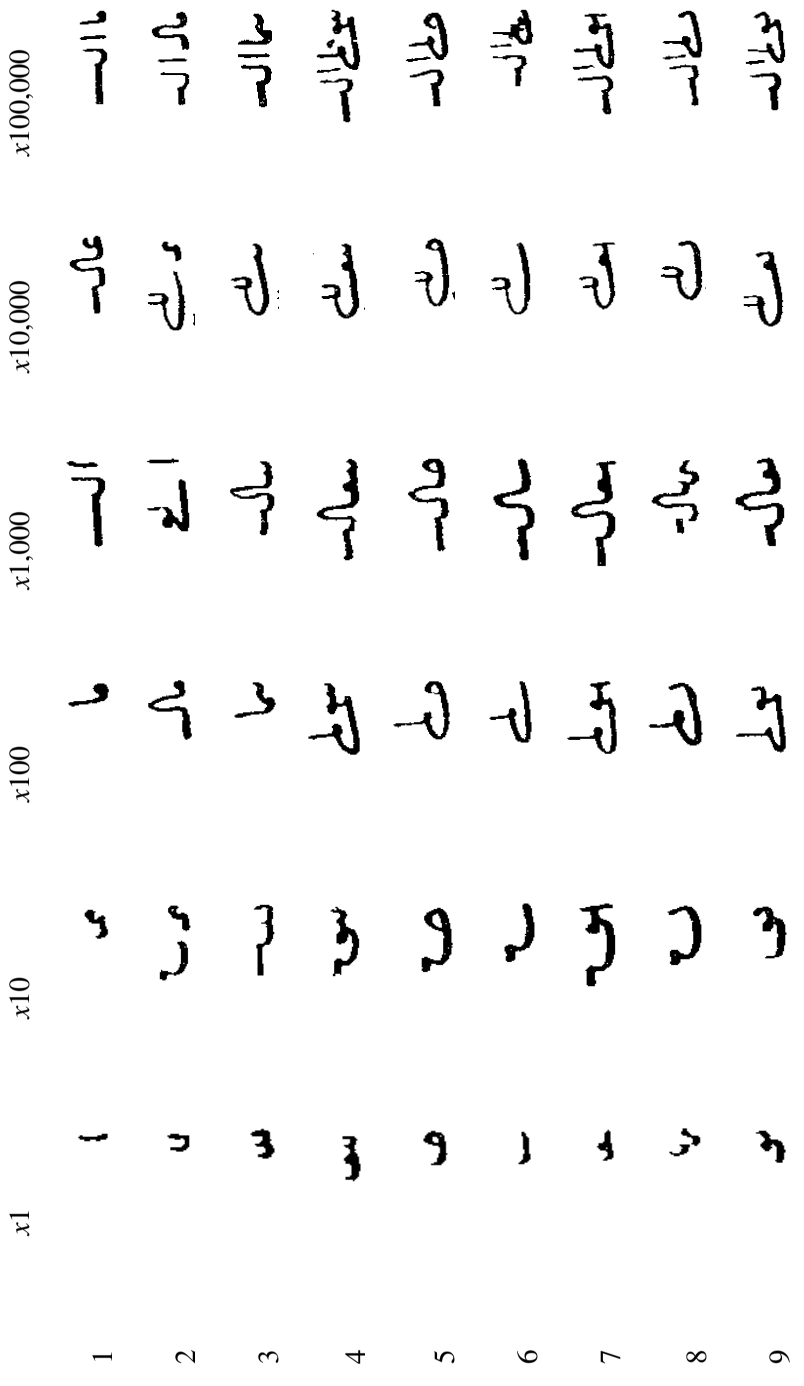


Table 3: Turkish forms of the Siyaq numerals

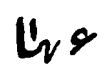
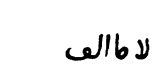
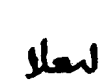
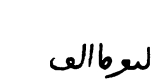
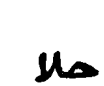
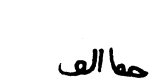
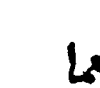
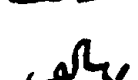
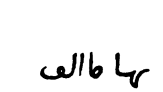
	*x*1	*x*10	*x*100	*x*1,000	*x*10,000	*x*100,000
1						
2						
3						
4						
5						
6						
7						
8						
9						

Table 4: Diwani forms of the Siyaq numerals

	19	18	17	16	15	14	13	12	11	10
P										
T										
SA										
D										

Table 5: The forms of the composite numbers 11–19 in the four styles. Persian forms derived from Tisdall; Turkish forms derived from Cevdet; South Asian forms derived from Stewart; Diwani forms derived from Kazem-Zadeh.

3 Description of the Numerals

3.1 The Primary Unit

	P	T		SA	D	NAME
1						أحد / عدسة
2						إثنان / عددن
3						ثلاثة
4						أرْبعة
5						خمْسة
6						ستّة
7						سبْعة
8						ثمانية
9						تسْعة

The Siyaq numerals for the primary units 1 through 9 are derived from the Arabic names for these numbers. The Siyaq primary numerals are either stylized monograms of the Arabic names or abbreviations consisting of the initial and one or more letters of the names. Figure 9 shows the Arabic sources for forms of the primary numerals as found in the South Asian tradition. In the South Asian tradition, alternate forms of the primary numerals are used in the writing of composite numbers (see Section 3.1.1).

SIYAQ NUMERAL ONE This numeral is derived from both the Arabic عدَسَة *'dasah* "number" and the name for the numeral, أَحَد *'aḥad* "one." The South Asian form is a monogram of عدسة. The Turkish and Diwani forms are derived from احد, which is abbreviated as ا ALEF. The Persian form is a monogram of احد.

SIYAQ NUMERAL TWO This numeral is derived from both the Arabic عدَدَن *'dadan* "dual" and the name for number, إِثنَانِ *iṯnāni* "two." The South Asian form is a monogram of عددن written with a vertical or looped terminal that represents final NOON. The Persian form is also derived from عددن and is an abbreviation of that word consisting only of the initial AIN followed by a horizontal stroke. The Turkish and Diwani forms are derived from اثنان and are represented as monograms consisting of ا ALEF and a stylized vertical final NOON.

SIYAQ NUMERAL THREE This numeral is derived from the Arabic ثَلَاثَة *s̱alās̱ah* "three." The South Asian and Diwani forms are a monogram of ثلاثة written as THEH + LAM + HEH GOAL. The HEH GOAL takes a wavy form and appears as YEH BARREE. In the Persian form this numeral is an abbreviation consisting of the bare initial form of ث THEH, which is also the base form used for writing numerals of higher units.

SIYAQ NUMERAL FOUR This numeral is derived from the Arabic أَرْبَعَة *arba'ah* "four." It is a monogram of أربعة represented as ALIF + REH + AIN, written without attention to the non-connecting properties of the letters ALIF and REH.

SIYAQ NUMERAL FIVE This numeral is derived from the Arabic خَمْسَة *ẖamsah* "five." It consists of the bare initial form of the letter خ KHAH in خمسة.

SIYAQ NUMERAL SIX This numeral is derived from the Arabic سِتَّة *sittah* "six." The P and T forms are composed of the initial SEEN of ستّة, which is represented as the swash form of the letter. The SA form is a monograph of ستّة represented as SEEN + YEH BARREE, written with the swash form of SEEN. The use of YEH BARREE represents the transcription of ہ HEH GOAL as it is realized in Urdu. In some styles the initial SEEN is written as a loop or curve that resembles the initial form of MEEM.

SIYAQ NUMERAL SEVEN This numeral is derived from the Arabic سَبْعَة *sab'ah* "seven." The SA and T forms are monograms of سبعة represented as SEEN + AIN + HEH GOAL. The P form contains the initial form of SEEN. In each of the styles SEEN is written as a loop or curve that resembles the initial form of MEEM.

SIYAQ NUMERAL EIGHT This numeral is derived from the Arabic ثَمَانِيَة *s̱amāniyah* "eight." The forms differ across the four styles. The SA form is a monogram of ثمانية represented as THEH + ALIF + YEH BARREE. The P form and T form are monograms of ثمانية represented as THEH + MEEM + ALIF. The basic shape of the numeral is an elongated bare initial form of THEH, which is the root shape of the numerals for magnitudes of eight.

SIYAQ NUMERAL NINE This numeral is derived from the Arabic تِسْعَة *tis'ah* "nine." It is a monogram of تسعة represented as TEH + AIN and terminated by a short horizontal stroke. The P form is based on the same pattern, but the initial top stroke is curved to the left, not vertical.

3.1.1 Composite Forms of the Primary Numerals

In the South Asian and Diwani traditions, the numerals for the primary units take different forms when written in composite numbers. It is not necessary to encode these variant forms. The change from the regular to the composite forms of the primary numerals should be controlled at the font level.

South Asian Forms The variant forms of the South Asian primary numerals resemble the Persian and Turkish forms of the primary numerals.

	1	2	3	4	5	6	7	8	9
INDEPENDENT									
ALTERNATE									

Diwani Forms When written with composite numbers, the Diwani primary numerals 4–9 lose their left vertical terminal.

	1	2	3	4	5	6	7	8	9
INDEPENDENT									
ALTERNATE	—	—	—						

3.1.2 Variant Forms

There are variant forms of the primary numerals.

3.2 The Tens Unit

	P	T	SA	D	NAME
10					عَشَرَة
20					عِشْرُونَ
30					ثَلَاثُونَ
40					أَرْبَعُونَ
50					خَمْسُونَ
60					سِتُّونَ
70					سَبْعُونَ
80					ثَمَانُونَ
90					تِسْعُونَ

Typology The Siyaq numerals for the tens unit are composed of the base forms of the primary numerals joined to a distinct terminal. The exceptions are the numerals for TEN and TWENTY.

