Archaic cuneiform numerals

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1 Summary

This document proposes encoding, at U+12550–U+12586, 311 numerals used in the fourth millennium (Uruk IV and Uruk III periods) and Early Dynastic period in conjunction with the Sumero-Akkadian cuneiform script[1] and the proto-cuneiform script[2]. The proposed characters are listed in §2. Most of them were listed in [L2/23-190]. The present document provides a more detailed rationale for their encoding and additional information about their identity and usage, both as part of the rationale and in §5. Some characters have been removed, in some cases because they are non-encodable variants, in others because their encodability should be considered as part of the proto-cuneiform proposal; these are discussed in §6. The glyphs have also been reworked, and additional characters used in the Early Dynastic period have been added.

The non-numeric signs of proto-cuneiform will be the subject of a separate proposal; we need only note here that the divergence between the approaches to character identity in modern scholarship requires that proto-cuneiform be disunified from cuneiform: proto-cuneiform is effectively treated as an undeciphered script. In contrast, the cuneiform encoding model requires an understanding of the text to correctly encode it.

However, the *numerals* used in proto-cuneiform should be unified with ones used in the Early Dynastic period, for the reasons set forth in §4. The proposed "curved", or "curviform", numerals[3] should however *not* be unified with the already-

[1] [ISO15924]: Xsux, Script property value long name: Cuneiform; encoded since Unicode Version 5.0.
[2] [ISO15924]: Pcun, not yet encoded.
[3] Impressed into clay using cylindrical styli, held either perpendicular to the tablet, yielding • (small stylus) or ● (large stylus), or at a shallower angle:  ,  (small stylus),  ,  (large stylus). Some numerals are composed of multiple such impressions, *e.g.*, . The terms "curved", "curviform", "curvilinear", and "round" can be found in the literature. We avoid the term "round" here as it has other meanings in the context of numbers. We use "curviform" in this document as, being the least common term, it is least likely to lead to confusion, and "CURVED" in the character names for consistency with documentation about the modifier @c used in machine readable ATF transliterations [Tin19].

encoded cuneiform numerals[4]. Since the encoding proposals for the cuneiform script twenty years ago provisionally considered the curviform numerals to be glyph variants of the cuneiform numerals, a detailed rationale is provided in §3, including compatibility considerations in §3.7.

The overall picture of unifications and disunifications over time is illustrated in table 1. The Script_Extensions property assignments in §2.3 reflect the overlap. Many of these numerals are also used in proto-Elamite[5] texts, where they are treated as identical characters in scholarship on proto-Elamite, so that they should be unified with those that were proposed (but not yet accepted) in [L2/23-196]. However, in the interest of time, we do not provide a detailed rationale for this unification in this document, and we are not proposing that the numerals be given the corresponding Script_Extensions property value for now. Neither do we propose encoding any numerals that are solely attested in proto-Elamite texts, or well-attested in proto-Elamite texts but insufficiently attested in Uruk—those are discussed in §6.

<table>
<tr><td></td><td>Uruk III & earlier</td><td>ED – Ur III</td><td>OB & later</td></tr>
<tr><td rowspan="2">Numerals</td><td colspan="2">This proposal</td><td></td></tr>
<tr><td></td><td rowspan="2" colspan="2">Existing Xsux</td></tr>
<tr><td>Non-numeric signs</td><td>Future Pcun</td></tr>
</table>

Table 1: Usage of existing, proposed, and future characters across functions and time periods.

