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Title: Proposal to Encode Coptic Numerals in ISO/IEC 10646
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1 Introduction

This is a proposal to encode Coptic Numerals in the Universal Character Set (ISO/IEC 10646). The characters proposed here are elements of a Coptic numeric notation system that differs from the representation of numbers using letters from the Coptic alphabet (see Table 1 for a comparison of the two systems). The Coptic Numerals belong to a notation system has unique numerals for the primary, tens, and hundreds units. The thousands are represented by writing a slash-mark beneath the numerals.

The Coptic Numerals were not included by Michael Everson in his "Revised proposal to add the Coptic alphabet to the BMP of the UCS" (N2636). The Coptic Numerals proposed here appear in Figure 14 of N2636, an excerpt of which is given in Figure 4. In the caption of the figure, Everson writes that "further study may indicate that some of the additional characters and symbols shown here should also be added to the Standard". Indeed, additional research has shown that the 'Signes de numération' illustrated in the figure were also described by Antoine P. Pihan in her *Exposé des signes de numération* (see Figure 2). Encoding these characters in the UCS will enable representation of the historical numeric notation system of Coptic.

2 Characters Proposed

There is a requirement of 29 characters for fully representing the Coptic Numerals:

Primary Numerals Nine characters:

ⲇ	COPTIC NUMERAL ONE	ⲋ	COPTIC NUMERAL SIX
ⲃ	COPTIC NUMERAL TWO	ⲍ	COPTIC NUMERAL SEVEN
ⲅ	COPTIC NUMERAL THREE	ⲏ	COPTIC NUMERAL EIGHT
ⲇ	COPTIC NUMERAL FOUR	ⲑ	COPTIC NUMERAL NINE
ⲉ	COPTIC NUMERAL FIVE		

Tens Numerals Nine characters:

ⲓ	COPTIC NUMERAL TEN	ⲝ	COPTIC NUMERAL SIXTY
ⲕ	COPTIC NUMERAL TWENTY	ⲟ	COPTIC NUMERAL SEVENTY
ⲗ	COPTIC NUMERAL THIRTY	ⲡ	COPTIC NUMERAL EIGHTY
ⲙ	COPTIC NUMERAL FORTY	ⲟ	COPTIC NUMERAL NINETY
ⲛ	COPTIC NUMERAL FIFTY		

Hundreds Numerals Nine characters:

ϣ	COPTIC NUMERAL ONE HUNDRED	ϧ	COPTIC NUMERAL SIX HUNDRED
ϥ	COPTIC NUMERAL TWO HUNDRED	ϩ	COPTIC NUMERAL SEVEN HUNDRED
ϧ	COPTIC NUMERAL THREE HUNDRED	ϫ	COPTIC NUMERAL EIGHT HUNDRED
ϩ	COPTIC NUMERAL FOUR HUNDRED	ϭ	COPTIC NUMERAL NINE HUNDRED
ϫ	COPTIC NUMERAL FIVE HUNDRED		

Various Signs Two characters:

◌͵	COPTIC THOUSANDS MARK	◌̿	COPTIC NUMBER MARK

3 The Notation System

Structure Coptic Numerals represent units of a base-10 (decimal) positional system. The notation system is additive, that is, the value of a number is the sum of the values of the numerals that constitute it. There is no character for zero; it is inherently represented in the distinct numerals for the various decimal orders. The numerals are written left-to-right.

Orthography The thousands are represented by writing the primary numerals and ◌͵ COPTIC THOUSANDS MARK: ϵ FIVE + ◌͵ THOUSANDS MARK = ϵ͵ 5,000. The ten thousands are written using the tens numerals and the THOUSANDS MARK: ν FIFTY + ◌͵ THOUSANDS MARK = ν͵ 50,000. The hundred thousands are written with the numerals for the hundreds and the THOUSANDS MARK: ϫ FIVE HUNDRED + ◌͵ THOUSANDS MARK = ϫ͵ 500,000.

Numbers of decimal orders larger than the hundred thousands may theoretically be represented by multiple use of the THOUSANDS MARK, however, this practice is unattested. This practice is similar in principle to the writing of numbers using letters of the Coptic alphabet, where the overline is doubled to indicate the orders of the thousands.

Composite numbers are producing using the primary numerals and the numerals of larger decimal orders. The larger numeral is written first, then the primary numeral: ωϵ = 25 (TWENTY + FIVE); ϣϵ = 205 (TWO HUNDRED + FIVE); ϣν = 250 (TWO HUNDRED + FIFTY);

Numbers are marked using the ◌̿ COPTIC NUMBER MARK. The length of the NUMBER MARK extends to cover the number of numerals written. ιϵ̿ = 15; ϫν̿ = 550; ϵ͵ϫϵ̿ = 5,505.