Distinguishing Feature The distinguishing feature of the tens is a stylized form of the ن NOON in the Arabic suffix for "ten" أُونَ, represented as a loop or hook. The terminal forms in the four styles are:

P	T	U	D	SOURCE

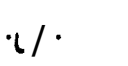
Special Forms The SIYAQ NUMERAL TEN is derived from Arabic عَشَرَة *'ašarah* "ten." The numeral is composed of the initial form of the letter ع AIN in عَشَرَة followed by the tens terminal. The SIYAQ NUMERAL TWENTY is derived from Arabic عِشْرُونَ *'išrūna* "twenty" (literally, dual form of "ten"). The numeral is composed of the initial form of the letter ع AIN in عِشرُونَ and, in the SA and P forms, followed by an upward hook that represents ش SHIN, and the tens terminal. The T form consists of the initial form of AIN and the tens terminal separated by a small space.

3.3 The Hundreds Unit

	P	T	SA	D	NAME
100					مِائة
200					مِائَتَانِ
300					ثَلَاثُ مِائةٍ
400					أَرْبَعُ مِائةٍ
500					خَمْسُ مِائةٍ
600					سِتُّ مِائةٍ
700					سَبْعُ مِائةٍ
800					ثَمَانِ مِائةٍ
900					تِسْعُ مِائةٍ

Typology The Siyaq numerals for the hundreds unit are composed of the base forms of the primary numerals joined to a terminal, which distinguishes the hundreds from other ranks.

Distinguishing Feature The distinguishing feature of the hundreds is a terminal representing the Arabic word مِائة "hundred" abbreviated as ما. Some varieties of the Persian hundreds incorporate the ة TEH MARBUTA, which is represented as a dot. The monograms in the four styles are:

P	T	U	D	SOURCE
				مِائة

Special Forms The exceptions are the numerals for ONE HUNDRED and TWO HUNDRED. While the forms of these numerals are derived from the Arabic names, the pattern of the names for 100 and 200 differ from the pattern for the names of 300–900. The character SIYAQ NUMERAL ONE HUNDRED is a monogram of the مِائة *miāʻat* "one hundred." The character SIYAQ NUMERAL TWO HUNDRED is a monogram of the Arabic مِائَتَانِ "two hundred."

3.4 The Thousands Unit

	P	T	SA	D	NAME
1,000					أَلف
2,000					أَلفَانِ
3,000					ثَلَاثَةُ آلَافٍ
4,000					أَرْبَعَةُ آلَافٍ
5,000					خَمْسَةُ آلَافٍ
6,000					سِتَّةُ آلَافٍ
7,000					سَبْعَةُ آلَافٍ
8,000					ثَمَانَةُ آلَافٍ
9,000					تِسْعَةُ آلَافٍ

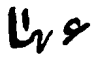
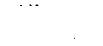
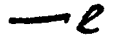
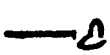
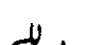
Typology The Siyaq numerals for the thousands unit are composed of the base forms of the primary numerals joined to a terminal, which distinguishes the thousands from other ranks.

Distinguishing Feature The distinguishing feature of the thousands is a terminal representing the Arabic word أَلف "thousand." The monograms for أَلف in the four styles are:

P	T	U	D	SOURCE
				أَلف

Special Forms The exceptions are the numerals for ONE THOUSAND and TWO THOUSAND. While the forms of these numerals are derived from the Arabic names, the pattern of the names for 1,000 and 2,000 differ from the pattern for the names of 3,000–9,000. The character SIYAQ NUMERAL ONE THOUSAND is a monogram of the أَلف *'alf* "one thousand." The character SIYAQ NUMERAL TWO THOUSAND is a monogram of the Arabic أَلفَانِ *'alfāni* "two thousand."

3.5 The Ten Thousands Unit

	P	T	SA	D	NAME
10,000					
20,000					
30,000					
40,000					
50,000					
60,000					
70,000					
80,000					
90,000					

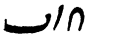
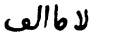
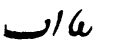
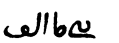
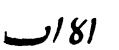
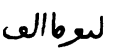
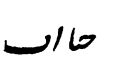
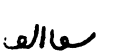
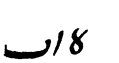
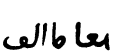
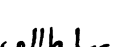
Typology There are variant methods of writing the ten thousands within traditions; however the forms are still derived from the base shape of the primary numerals and denoted with a terminal for the order.

Distinguishing Feature The monograms in the four styles are:

P	T	U	D	SOURCE

Special Forms The exceptions are the numerals for 10,000 and 20,000. While the forms of these numerals are based on the forms of 10 and 20.

3.6 The Hundred Thousands Unit

	P	T	SA	D
100,000				
200,000				
300,000				
400,000				
500,000				
600,000				
700,000				
800,000				
900,000				

Typology The representation of numbers of the hundred thousands is influenced by local number systems. There are variant methods of writing this unit within traditions. In the Persian, Turkish, and Diwani traditions, the hundred thousands are written using the character for the hundreds unit followed by the character for the thousands. In the South Asian tradition, words from the South Asian number system enter into Siyaq notation.

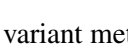
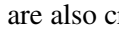
Distinguishing Feature The monograms in the four styles are:

P	T	U	D	SOURCE

Regional Orthographies In the South Asian tradition, the hundred thousands unit is called *lākh* लाख). It is represented in Siyaq as . The numbers 100,000 and 200,000 are written using special forms of : *lakhah* and *lakhān*, respectively.

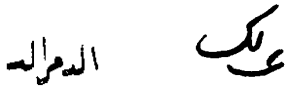
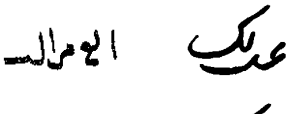
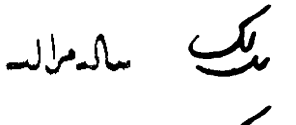
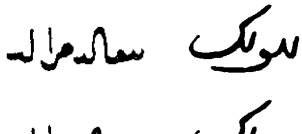
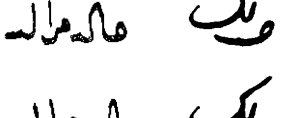
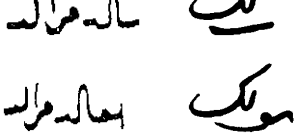
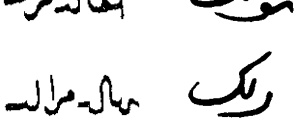
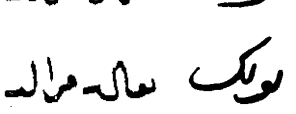
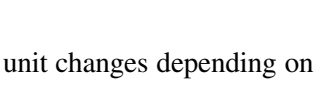
The hundred thousands are written using the regular form of the primary numeral and the monogram ; the exception is 100,000, which is written using the composite form of SIYAQ NUMERAL ONE () instead of

the regular form .

The writing of the hundred thousands unit reflects the expression of numbers of the group. The number 300,000 is expressed as  . It is, therefore, written with SIYAQ NUMERAL THREE and the unit marker as  . It is not written as *.

There are variant methods of writing this unit in Persian. In addition to the forms shown above, the hundred thousands are also created by dropping the hundreds terminal and adding SIYAQ NUMERAL ONE THOUSAND:

3.7 The Millions Unit

	P	T	SA	D	NAME
1,000,000					
2,000,000					
3,000,000					
4,000,000					
5,000,000					
6,000,000					
7,000,000					
8,000,000					
9,000,000					

Typology The forms of the millions unit changes depending on the tradition.

Distinguishing Feature The monograms in the four styles are:

P	T	U	D	SOURCE
–		لک / کرور	–	

Regional Orthographies In the South Asian tradition, the millions from 1,000,000 to 9,000,000 are denoted with لک *lākh*. The range 100,000 to 9,000,000 are considered multiples of the *lākh* unit, where 100,000 is 1 *lākh* (1,00,000) and 9,000,000 is 90 *lākh* (90,00,000). The millions from 10,000,000 are written with کرور (from Hindi करोड़ *karoṛ*). The number 20,000,000 has a special form (similar to 200,000) and is written کروڑاں *karorān*. The millions are written as tens of *lākh*s using the tens numerals and the *lākh* monogram. For example, 30,000,000 million is written using SIYAQ NUMERAL THIRTY and the *lākh* monogram.

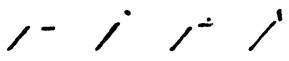
In the Turkish tradition, the millions are denoted with , which is a monogram formed from a combination of the word مَرَّةً "times" abbreviated as مر, and the word أَلف "thousand." The notion of 1,000,000 is

conceived of as 1,000 times 1,000. The millions, are therefore written using the numeral for the thousands followed by the monogram .

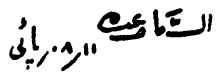
3.8 Fraction and Currency Signs

South Asian Signs The South Asian tradition has four signs for representing fractions and one mark for denoting currency. Figure 18 shows the use of the currency mark. The fraction signs written with the South Asian form of SIYAQ CURRENCY MARK:[2]

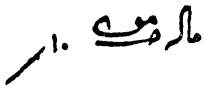
¼ ½ ¾ 1

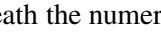


1,125 Rs, 11 Anas, 8¾ pai

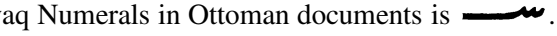


795 Rs, 11¾ Anas



Turkish Signs The Turkish tradition used the character ٩ to represent the fraction ½. There are no other fraction signs in the Turkish tradition.[3] It is written beneath the numeral, as in 2,163½  .