2 Proposed changes to the Standard

2.1 Core specification text

Amend [Uni16, §11.1.2, *sub* "Cuneiform Numerals"], as follows:

> ***Cuneiform Numerals.*** In general, numerals that also have a phonetic, logographic, or determinative value are encoded in the main Cuneiform block; as a result, some series of numerals, such as 𒐕–𒐚 1(diš)–9(diš) or 𒐖–𒐞 1(u)–9(u), are split across the two blocks. Numerals have been encoded separately from signs that are visually identical but ~~semantically different~~ etymologically unrelated (for example, U+1244F 𒑏 CUNEIFORM NUMERIC SIGN ONE BAN2, U+12450 𒑐 CUNEIFORM NUMERIC SIGN TWO BAN2, and so on, versus U+12226 𒈦 CUNEIFORM SIGN MASH, U+1227A 𒉺 CUNEIFORM SIGN PA, and so on).
>
> The relation between series of numerals depends on the metrological system; for instance, when counting talents, written 𒁹 (a unit of weight, approximately 30 kg), 𒐕𒁹 is used for "one talent", and 𒐖𒁹 for "ten talents". However, when measuring areas, the area 𒆠 (one *būrum*) is eighteen times 𒐕𒆠 (one *ikûm*, approximately 3600 m^2). The Numeric_Value property assignment of a cuneiform numeral therefore

[4] Impressed into clay using a stylus with a trihedral end: 𒹰 (stylus held horizontally), 𒹱 (vertically), 𒹲 (diagonally) 𒹳 (with the head of the stylus), 𒹴 (stylus pressed deeper, forming a larger wedge), 𒹵 (combining 𒹱 and 𒹳), etc.

[5] [ISO15924]: Pelm, not yet encoded.

reflects only its relation to the first numeral in its series, rather than the absolute numeric value that it might represent. For instance, the number "fifty" is written 𒐐, but U+12410 𒐐 CUNEIFORM NUMERIC SIGN FIVE U has Numeric_Value=5, as it is 5 × 𒐋.

In the third millennium, and especially in the Early Dynastic period, some numerals are written using a cylindrical tool, rather than the cuneiform stylus, forming curved rather than cuneiform numerals (𒁹 rather than 𒁺). The cuneiform numerals are descended from these curved numerals. However, in the Early Dynastic period, the curved numerals contrast with the cuneiform ones, and are used together with them in several metrological systems; they are therefore separately encoded. Most curved numerals are encoded in the Archaic Cuneiform Numerals block, with the exception of two fractions in the Cuneiform Numbers and Punctuation block: U+1245D 𒑝 CUNEIFORM NUMERIC SIGN ONE THIRD VARIANT FORM A and U+1245E 𒑞 CUNEIFORM NUMERIC SIGN TWO THIRDS VARIANT FORM A, the curved counterparts of U+1245A 𒑚 CUNEIFORM NUMERIC SIGN ONE THIRD DISH and U+1245B 𒑛 CUNEIFORM NUMERIC SIGN TWO THIRDS DISH.

Add after [Uni16, §11.1.3]:

11.1.4 Archaic Cuneiform Numerals: U+12550–U+1268F

This block contains numerals used in the fourth millennium and third millennium. The numerals that are used in the fourth millennium and Early Dynastic I–II period (2900–2700 BCE) are named according to the conventions of the Berlin *Archaische Texte aus Uruk* (ATU) project, with names such as U+12550 𒕐 CUNEIFORM NUMERIC SIGN ONE N01 or U+125B6 𒖶 CUNEIFORM NUMERIC SIGN ONE N39A. For the signs that are also used in the third millennium, informative aliases provide correspondences to more common third millennium conventions, such as "1 aš curved" for U+12550 𒕐 CUNEIFORM NUMERIC SIGN ONE N01. The numerals that are only used starting in the Early Dynastic III period, where the ATU notation is not used, are named in the same fashion as the numerals of the Cuneiform Numbers and Punctation block.