4 Implementation

4.1 Allocation

There is no allocation for the Coptic Numerals in the Unicode Roadmaps. Also, there is no space in the Coptic block (U+2C80..2CFF) or in the the Greek and Coptic block (U+0370..03FF). An allocation for Coptic Numerals requires a minimum of 29 code-points. Some space should be reserved to account for fraction signs and other characters that may be identified through additional investigation. The range U+102E0..102FF in the Supplementary Multilingual Plane (SMP) is a possible location for Coptic Numerals, offering 32 code-points.

4.2 Character Properties

The Coptic Numerals have the following properties, expressed in the format of the Unicode Character Database:

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xx01 COPTIC NUMERAL ONE;No;0;L;;;;1;N;;;;;
xx02 COPTIC NUMERAL TWO;No;0;L;;;;2;N;;;;;
xx03 COPTIC NUMERAL THREE;No;0;L;;;;3;N;;;;;
xx04 COPTIC NUMERAL FOUR;No;0;L;;;;4;N;;;;;
xx05 COPTIC NUMERAL FIVE;No;0;L;;;;5;N;;;;;
xx06 COPTIC NUMERAL SIX;No;0;L;;;;6;N;;;;;;
xx07 COPTIC NUMERAL SEVEN;No;0;L;;;;7;N;;;;;
xx08 COPTIC NUMERAL EIGHT;No;0;L;;;;8;N;;;;;
xx09 COPTIC NUMERAL NINE;No;0;L;;;;9;N;;;;;
xx0A COPTIC NUMERAL TEN;No;0;L;;;;10;N;;;;;
xx0B COPTIC NUMERAL TWENTY;No;0;L;;;;20;N;;;;;
xx0C COPTIC NUMERAL THIRTY;No;0;L;;;;30;N;;;;;
xx0D COPTIC NUMERAL FORTY;No;0;L;;;;40;N;;;;;
xx0E COPTIC NUMERAL FIFTY;No;0;L;;;;50;N;;;;;
xx0F COPTIC NUMERAL SIXTY;No;0;L;;;;60;N;;;;;
xx10 COPTIC NUMERAL SEVENTY;No;0;L;;;;70;N;;;;;
xx11 COPTIC NUMERAL EIGHTY;No;0;L;;;;80;N;;;;;
xx12 COPTIC NUMERAL NINETY;No;0;L;;;;90;N;;;;;
xx13 COPTIC NUMERAL ONE HUNDRED;No;0;L;;;;100;N;;;;;
xx14 COPTIC NUMERAL TWO HUNDRED;No;0;L;;;;200;N;;;;;
xx15 COPTIC NUMERAL THREE HUNDRED;No;0;L;;;;300;N;;;;;
xx16 COPTIC NUMERAL FOUR HUNDRED;No;0;L;;;;400;N;;;;;
xx17 COPTIC NUMERAL FIVE HUNDRED;No;0;L;;;;500;N;;;;;
XX18 COPTIC NUMERAL SIX HUNDRED;No;0;L;;;;600;N;;;;;
XX19 COPTIC NUMERAL SEVEN HUNDRED;No;0;L;;;;700;N;;;;;;
xx2A COPTIC NUMERAL EIGHT HUNDRED;No;0;L;;;;800;N;;;;;
xx2B COPTIC NUMERAL NINE HUNDRED;No;0;L;;;;900;N;;;;;
XX2C COPTIC THOUSANDS MARK;Mn;0;NSM;;;;1000;N;;;;;
XX2D COPTIC NUMBER MARK;So;0;ET;;;;;N;;;;;
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5 References

Everson, Michael. 2003. “Revised proposal to add the Coptic alphabet to the BMP of the UCS.” ISO/IEC JTC1/SC2/WG2 N2636. October 1, 2003. http://std.dkuug.dk/jtc1/sc2/wg2/docs/n2636.pdf

King, David A. 2001. *The Ciphers of the Monks: A Forgotten Number-Notation of the Middle Ages*. Stuttgart: F. Steiner.

Pihan, Antoine Paulin. 1860. *Exposé des signes de numération usités chez les peuples orientaux anciens et modernes*. Paris: L’imprimerie impériale.