3.9 Other Signs

A common mark found with Siyaq Numerals in Ottoman documents is  . It is an abbreviation of the word سياقاة produced from the initial form of SEEN. The mark is written above Siyaq numerals to distinguish them from other text. It is an extending character.

[2] Platts: 60. [3] Fekete, 1955: 38.

4 Background

Materials in Siyaq There is an abundance of manuscripts containing Siyaq Numerals, the majority of which are Ottoman records.

Metal Fonts The numerals rarely appear in printed materials, but metal fonts for the Siyaq Numerals were developed in India in the late 18th century. They appear in a work by Francis Gladwin titled *A Compendious System of Bengal Revenue Accounts*, which is perhaps the first published book to contain printed Siyaq numerals. [4] The Siyaq fonts were commissioned specifically for the work. Specimens of the Siyaq metal fonts are given in Figure 17.

5 Orthography

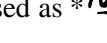
5.1 Number System

The Siyaq number system is a base 10 system. The signs for the numbers represent values of numerical rank. The writing of numerals follows the additive principle, which entails the summation of the values of the numerals. There is no sign for zero, instead the positional value of zero is inherently represented in the distinct signs for the orders of magnitudes.

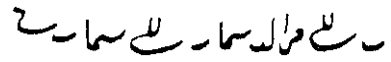
5.2 Ordering

The manner of writing numbers reflects the method of expressing numbers in Arabic. This rule governs the sequence in which numerals are written.

The writing of composite numbers of the tens and primary units mirrors the expression of these numbers in Arabic. The primary unit is articulated before the tens unit and, therefore, the numeral for the primary unit is written before the tens numeral. For example, 25 is خمسة و عشرون. Given the pattern of expression, 25 is written as with the numeral 5 preceding the numeral 20. The number would never be written as * with the order of the numerals reversed. The use of و *wa* “and” in expressing composite numbers is not retained in Siyaq notation.

In composite numbers consisting of the hundreds and the primary units, the numeral for the primary unit is written after the hundreds unit. For example, 205 is expressed as مايتان و خمسة. Its written form follows the spoken order with the numeral 5 following the numeral 200. The number would never be expressed as *  with the order reversed.

The following is the number 66,666,666 written in the Turkish style:[5]



Its components are:

60	6	600	60,000	6	600	*x 1,000*	60,000	6

It is realized as “six and (sixty thousand (times thousand)), six hundred and (six and sixty thousand), six hundred and (six and sixty).”

[4] Gladwin, 1790: vii. [5] Cevdet, 1937: 19.

5.3 Positioning

Depending upon the tradition, when composite numbers are written, the variant forms of the primary numerals are written at the baseline and the higher ranks are written above the primary numerals.

In the Persian tradition, when thousands and hundreds are written together, the numeral for the hundreds unit is written inside and above the terminal stroke of the thousands character. For example, the number 1,300 is written with SIYAQ NUMERAL ONE THOUSAND and SIYAQ NUMERAL THREE HUNDRED. The combination is represented as , not as

5.4 Shaping

Several numerals modify their form when written in composite numbers. Changes include the elision of certain features and the use of alternate forms. These changes are dependent upon the tradition.

Persian In composite numbers of primary and tens units, the horizontal line of the primary numerals is rounded upwards to meet the tens numeral. The exception is SIYAQ NUMERAL ONE, which does not change shape. For example, in writing the number 17 SIYAQ NUMERAL 7 changes as .

The distinguishing feature of the Persian hundreds are dropped in composite forms: 100 loses the terminal to become , as in 110 .

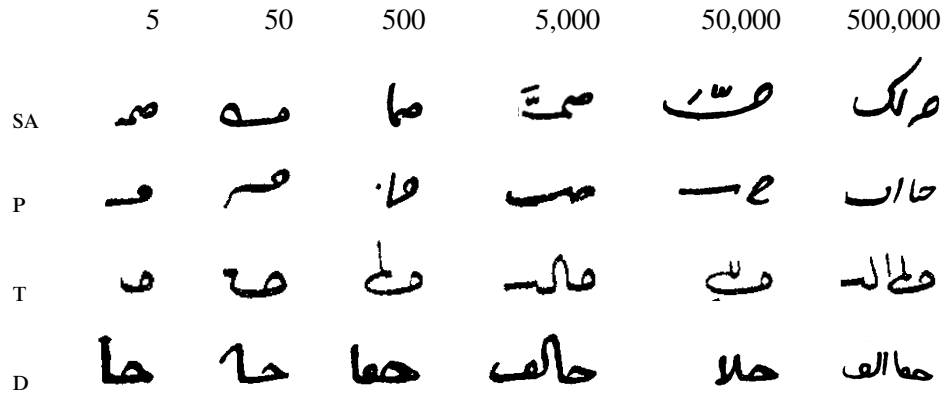
Diwani The numerals 4 through 9 and the numeral 10 in the Diwani style lose their left vertical terminal when written in composite numbers: In writing the number 15 , Diwani 10 becomes and 5 becomes .

6 Technical Features

6.1 Encoding Model

The encoding model for the Siyaq Numerals is dependent upon a determination regarding the typology of the numerals. The Siyaq Numerals may be considered as either independent characters or characters built from primitives.

As described in Section 3, at the most fundamental level the Siyaq Numerals consist of the base forms of the primary numerals (1..9) joined to a terminal or mark that uniquely represents each decimal order. The exceptions are the forms of the primary numerals when representing numbers of the primary units and the forms of numerals for different magnitudes of 10 and 20. The following table illustrates the basic typology with magnitudes of 5 for six decimal orders:



The comparison shows that the form ھ exists in each magnitude of 5 for each decimal order across the four styles. Each magnitude of five is written using the terminal distinct to each decimal order. The numerals for the primary, tens, hundreds, and thousands units may be considered distinct characters that constitute the base set of Siyaq Numerals. The forms of numerals for the ten thousands and hundred thousands are not unique.

The numerals for the higher decimal orders are created from the base set and unit marks for the orders. For example, in the South Asian tradition the number 500,000 is written as ھ‌لک. This form is decomposed as the numeral 5 ھ and the mark for the hundred thousands unit لک. In the Persian tradition the number is written as حاراں. This form is decomposed as a shaping variant of the number 500 ہا and the thousands mark اں.

The same practice is evident in the writing of millions in the South Asian tradition. The number 5 million is realized as 50 *lākh* (fifty one-hundred-thousands) ھ‌لک. It is represented as a shaping variant of 50 ہ written with the hundred thousands mark لک.

Given these characteristics, there are three possible models for encoding the Siyaq Numerals:

1. Encode each individual numeral
2. Encode numerals for the primary unit and primitives for higher units
3. Encode numerals for the primary, tens, hundreds, and thousands and primitives for higher units

6.1.1 Encode each individual numeral

The elementary approach to encoding the Siyaq Numerals is to encode each individual numeral. This model would require nine characters for each of the seven decimal orders — primary units, tens, hundreds, thousands, ten thousands, hundred thousands, and millions — for a total of 63 characters for the numerals.

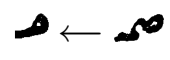
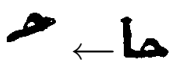
Advantages The advantage of this model is that each numeral is defined as a unique character.

Disadvantages The disadvantage is the encoding of redundant characters. As shown above, in some Siyaq traditions the numerals for higher decimal orders are composed of smaller units and marks representing the order.

6.1.2 Encode Primary Numerals and Unit Primitives

The alternative to encoding each individual numeral is to encode the primary numerals and to represent the decimal orders through the use of unit marks. This model based on primitives reflects the inherent typology of Siyaq Numerals.

Thus, instead of encoding separate characters for each magnitude of the primary numerals within each decimal order, the given order is represented with a single character. This character, or unit mark, is written after a primary numeral to indicate the order of that numeral. For example, instead of encoding a character for Siyaq numeral 50, the numeral would be written using SIYAQ NUMERAL FIVE + SIYAQ TENS MARK, as illustrated below:

	Siyaq Numeral Fifty	=	SIYAQ TENS MARKER	+	SIYAQ NUMERAL FIVE
SA		=		+	
P		=		+	
T		=		+	
D		=		+	

The same principle governs all decimal orders. The character for Siyaq 3,000 would be encoded as SIYAQ NUMERAL THREE + SIYAQ THOUSANDS MARK.

Advantages This approach would require only 15 characters to encode the entire set of Siyaq Numerals. There are nine characters for the primary unit and six characters for the primitives that represent each decimal order: SIYAQ TENS MARK, SIYAQ HUNDREDS MARK, SIYAQ THOUSANDS MARK, SIYAQ TEN THOUSANDS MARK, SIYAQ HUNDRED THOUSANDS MARK, and SIYAQ MILLIONS MARK. Encoding all numerals individually requires a minimum of 63 characters.

As described above, the manner of representing the hundred thousands and millions uses smaller numerals and unit marks. Therefore, in order to eliminate redundancy, it is practical to encode the hundred thousands unit using primitives rather than encoding each numeral of these magnitude individually.

Disadvantages One drawback to this approach is that two characters are required to encode numerals beyond the primary units. For example, if all numerals are encoded independently, only a single character is required to represent Siyaq ten. With primitives, two characters are required: the primary numeral and the tens marker.