The curved numerals are produced using cylindrical tools of two different sizes, producing small curved indents (𒕐, 𒖵, and •), and large ones (𒃻, 𒖶, and ●). These can be combined, as in U+12574 𒉾 CUNEIFORM NUMERIC SIGN ONE N48, U+12582 𒊊 CUNEIFORM NUMERIC SIGN ONE N50, or U+125A3 𒖣 CUNEIFORM NUMERIC SIGN ONE N54. Consistent sizing is important to identifying these characters, as there is no visual distinction other than size between, for instance, U+12566 𒐞 CUNEIFORM NUMERIC SIGN FIVE N14 and U+1257D 𒑊 CUNEIFORM NUMERIC SIGN FIVE N45. The reference glyphs of some of the larger signs have been resized to fit in the code charts cells, but fonts for these characters should retain consistent size across the numeral series.

Editor's note: The dashed-box convention for wide dashes, see [Uni16, §24.1.2, sub *"Dashed Box Convention"] should probably not be extended to these characters, since numbers enclosed in a real dashed box are a thing in proto-Elamite texts.*

The Numeric_Value assignments follow the same principles as in the Cuneiform Numbers and Punctuation block. Numerals used in the third millennium have the Cuneiform script property value; numerals used only in the fourth millennium have the Proto-Cuneiform script property value. Numerals used in both the fourth and third millennium have both scripts in their Script_Extensions values.

The sign ŠAR$_2$. When used logographically, the sign ŠAR$_2$ has the same (cuneiform) appearance as U+1212D 𒈬 CUNEIFORM SIGN HI in all but the most archaizing Early Dynastic texts. The character U+122B9 CUNEIFORM SIGN SHAR2 should be used for logographic šar$_2$, whether cuneiform or curved. Most period-specific fonts will have the same cuneiform glyph for U+122B9 and U+1212D. In the Early Dynastic period, numeric 1 šar$_2$ is typically written with a curved glyph, contrasting with logographic šar$_2$. U+12579 𒕹 CUNEIFORM NUMERIC SIGN ONE N45 should be used for curved 1 šar$_2$. In later periods, long after ŠAR$_2$ and ḪI have merged, even numeric 1 šar$_2$ has a cuneiform glyph. U+122B9 CUNEIFORM SIGN SHAR2 should be used for cuneiform 1 šar$_2$.

The reference glyph for U+122B9 𒊹 CUNEIFORM SIGN SHAR2 is curved, reflecting the rarer and more archaic practice, instead of cuneiform as it would be in the Ur III period, so as to distinguish it from U+1212D 𒈬 CUNEIFORM SIGN HI.

2.2 Code charts

The code charts for the proposed block, including the character names list with proposed informative aliases, cross references, and informative notes, are shown on the following pages. A plain text file containing the NamesList.txt lines is attached to this document.