	1	2	3	4	5	6	7	8	9
1	ⲁ	ⲃ	ⲅ	ⲇ	ⲉ	ⲋ	ⲍ	ⲏ	ⲑ
	ⳁ	ⳃ	ⳅ	ⳇ	ⳉ	ⳋ	ⳍ	ⳏ	ⳑ
10	ⲓ	ⲕ	ⲗ	ⲙ	ⲛ	ⲝ	ⲟ	ⲡ	ⲣ
	ⳓ	ⳕ	ⳗ	ⳙ	ⳛ	ⳝ	ⳟ	ⳡ	ⳣ
100	ⲥ	ⲧ	ⲩ	ⲫ	ⲭ	ⲯ	ⲱ	ⲳ	ⲵ
	⳥	⳧	⳩	Ⳬ	Ⳮ	ⳮ	⳯	Ⳳ	⳶
1,000	ⲁ͵	ⲃ͵	ⲅ͵	ⲇ͵	ⲉ͵	ⲋ͵	ⲍ͵	ⲏ͵	ⲑ͵
	ⳁ͵	ⳃ͵	ⳅ͵	ⳇ͵	ⳉ͵	ⳋ͵	ⳍ͵	ⳏ͵	ⳑ͵
10,000	ⲓ͵	ⲕ͵	ⲗ͵	ⲙ͵	ⲛ͵	ⲝ͵	ⲟ͵	ⲡ͵	ⲣ͵
	ⳓ͵	ⳕ͵	ⳗ͵	ⳙ͵	ⳛ͵	ⳝ͵	ⳟ͵	ⳡ͵	ⳣ͵
100,000	ⲥ͵	ⲧ͵	ⲩ͵	ⲫ͵	ⲭ͵	ⲯ͵	ⲱ͵	ⲳ͵	ⲵ͵
	⳥ͅ	⳧ͅ	⳩ͅ	Ⳬͅ	Ⳮͅ	ⳮͅ	⳯ͅ	Ⳳͅ	⳶ͅ

Table 1: Numbers written using Coptic Numerals (top) and the alphabetic system (bottom).

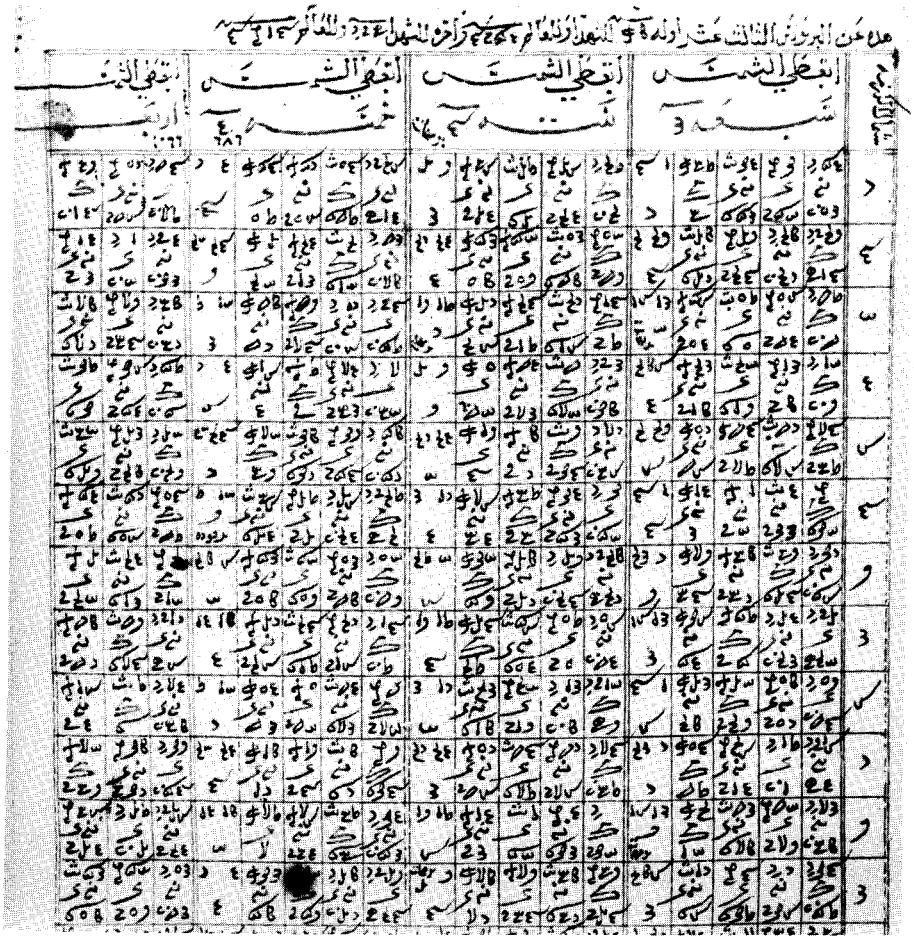

Fig. C.6 Coptic numerals in a copy from *ca.* 1800 of a set of astronomical tables by the early-13th-century Coptic scholar Ibn ‘Assal. This notation has separate, unrelated symbols for the units, tens and hundreds, *etc.*, and for simple fractions. (From MS Cairo DM 910,1, fol. 81v, courtesy of the Egyptian National Library.)