The problem with deriving all numerals from primitives is evident in the South Asian method of writing the millions. The millions can simply be expressed using the millions mark. However, the South Asian conception of millions differs from the Western. The number 5,000,000 is conceived of as 50 times 100,000. The default encoding for 5,000,000 would therefore be SIYAQ NUMERAL FIFTY + SIYAQ HUNDRED THOUSANDS MARK, not SIYAQ NUMERAL FIVE + SIYAQ MILLIONS MARK.

6.1.3 Encode Primary, Tens, Hundreds, and Thousands and Unit Primitives

A third approach is to encode the numerals of the primary, tens, hundreds, and thousand units and to represent other orders using primitives. The numerals of these units have distinct shape and are traditionally considered the basic elements of the Siyaq system. Forms of numerals of higher units are based on these.

The tens and hundreds undergo shaping changes when written in combination with other units.

6.2 Ordering

The Siyaq Numerals should be encoded according to the logical order of the numerical sequence represented, including composite numbers of the primary and tens units. For example, the number 35 is written as . The number is formed from the character (the South Asian variant form of SIYAQ NUMERAL FIVE) and the character SIYAQ NUMERAL THIRTY. As the primary units are written first in composite numbers, the literal representation of is SIYAQ NUMERAL FIVE + SIYAQ NUMERAL THIRTY. The number 35, however, should be encoded in the logical order as SIYAQ NUMERAL THIRTY + SIYAQ NUMERAL FIVE. The rendering engine should transpose the numerals.

7 References

Ahmad Dihlavī, Sayyid. 1974?. فرهنگ آصفیه [*Farhang-i Āsafiyyah*]. vol. 2. Delhi: Taraqqī-e-Urdū Board, National Academy.

Barker, Muhammad Abd-al-Rahman. 1967. *A Course in Urdu*. Vol. 1. Montreal: Institute of Islamic Studies, McGill University.

Cevdet, Mehmed. 1937. Siyakat yazisi ve rakkamlari. Bozkurt Matbaasi.

درسی اردو لغت [*Darsi Urdu Lughat*]. 2001. Taba‘ 1. Silsilah-yi matbu’at-yi Muqtadirah-yi Qaumi Zaban; 391. Islamabad: Muqtadirah Qaumi Zaban.

Fekete, Lajos. 1995. *Die Siyāqat-Schrift in der Türkischen Finanzverwaltung.* Beitrag zur Türkischen Paläographie mit 104 Tafeln. Erster Band: Einleitung, Textproben. Bibliotecha Orientalis Hungarica VII. Budapešt: Akadémiai Kiadó.

Gladwin, Francis. 1790. *A Compendious System of Bengal Revenue Accounts*. In three parts. Calcutta: Manuel Cantopher.

Hanaway, William L. and Brian Spooner. 1995. “Reading Nasta‘liq: Persian and Urdu Hands from 1500 to the Present.” Bibliotheca Iranica, Literature Series No. 3. Costa Mesa, California: Mazda Publishers.

Ifrah, Georges. 2000. *The Universal History of Numbers: From Prehistory to the Invention of the Computer*. Translated from the French by David Bellos, E. F. Harding, Sophie Wood, and Ian Monk. New York: John Wiley & Sons, Inc.

International Organization for Standardization. 2005. ”ISO/IEC JTC 1/SC 2/WG 2 N3002: Principles and Procedures for Allocation of New Characters and Scripts.” (October 5, 2005). `http://std.dkuug.dk/JTC1/SC2/WG2/docs/n3002.pdf`.

Kazem-Zadeh, H. 1915. “Les Chiffres Siyâk et la Comptabilité Persane.” In *Revue du Monde Musulman*, vol. 30, pp. 1–51.

Naim, Chaudhry M. 1999. *Introductory Urdu*. 3rd ed. rev. Chicago: South Asia Language & Area Center, University of Chicago.

Muhazzab, Muhammad Mirza. 195-?. مہزّب اللّغت [*Muhazzab al-Lughat*]. Lakhnau, Muhafiz Urdu Book Depot.

Platts, John T. 1909. *A Grammar of the Hindūstānī or Urdū Language*. 5th imp. London: C. Lockwood.

Stewart, Charles. 1825. *Original Persian Letters and Other Documents with Fac-Similes*. London: printed for the author by W. Nicol.

Tisdall, William St. Clair. 1959. *Modern Persian Conversation Grammar*. With New Reading Lessons and Persian Letters selected by Zia Missaghi. New York: Frederick Ungar Publishing Co.

Wollaston, Arthur N. 1978 [1842]. *An English-Persian Dictionary*. (Compiled from original sources). 1st Indian reprint. New Delhi: Cosmo Publications.

Figure 1: Tables showing the evolution of Siyaq forms from the original Arabic words (from Kazem-Zadeh, 1915: Plate I, Plate II, Plate III).

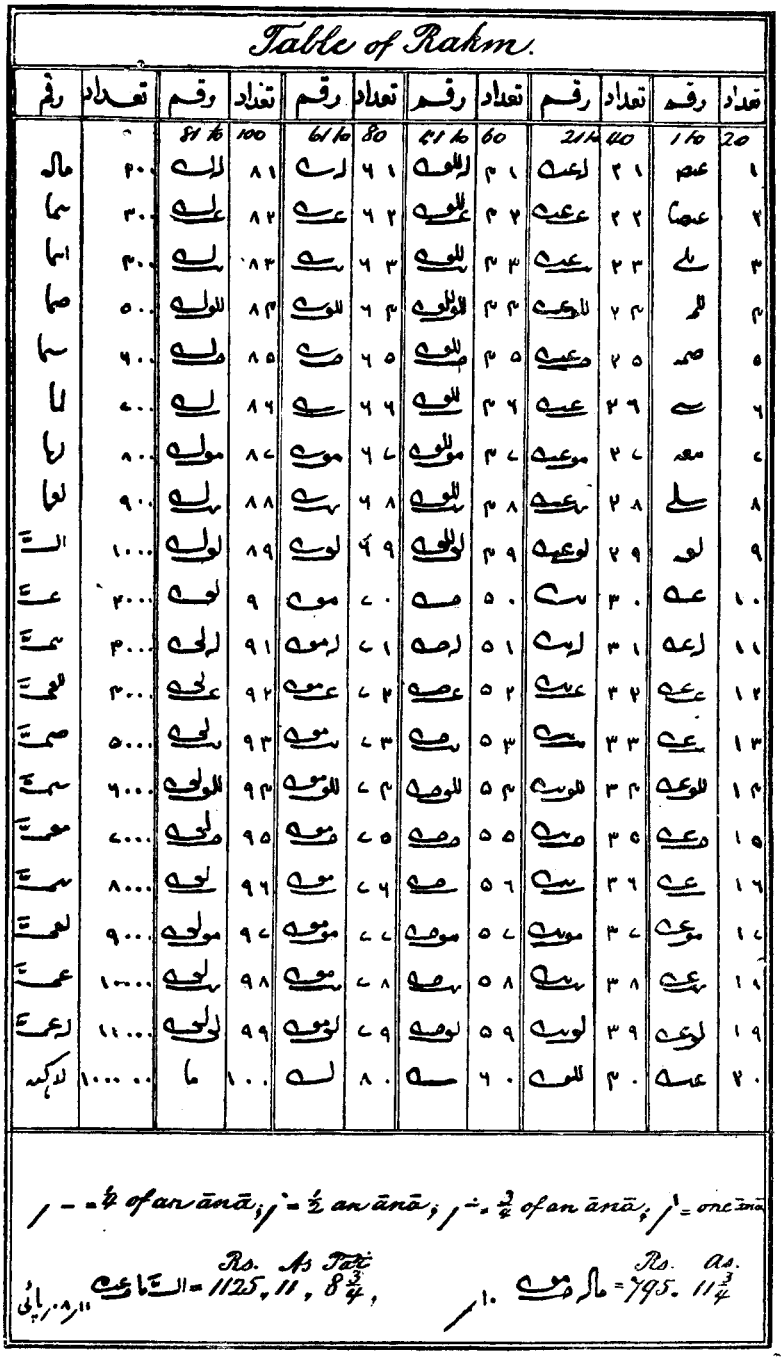


Figure 2: Table showing Siyaq forms as used in South Asia (from Platts, 1909: 60).

SYMBOL	VALUE	SYMBOL	VALUE	SYMBOL	VALUE
ـر	-/-/3	ـٔر	-/-/9	ـٰر	-/1/3
ـٔر	-/-/6	ار	-/1/-	اٰر	-/1/6

SYMBOL	VALUE	SYMBOL	VALUE	SYMBOL	VALUE
اٰر	-/1/9	عـعـر	12/-/-	معـر	70/-/-
٢ر	-/2/-	ـعـر	13/-/-	لـر	80/-/-
عـر	1/-/-	للعـعـر	14/-/-	لعـر	90/-/-
عار	2/-/-	صـعـر	15/-/-	مار	100/-
ـعـر	3/-/-	ـعـر	16/-/-	مار	200/-
للعـر	4/-/-	معـعـر	17/-/-	سار	300/-
صـر	5/-/-	ـعـر	18/-/-	للعمار	400/-
ـعـر	6/-/-	لعـعـر	19/-/-	صمار	500/-
معـر	7/-/-	عـر	20/-/-	سمار	600/-
ـعـر	8/-/-	ـر	30/-/-	معمار	700/-
لعـر	9/-/-	للعـر	40/-/-	سار	800/-
عـر	10/-/-	صـر	50/-/-	لعمار	900/-
لعـر	11/-/-	ـر	60/-/-	الـٰر	1,000/-
				لاکھ	lakh/-

Figure 3: Table showing Siyaq forms as used in South Asia (from Barker, 1967: 356–357).