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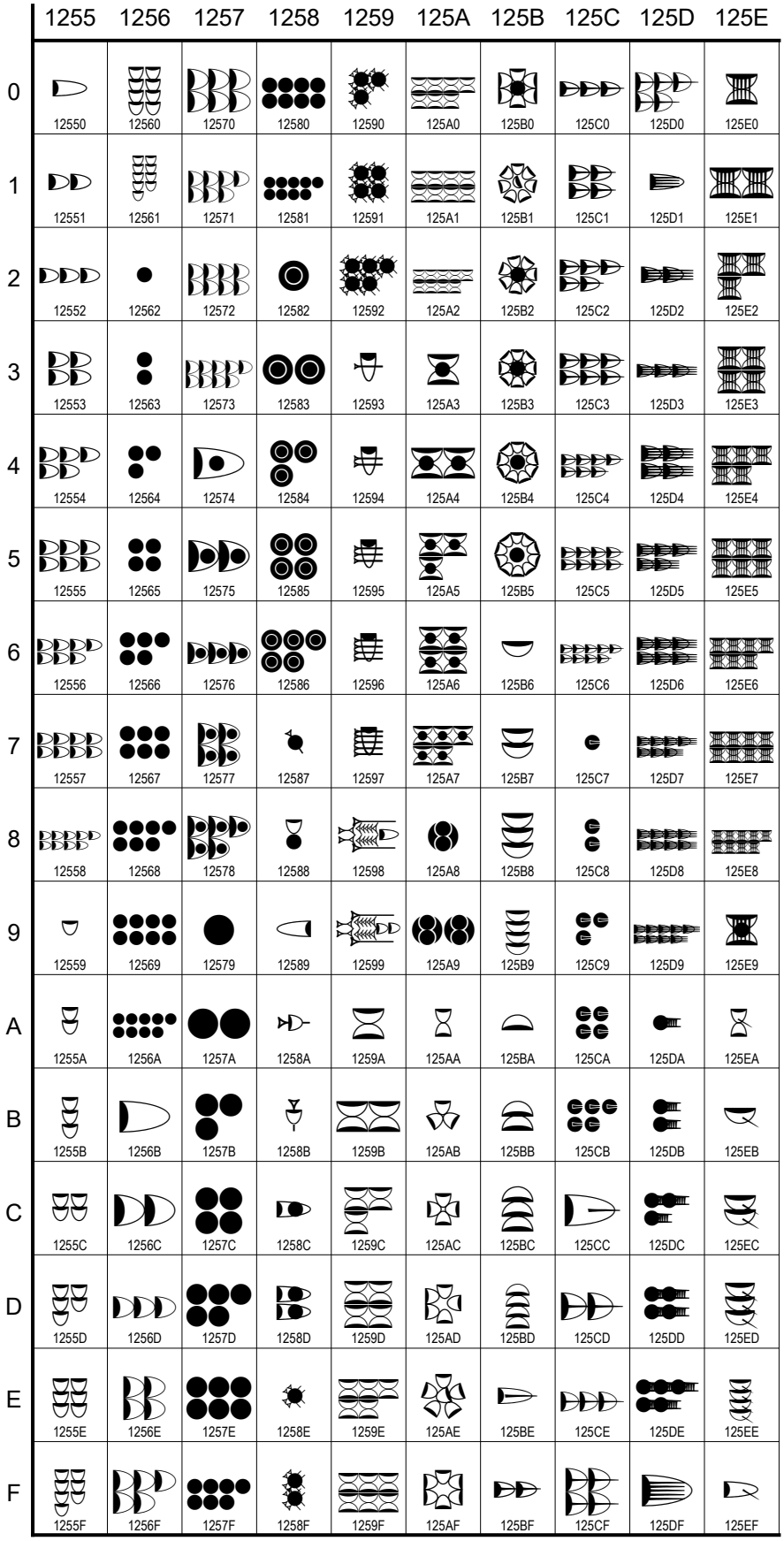
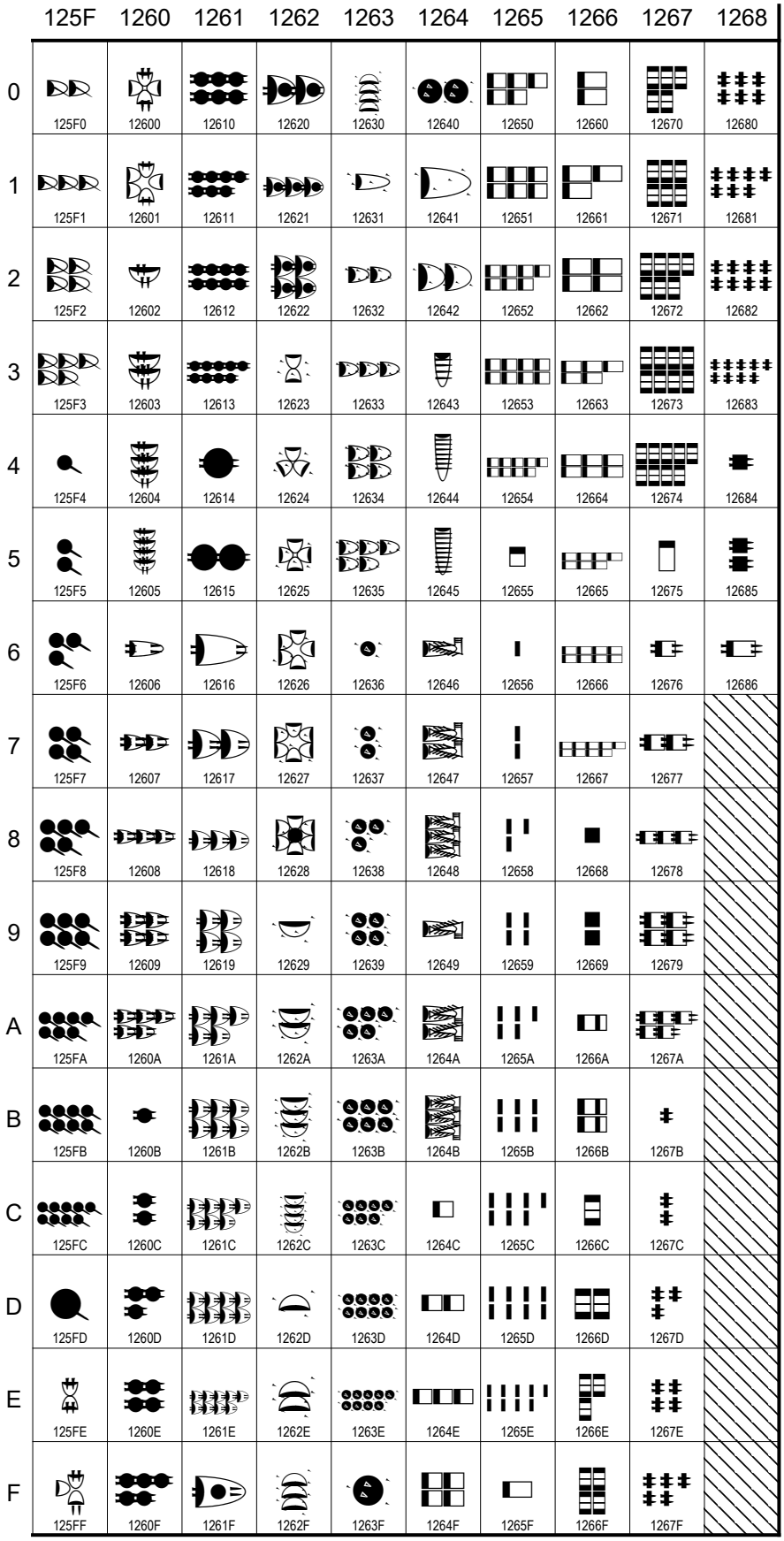