Figure 1: Excerpt of a manuscript showing the use of Coptic Numerals with the Arabic script (from King 2001: Appendix C, p. 299).

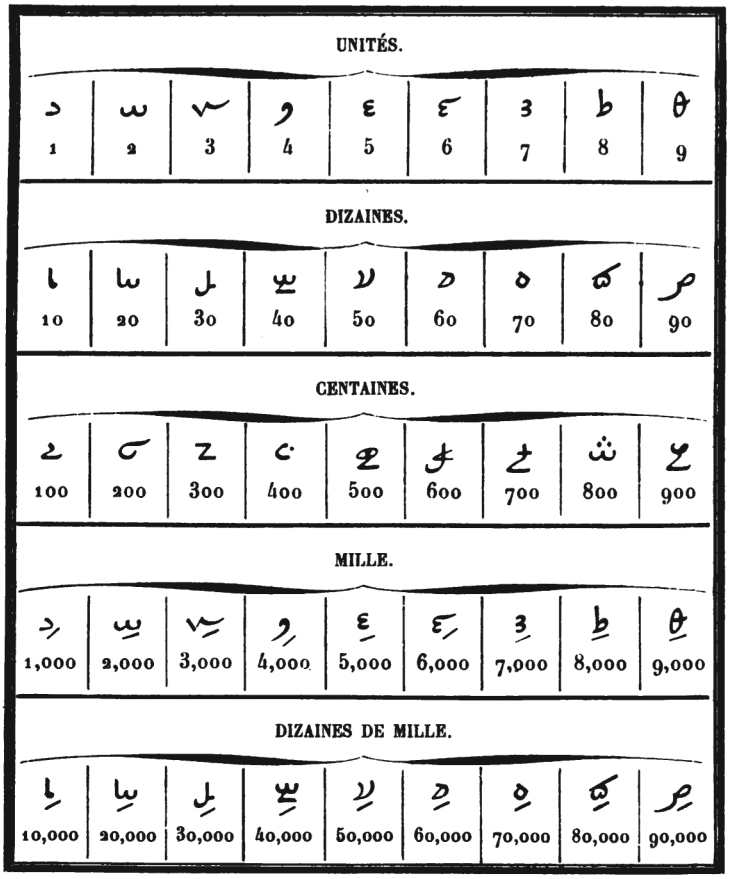

Figure 2: Table showing the forms of Coptic Numerals (from Pihan 1860: 213). Compare the Coptic Numerals to the alphabetic system system shown in Figure 5.

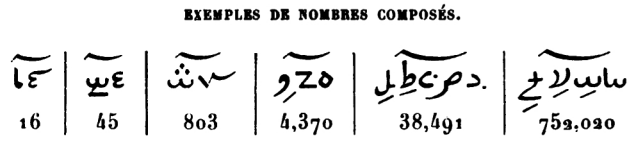

Figure 3: Table showing composite numbers written with Coptic Numerals (from Pihan 1860: 214).

Figure 4: Coptic Numerals for the primary, tens, hundreds, and thousands shown in a specimen of Coptic type under the heading 'Signes de numération'. Two length variants of the COPTIC NUMBER MARK are shown under the heading 'Lettres accentuées...'(reproduced from Everson 2003: Figure 14).

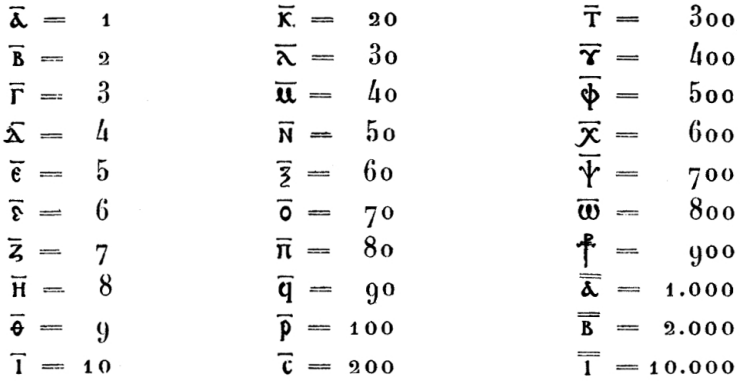

Figure 5: The representation of numbers in Coptic using letters of the alphabet and horizontal overlines (reproduced from Everson 2003: Figure 12).