8.6. Sums: Both India and Pakistan now have a decimal coinage system, a rupee being divided into one hundred paisas. In Urdu, the decimal point is wirtten as: ٫ .Examples:

١٫٠ = Re. 1.00 ٫٥٠ = 50 p. ٫٠٥ = 5 p. ١٫١٤ = Rs. 1.14

8.7. Before the currency was refomed in the two countries, a rupee was divided into sixteen annas or sixty-four pice (paisa). There was then also a different system, besides the numerals, for writing sums.

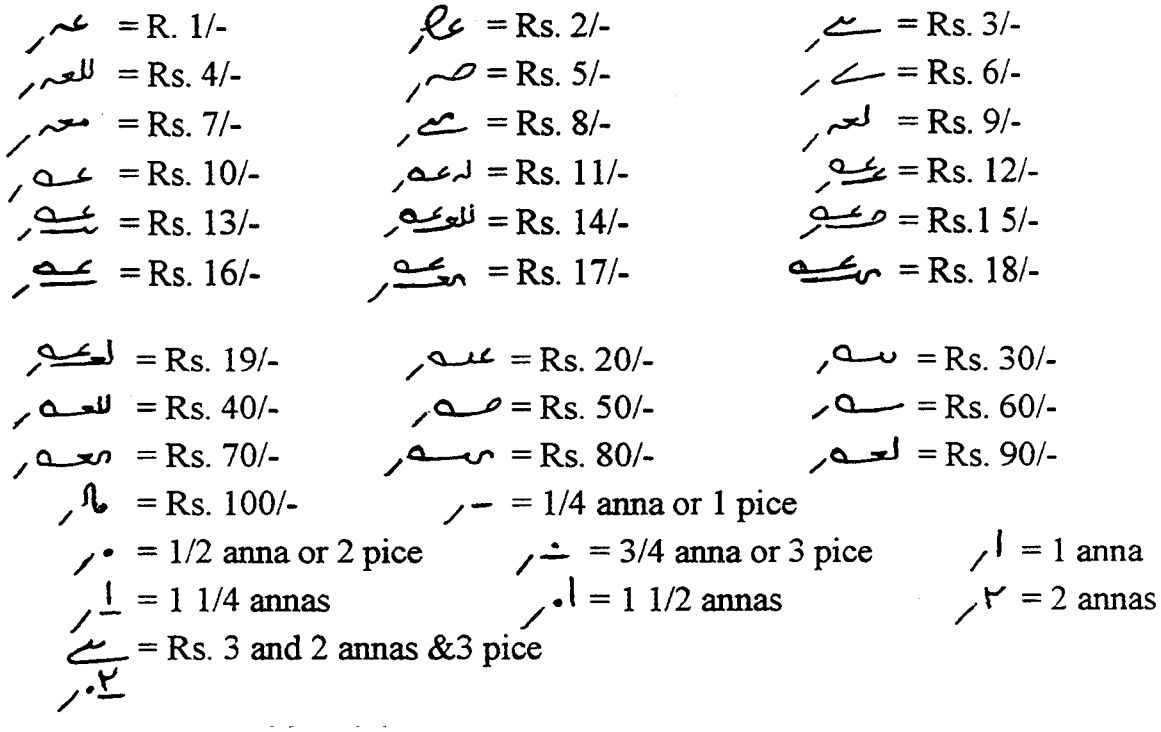


Figure 4: (Table showing Siyaq forms as used in South Asia from Naim, 1999: 49–50).

LES CHIFFRES « DÎVÂNÎ » CHEZ LES ARABES (1)

CHIFFRES	VALEUR	CHIFFRES	VALEUR	CHIFFRES	VALEUR
ا	1	[illegible]	19	الف ou [illegible]	1,000
لا	2	[illegible]	20	[illegible]	2,000
[illegible] ou [illegible]	3	[illegible]	30	[illegible]	3,000
[illegible]	4	[illegible]	40	[illegible]	4,000
[illegible]	5	[illegible]	50	[illegible]	5,000
[illegible]	6	[illegible]	60	[illegible]	6,000
[illegible]	7	[illegible]	70	[illegible]	7,000
[illegible]	8	[illegible]	80	[illegible]	8,000
[illegible]	9	[illegible]	90	[illegible]	9,000
[illegible]	10	[illegible]	100	[illegible]	10,000
[illegible]	11	[illegible]	200	[illegible]	20,000
[illegible]	12	ou [illegible]	300	[illegible]	30,000
[illegible]	13	[illegible]	400	[illegible]	40,000
[illegible]	14	[illegible]	500	[illegible]	50,000
[illegible]	15	[illegible]	600	[illegible]	60,000
[illegible]	16	[illegible]	700	[illegible]	70,000
[illegible]	17	[illegible]	800	[illegible]	80,000
[illegible]	18	[illegible]	900	[illegible]	90,000

(1) D'après un manuscrit du *Vocabulaire arabe-persan* de ZAMAKHCHARÎ (Bibliothèque Nationale, ancien fonds arabe n° 1256), reproduits dans la *Grammaire arabe* de SILVESTRE DE SACY et dans l'ouvrage de A.-P. Pihan.

Figure 5: Table showing the Diwani number forms (from Kazem-Zadeh, 1915: Plate VII).

Units

1	ا	4	لىعا	7	ىعا
2	لا	5	حا	8	ىها
3	ىے or للا	6	سا	9	ىعا

Tens

10	عا	40	لىعا	70	ىعا
20	ىعا	50	حا	80	ىا
30	ىا	60	سا	90	ىعا

Hundreds

100	ما	400	لىعما	700	ىعما
200	ما	500	حما	800	ىما
300	سىما or ىلما	600	سما	900	ىعما

Thousands

1,000	الىا or الف	4,000	لىعالف	7,000	ىعالف
2,000	الفى	5,000	حالف	8,000	ىهالف
3,000	سالف	6,000	سالف	9,000	ىعالف

Ten Thousands

10,000	عالف	40,000	لىعلا	70,000	ىعلا
20,000	ىعلا	50,000	حلا	80,000	ىلا
30,000	ىلا	60,000	سلا	90,000	ىعلا

Hundred Thousands

100,000	ماالف	400,000	لىعماالف	700,000	ىعاماالف
200,000	لاماالف	500,000	حماالف	800,000	ىهاماالف
300,000	ىےماالف	600,000	سماالف	900,000	ىعاماالف

Figure 6: Table showing Diwani forms of Siyaq (from Ifrah, 2000: 544).

Kitapçı Bay Raifin hediye ettiği mecmuanın ilk sahifesi. Bu eserde siyakat rakkamlarını gösterir 15 sahife vardır.

1 — 42 ye kadar siyakat rakkamları. Siyakat rakkamları siyah mürekkeple ve arapça harflerinden telhis olunarak vücude getirilmiştir. Rakkamlar kırmızı mürekkep ile yazılıdır.

43 — 82 ye kadar siyakat rakkamları

83 — 260 a kadar siyakat rakkamları

260 — 990 a kadar siyekat rakkamları

1000 — 7,000,000 e kadar siyakat rakkamları

Müteferrik siyakat rakkamlarına ait nümuneler. Ayni eser

Müteferrik siyakat rakkamlarına ait nümuneler. Ayni eser

Figure 7: Table showing Siyaq forms as used in Turkey (from Cevdet, 1937: 17–18).

Units

1	١	4	٤	7	٧
2	٢	5	٥	8	٨ or ٨
3	٣	6	٦ or ٠	9	٩

Tens

10	١٠	40	٤٠	70	٧٠
20	٢٠	50	٥٠	80	٨٠
30	٣٠	60	٦٠	90	٩٠

Hundreds

100	١٠٠	400	٤٠٠	700	٧٠٠
200	٢٠٠	500	٥٠٠	800	٨٠٠
300	٣٠٠	600	٦٠٠	900	٩٠٠

Thousands

1,000	١٠٠٠	4,000	٤٠٠٠	7,000	٧٠٠٠
2,000	٢٠٠٠	5,000	٥٠٠٠	8,000	٨٠٠٠
3,000	٣٠٠٠	6,000	٦٠٠٠	9,000	٩٠٠٠

Ten Thousands

10,000	١٠٠٠٠	40,000	٤٠٠٠٠	70,000	٧٠٠٠٠
20,000	٢٠٠٠٠	50,000	٥٠٠٠٠	80,000	٨٠٠٠٠
30,000	٣٠٠٠٠	60,000	٦٠٠٠٠	90,000	٩٠٠٠٠

Figure 8: Table showing Siyaq forms as used in Turkey (from Ifrah, 2000: 547–548).