1255 1256 1257 1258 1259 125A 125B 125C 125D 125E
0 12550 12560 12570 12580 12590 125A0 125B0 125C0 125D0 125E0
1 12551 12561 12571 12581 12591 125A1 125B1 125C1 125D1 125E1
2 12552 12562 12572 12582 12592 125A2 125B2 125C2 125D2 125E2
3 12553 12563 12573 12583 12593 125A3 125B3 125C3 125D3 125E3
4 12554 12564 12574 12584 12594 125A4 125B4 125C4 125D4 125E4
5 12555 12565 12575 12585 12595 125A5 125B5 125C5 125D5 125E5
6 12556 12566 12576 12586 12596 125A6 125B6 125C6 125D6 125E6
7 12557 12567 12577 12587 12597 125A7 125B7 125C7 125D7 125E7
8 12558 12568 12578 12588 12598 125A8 125B8 125C8 125D8 125E8
9 12559 12569 12579 12589 12599 125A9 125B9 125C9 125D9 125E9
A 1255A 1256A 1257A 1258A 1259A 125AA 125BA 125CA 125DA 125EA
B 1255B 1256B 1257B 1258B 1259B 125AB 125BB 125CB 125DB 125EB
C 1255C 1256C 1257C 1258C 1259C 125AC 125BC 125CC 125DC 125EC
D 1255D 1256D 1257D 1258D 1259D 125AD 125BD 125CD 125DD 125ED
E 1255E 1256E 1257E 1258E 1259E 125AE 125BE 125CE 125DE 125EE
F 1255F 1256F 1257F 1258F 1259F 125AF 125BF 125CF 125DF 125EF