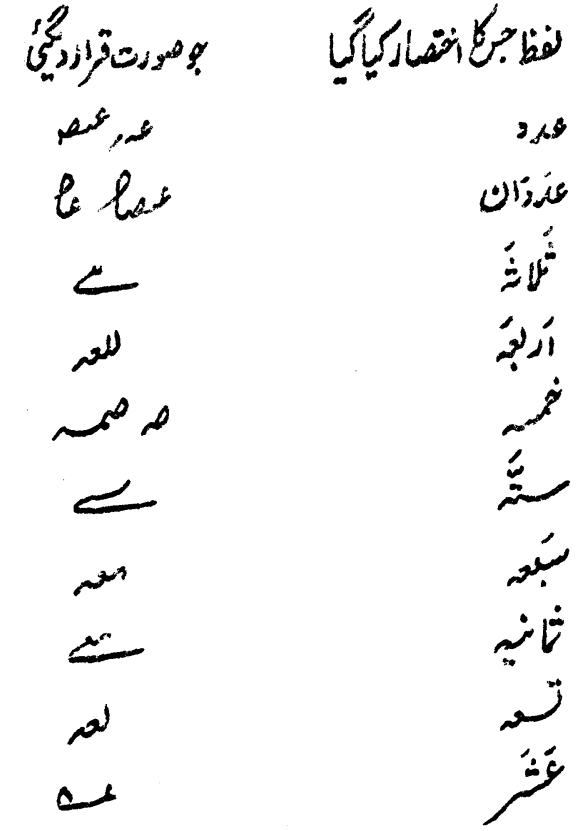


Figure 9: The Arabic sources of the Urdu Siyaq forms (from Muhazzab, 195-?: 51).

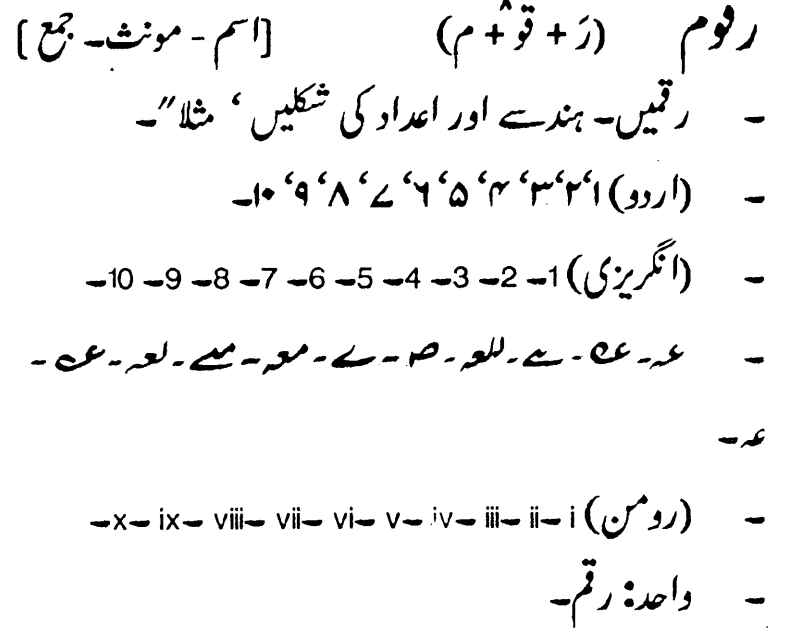
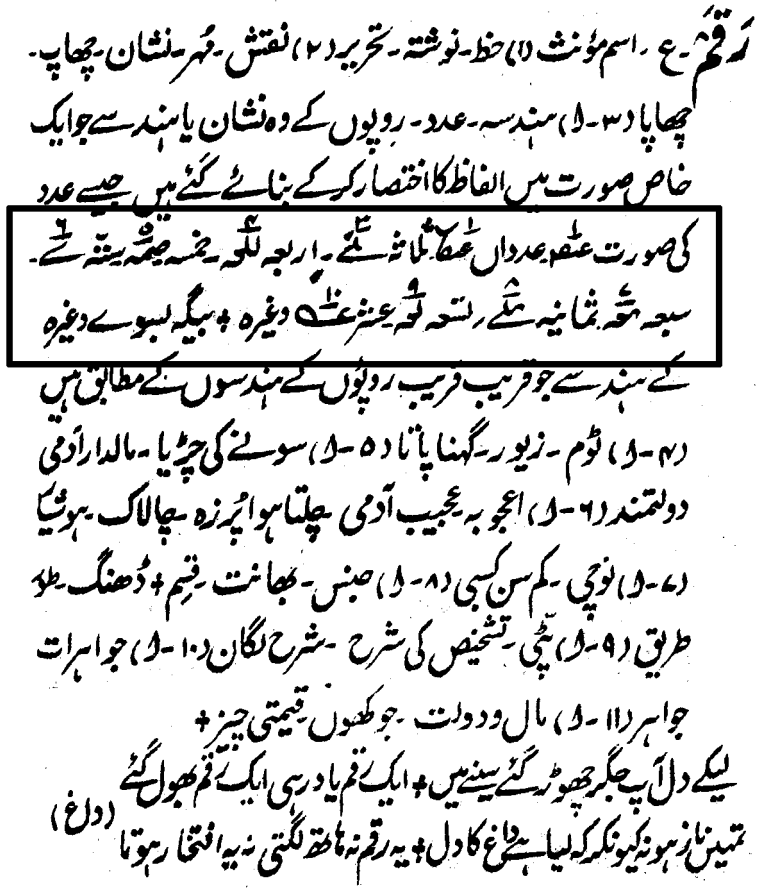


Figure 10: Table showing Siyaq forms as used in South Asia (from *Darsi Urdu Lughat*, 2001: 718).



رَقَم - ع - اسم مؤنث (۱) خط - نوشتہ - تحریر (۲) نقش - مُہر - نشان - چھاپ -
چھاپا (۳-ا) ہندسہ - عدد - روپوں کے وہ نشان یا ہندسے جو ایک
خاص صورت میں الفاظ کا اختصار کر کے بنائے گئے ہیں جیسے عدد
کی صورت عـ۱ـ عدداں عـ۱ـ ثلاثہ ـ۳ـ اربعہ ـ۴ـ خمسہ ـ۵ـ ستہ ـ۶ـ
سبعہ ـ۷ـ ثمانیہ ـ۸ـ تسعہ ـ۹ـ عشر ـ۱۰ـ وغیرہ + بیگہ بسوے وغیرہ
کے ہندسے جو قریب قریب روپوں کے ہندسوں کے مطابق ہیں
(۴-ا) ٹوم - زیور - گہنا پاتا (۵-ا) سونے کی چڑیا - مالدار آدمی
دولتمند (۶-ا) اعجوبہ - عجیب آدمی - چلتا ہوا پُرزہ - چالاک - ہوشیار
(۷-ا) نوچی - کم سن کسبی (۸-ا) جنس - بھانت - قسم + ڈھنگ - طور
طریق (۹-ا) پٹی - تشخیص کی شرح - شرح لگان (۱۰-ا) جواہرات
جواہر (۱۱-ا) مال و دولت - جوکھوں - قیمتی چیز +
لیکے دل آپ جگر چھوڑ گئے سینے میں + ایک رقم یاد رہی ایک رقم بھول گئے
تمہیں ناز ہو نہ کیونکر کہ لیا ہے داغ کا دل + یہ رقم نہ ہاتھ لگتی نہ یہ افتخار ہوتا (داغ)

Figure 11: Table showing Siyaq forms as used in South Asia (from Dihlavi, 1974: 363).

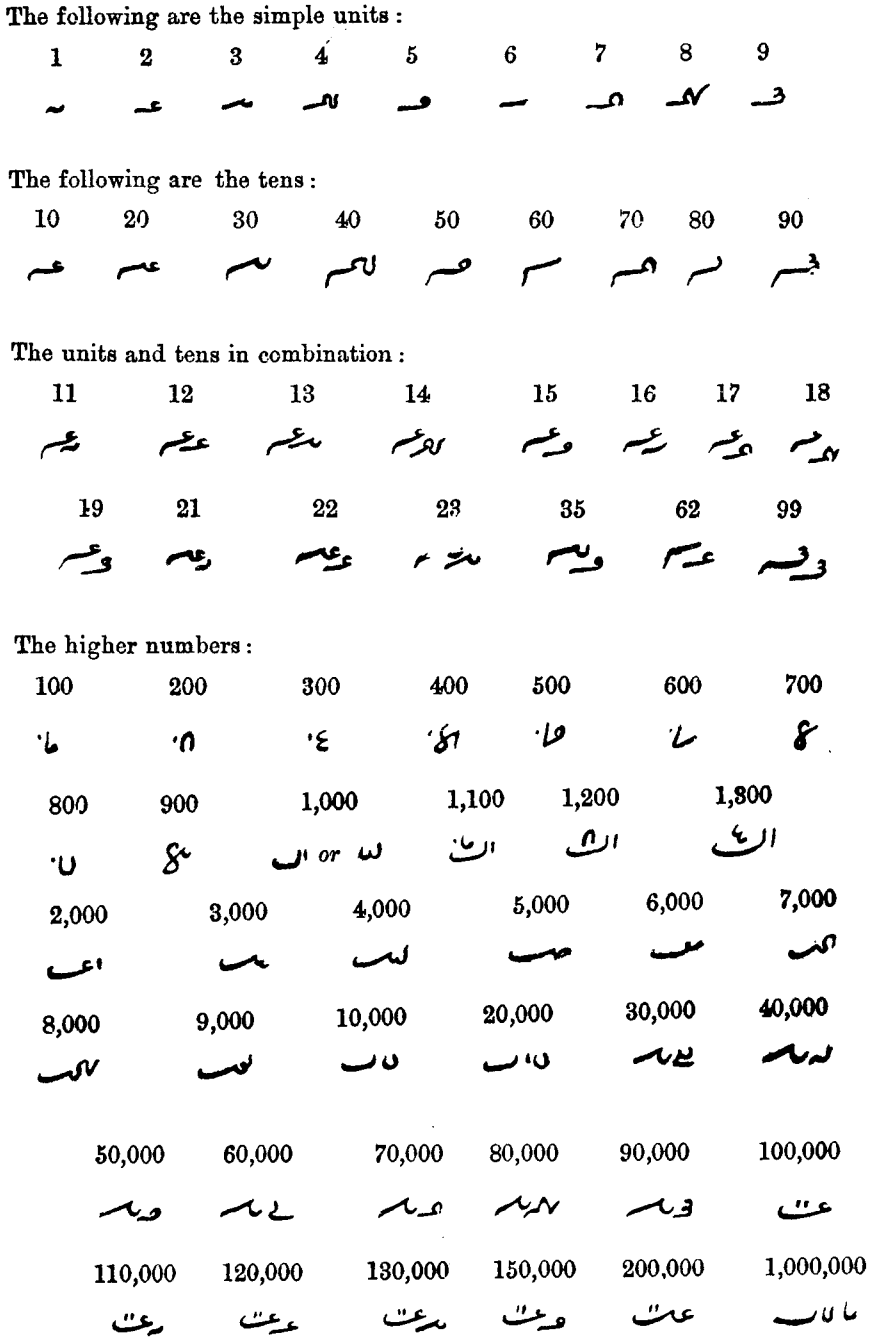


Figure 12: Table showing Siyaq forms as used in Iran (from Wollaston, 1842: 435–436).

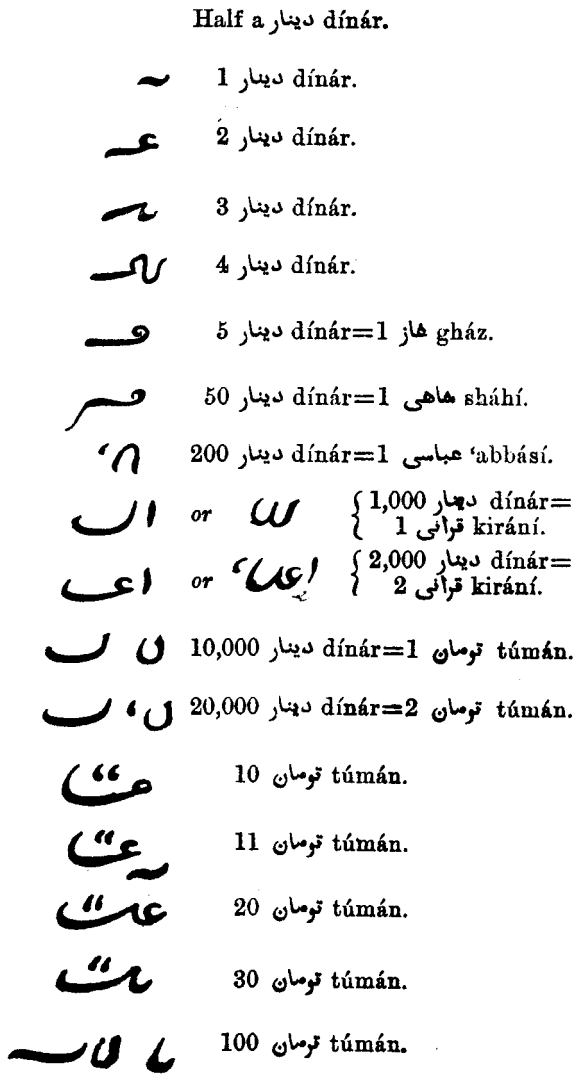


Figure 13: Table showing Siyaq forms as used in Iran (from Wollaston, 1842: 437).

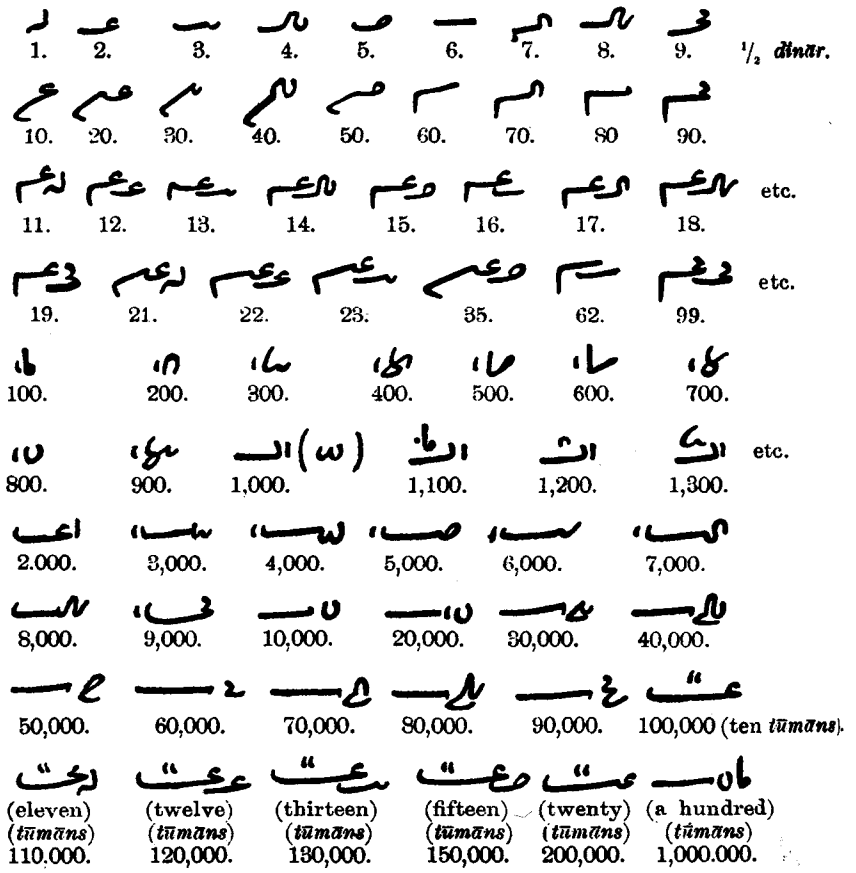


Figure 14: Table showing Siyaq forms as used in Iran (from Tisdall, 1959: 220).

Units

1		4		7	
2		5		8	
3		6		9	

Tens

10		40		70	
20		50		80	
30		60		90	

Hundreds

100		400		700	
200		500		800	
300		600		900	

Thousands

1,000		4,000		7,000	
2,000		5,000		8,000	
3,000		6,000		9,000	

Figure 15: Table showing Siyaq forms as used in Iran (from Ifrah, 2000: 545–546).

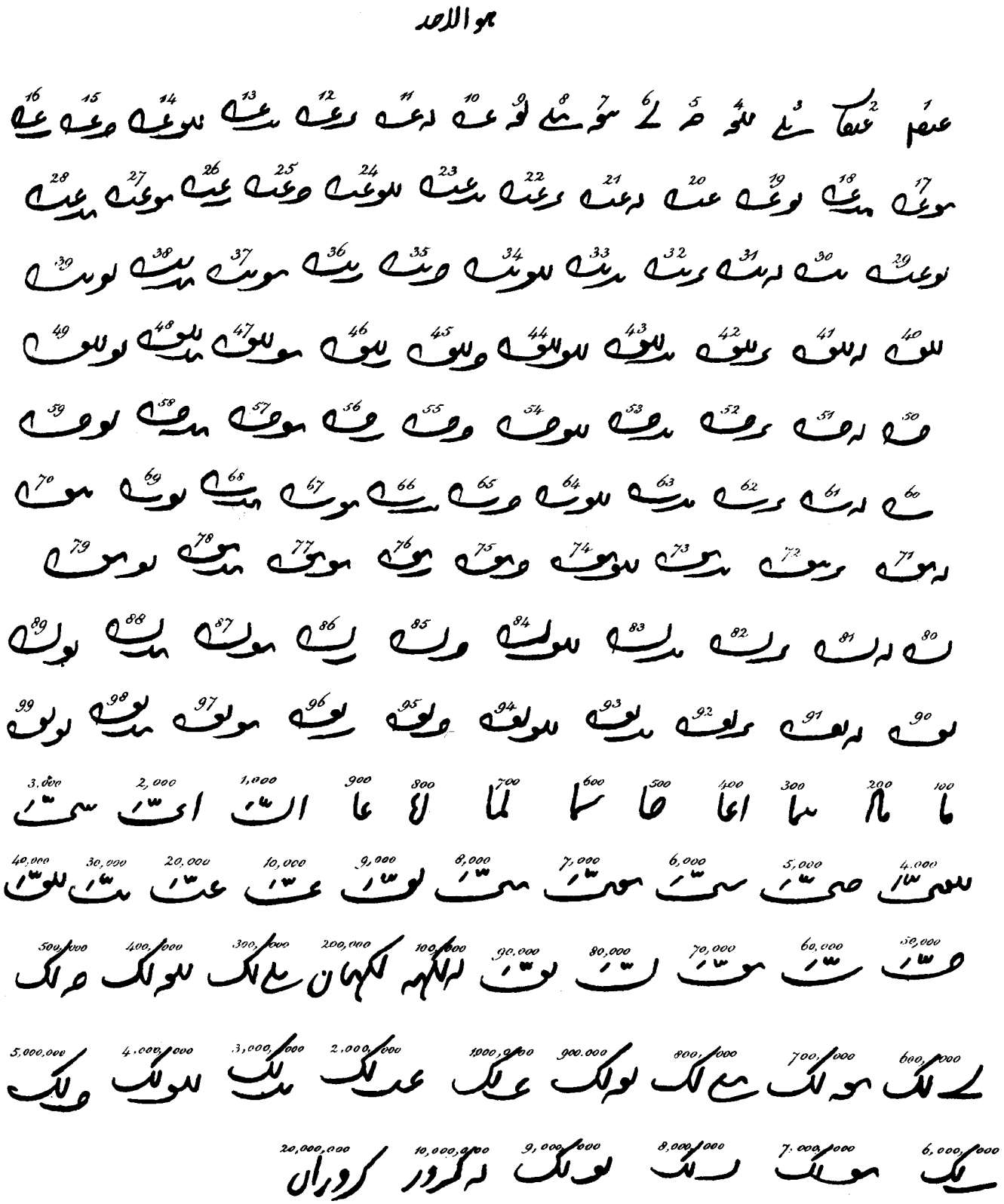


Figure 16: Table showing Siyaq forms as used in South Asia (from Stewart, 1825: Plate 7).