125F 1260 1261 1262 1263 1264 1265 1266 1267 1268
0 125F0 12600 12610 12620 12630 12640 12650 12660 12670 12680
1 125F1 12601 12611 12621 12631 12641 12651 12661 12671 12681
2 125F2 12602 12612 12622 12632 12642 12652 12662 12672 12682
3 125F3 12603 12613 12623 12633 12643 12653 12663 12673 12683
4 125F4 12604 12614 12624 12634 12644 12654 12664 12674 12684
5 125F5 12605 12615 12625 12635 12645 12655 12665 12675 12685
6 125F6 12606 12616 12626 12636 12646 12656 12666 12676 12686
7 125F7 12607 12617 12627 12637 12647 12657 12667 12677
8 125F8 12608 12618 12628 12638 12648 12658 12668 12678
9 125F9 12609 12619 12629 12639 12649 12659 12669 12679
A 125FA 1260A 1261A 1262A 1263A 1264A 1265A 1266A 1267A
B 125FB 1260B 1261B 1262B 1263B 1264B 1265B 1266B 1267B
C 125FC 1260C 1261C 1262C 1263C 1264C 1265C 1266C 1267C
D 125FD 1260D 1261D 1262D 1263D 1264D 1265D 1266D 1267D
E 125FE 1260E 1261E 1262E 1263E 1264E 1265E 1266E 1267E
F 125FF 1260F 1261F 1262F 1263F 1264F 1265F 1266F 1267F

Many of the reference glyphs for the higher numbers (THREE and above, in some cases TWO) have been rescaled to fit the code chart cells. They should be sized consistently with the corresponding ONE numerals.

Common Numerals

Used in the sexagesimal discrete counting system and other metrological systems

12550 CUNEIFORM NUMERIC SIGN ONE N01
= 1 aš curved
→ 12038 𒁹 cuneiform sign ash
• often used instead of diš in Early Dynastic counterparts of cuneiform metrological systems
→ 12079 𒁴 cuneiform sign dish

12551 CUNEIFORM NUMERIC SIGN TWO N01
→ 12400 𒐙 cuneiform numeric sign two ash

12552 CUNEIFORM NUMERIC SIGN THREE N01

12553 CUNEIFORM NUMERIC SIGN FOUR N01

12554 CUNEIFORM NUMERIC SIGN FIVE N01

12555 CUNEIFORM NUMERIC SIGN SIX N01

12556 CUNEIFORM NUMERIC SIGN SEVEN N01

12557 CUNEIFORM NUMERIC SIGN EIGHT N01

12558 CUNEIFORM NUMERIC SIGN NINE N01

12559 CUNEIFORM NUMERIC SIGN ONE N08
= 1 diš curved
→ 12079 𒁴 cuneiform sign dish
= 1/2 iku curved
• used for one half in multiple metrological systems
→ 12039 𒁺 cuneiform sign ash zida tenu
→ 12226 𒐦 cuneiform sign mash
= 1 bariga curved
• used in Early Dynastic capacity systems

1255A CUNEIFORM NUMERIC SIGN TWO N08
→ 1222B 𒈫 cuneiform sign min
= 2 bariga curved
→ 12456 𒑖 cuneiform numeric sign nigidamin

1255B CUNEIFORM NUMERIC SIGN THREE N08
→ 12408 𒐫 cuneiform numeric sign three dish
• used in Early Dynastic capacity systems
= 3 bariga curved
→ 12457 𒑗 cuneiform numeric sign nigidaesh