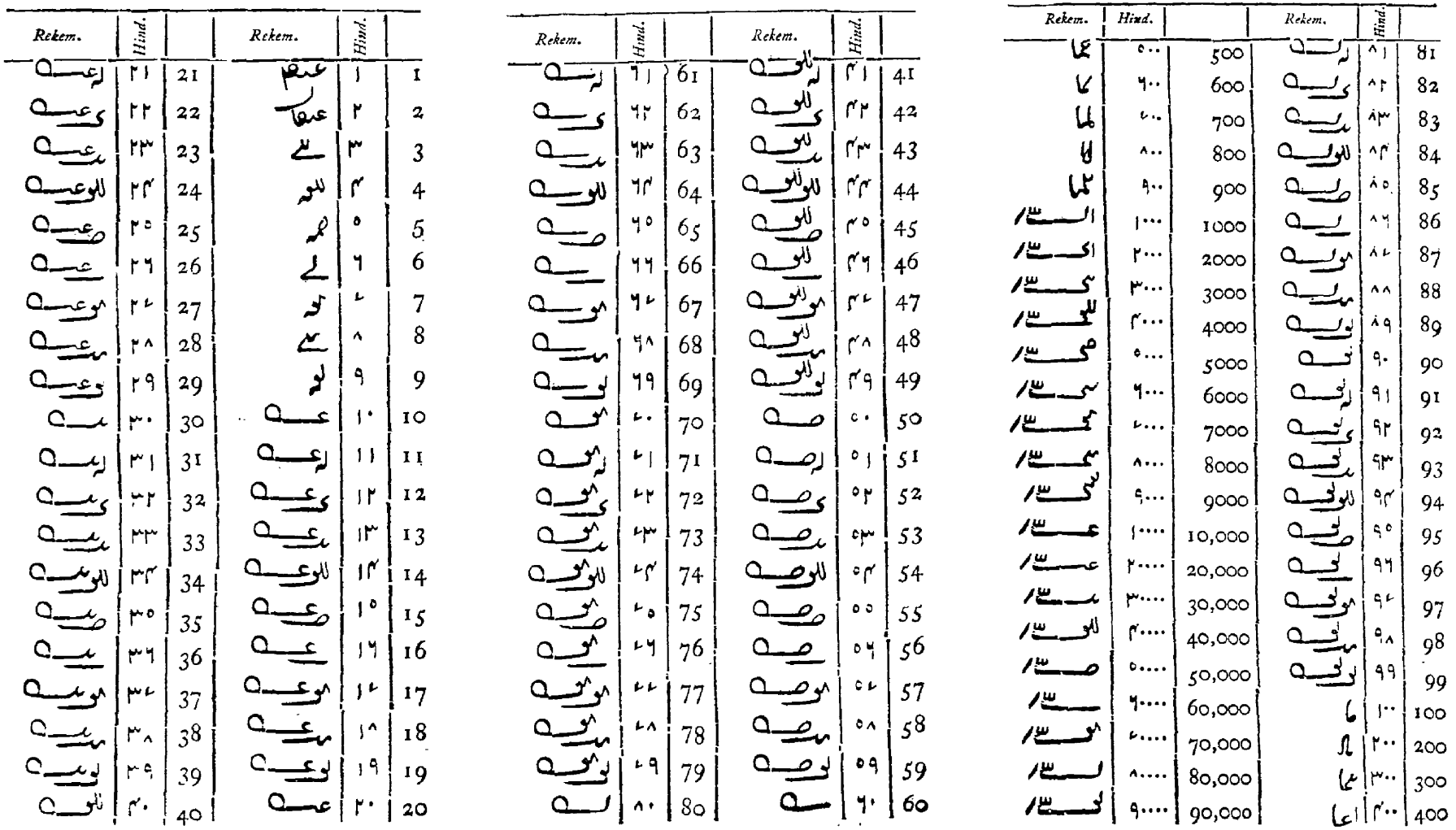


Figure 17: Table showing printed Siyaq forms as used in South Asia (from Gladwin, 1790: 2–4).

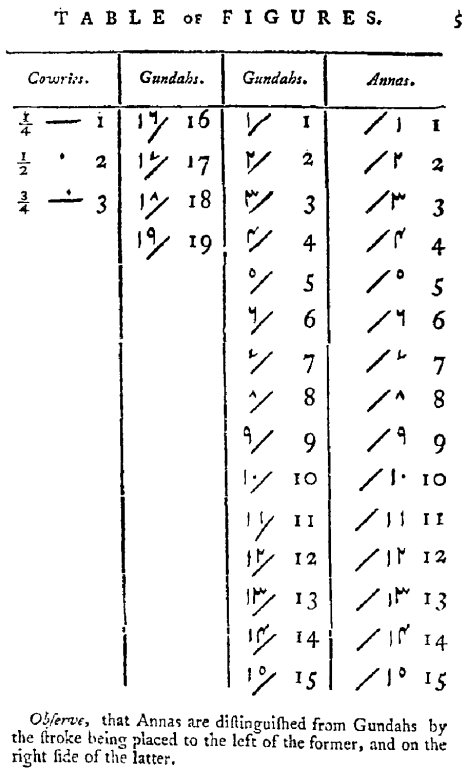


TABLE of FIGURES. 5

Cowries.	Gundahs.	Gundahs.	Annas.
¼ — 1	١٦ 16	١ 1	١ 1
½ • 2	١٧ 17	٢ 2	٢ 2
¾ —• 3	١٨ 18	٣ 3	٣ 3
	١٩ 19	٤ 4	٤ 4
		٥ 5	٥ 5
		٦ 6	٦ 6
		٧ 7	٧ 7
		٨ 8	٨ 8
		٩ 9	٩ 9
		١٠ 10	١٠ 10
		١١ 11	١١ 11
		١٢ 12	١٢ 12
		١٣ 13	١٣ 13
		١٤ 14	١٤ 14
		١٥ 15	١٥ 15

Obſerve, that Annas are diſtinguiſhed from Gundahs by the ſtroke being placed to the left of the former, and on the right ſide of the latter.

Figure 18: Table showing method of writing fractions in South Asian tradition (from Gladwin, 1790: 5)

The Rekem, or Siyak characters, being only contractions of Arabic words, the following Table may serve to impress them on the memory.

Arabic Words.	*Rekem.*		*Arabic Words.*	*Rekem.*		*Arabic Words.*	*Rekem.* *joined.*	*Rekem.* *separate.*	
عشر		10	احد عشر		11	١ و			1
عشرين		20	اثنا عشر		12	عدوان			2
ثلثين		30	ثالثة عشر		13	ثالثة			3
اربعين		40	اربعة عشر		14	اربعة			4
خمسين		50	خمسة عشر		15	خمسة			5
ستين		60	ستة عشر		16	ستة			6
سبعين		70	سبعة عشر		17	سبعة			7
ثمانين		80	ثمانية عشر		18	ثمانية			8
تسعين		90	تسعة عشر		19	تسعة			9

N O T E.

It is neceſſary to remark regarding the two firſt digits, that when combined with tens, لـ is a contraction of احد, and ـى of اثنا

Arabic Words.	*Rekem.*		*Arabic Words.*	*Rekem.*	
الف		1000	مائة		100
الفان		2000	مائتان		200
ثلثة آلاف		3000	ثلثمائة		300
اربعة آلاف		4000	اربعمائة		400
خمسة آلاف		5000	خمسمائة		500
ستة آلاف		6000	ستمائة		600
سبعة آلاف		7000	سبعمائة		700
ثمانية آلاف		8000	ثمانمائة		800
تسعة آلاف		9000	تسعمائة		900

Figure 19: Table showing the Arabic sources of Siyaq forms (from Gladwin, 1790: 6–7).

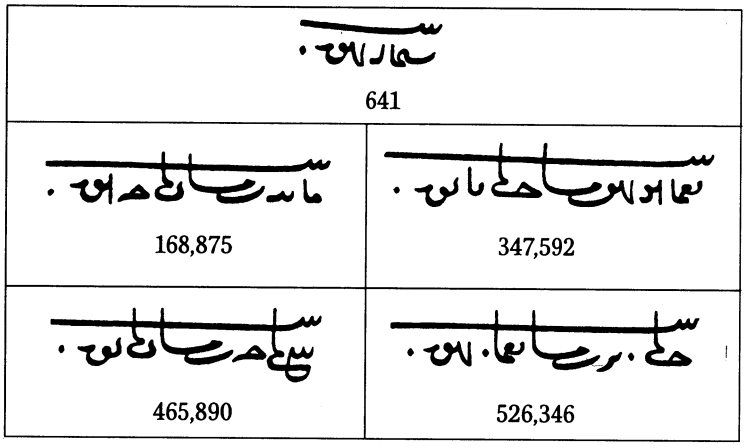


Figure 20: Turkish composite numbers (from Ifrah, 2000: 548).