1255C CUNEIFORM NUMERIC SIGN FOUR N08

1255D CUNEIFORM NUMERIC SIGN FIVE N08

1255E CUNEIFORM NUMERIC SIGN SIX N08

1255F CUNEIFORM NUMERIC SIGN SEVEN N08

12560 CUNEIFORM NUMERIC SIGN EIGHT N08

12561 CUNEIFORM NUMERIC SIGN NINE N08

12562 CUNEIFORM NUMERIC SIGN ONE N14
= 1 u curved
= 1 bur_3 curved
→ 1230B 𒄀 cuneiform sign u

12563 CUNEIFORM NUMERIC SIGN TWO N14
→ 12399 𒐘 cuneiform sign u u

12564 CUNEIFORM NUMERIC SIGN THREE N14
→ 1230D 𒄄 cuneiform sign u u u

12565 CUNEIFORM NUMERIC SIGN FOUR N14
→ 1240F 𒐯 cuneiform numeric sign four u

12566 CUNEIFORM NUMERIC SIGN FIVE N14

12567 CUNEIFORM NUMERIC SIGN SIX N14

12568 CUNEIFORM NUMERIC SIGN SEVEN N14

12569 CUNEIFORM NUMERIC SIGN EIGHT N14

1256A CUNEIFORM NUMERIC SIGN NINE N14

1256B CUNEIFORM NUMERIC SIGN ONE N34
= 1 $ŋeš_2$ curved
→ 12415 𒐕 cuneiform numeric sign one gesh2

1256C CUNEIFORM NUMERIC SIGN TWO N34

1256D CUNEIFORM NUMERIC SIGN THREE N34

1256E CUNEIFORM NUMERIC SIGN FOUR N34

1256F CUNEIFORM NUMERIC SIGN FIVE N34

12570 CUNEIFORM NUMERIC SIGN SIX N34

12571 CUNEIFORM NUMERIC SIGN SEVEN N34

12572 CUNEIFORM NUMERIC SIGN EIGHT N34

12573 CUNEIFORM NUMERIC SIGN NINE N34

12574 CUNEIFORM NUMERIC SIGN ONE N48
= 1 $ŋeš'u$ curved
→ 1241E 𒐞 cuneiform numeric sign one geshu

12575 CUNEIFORM NUMERIC SIGN TWO N48

12576 CUNEIFORM NUMERIC SIGN THREE N48

12577 CUNEIFORM NUMERIC SIGN FOUR N48

12578 CUNEIFORM NUMERIC SIGN FIVE N48

12579 CUNEIFORM NUMERIC SIGN ONE N45
= 1 $šar_2$ curved
• 122B9 𒊹 should be used for cuneiform 1 $šar_2$
• 122B9 𒊹 should be used for logographic $šar_2$, even when curved
→ 122B9 𒊹 cuneiform sign shar2

1257A CUNEIFORM NUMERIC SIGN TWO N45

1257B CUNEIFORM NUMERIC SIGN THREE N45

1257C CUNEIFORM NUMERIC SIGN FOUR N45

1257D CUNEIFORM NUMERIC SIGN FIVE N45

1257E CUNEIFORM NUMERIC SIGN SIX N45

1257F CUNEIFORM NUMERIC SIGN SEVEN N45

12580 CUNEIFORM NUMERIC SIGN EIGHT N45

12581 CUNEIFORM NUMERIC SIGN NINE N45

12582 CUNEIFORM NUMERIC SIGN ONE N50
= 1 $šar'u$ curved
→ 1242C 𒐬 cuneiform numeric sign one sharu
• used instead of 1258E 𒌍 in fourth millennium land area systems
→ 12434 𒐴 cuneiform numeric sign one buru

12583 CUNEIFORM NUMERIC SIGN TWO N50

12584 CUNEIFORM NUMERIC SIGN THREE N50

12585 CUNEIFORM NUMERIC SIGN FOUR N50

12586 CUNEIFORM NUMERIC SIGN FIVE N50

Numerals used for land areas

Together with N08, N01, N14, N45, and N50

12587 CUNEIFORM NUMERIC SIGN ONE EIGHTH IKU CURVED
→ 1245F 𒑏 cuneiform numeric sign one eighth ash

12588 CUNEIFORM NUMERIC SIGN ONE EIGHTH IKU CURVED VARIANT FORM

12589 CUNEIFORM NUMERIC SIGN ONE N01 REVERSED
= 1/4 iku curved
→ 12460 𒑒 cuneiform numeric sign one quarter ash

1258A CUNEIFORM NUMERIC SIGN ONE QUARTER IKU CURVED VARIANT FORM

1258B CUNEIFORM NUMERIC SIGN ONE HALF IKU CURVED VARIANT FORM
→ 12039 𒁺 cuneiform sign ash zida tenu

1258C CUNEIFORM NUMERIC SIGN ONE N22
= 1 $eše_3$ curved
→ 12458 𒑘 cuneiform numeric sign one eshe3

1258D CUNEIFORM NUMERIC SIGN TWO N22

1258E CUNEIFORM NUMERIC SIGN ONE BURU CURVED
→ 12434 𒐴 cuneiform numeric sign one buru

1258F CUNEIFORM NUMERIC SIGN TWO BURU CURVED

12590 CUNEIFORM NUMERIC SIGN THREE BURU CURVED

12591 CUNEIFORM NUMERIC SIGN FOUR BURU CURVED
12592 CUNEIFORM NUMERIC SIGN FIVE BURU CURVED

Early Dynastic capacity measures

12593 CUNEIFORM NUMERIC SIGN ONE BAN2 CURVED
→ 1244F cuneiform numeric sign one ban2
= 1/2 aš curved
• used for one half in multiple metrological systems
→ 12226 cuneiform sign mash
12594 CUNEIFORM NUMERIC SIGN TWO BAN2 CURVED
12595 CUNEIFORM NUMERIC SIGN THREE BAN2 CURVED
12596 CUNEIFORM NUMERIC SIGN FOUR BAN2 CURVED
12597 CUNEIFORM NUMERIC SIGN FIVE BAN2 CURVED

Early Dynastic weight fractions

12598 CUNEIFORM NUMERIC SIGN NINDA2 TIMES SHE PLUS ONE ASH CURVED
= 1/3 aš curved variant form
→ 1245D cuneiform numeric sign one third dish variant form a
→ 1245A cuneiform numeric sign one third dish
12599 CUNEIFORM NUMERIC SIGN NINDA2 TIMES SHE PLUS TWO ASH CURVED
= 2/3 aš curved variant form
→ 1245E cuneiform numeric sign two thirds dish variant form a
→ 1245B cuneiform numeric sign two thirds dish

Numerals used in the bisexagesimal system

Together with N08, N01, N14, and N34

1259A CUNEIFORM NUMERIC SIGN ONE N51
= 1 ŋeš$_2$ curved doubled, 1 ŋešmin curved
1259B CUNEIFORM NUMERIC SIGN TWO N51
1259C CUNEIFORM NUMERIC SIGN THREE N51
1259D CUNEIFORM NUMERIC SIGN FOUR N51
1259E CUNEIFORM NUMERIC SIGN FIVE N51
1259F CUNEIFORM NUMERIC SIGN SIX N51
125A0 CUNEIFORM NUMERIC SIGN SEVEN N51
125A1 CUNEIFORM NUMERIC SIGN EIGHT N51
125A2 CUNEIFORM NUMERIC SIGN NINE N51
125A3 CUNEIFORM NUMERIC SIGN ONE N54
= 1 ŋeš'u curved doubled, 1 ŋešmin'u curved
125A4 CUNEIFORM NUMERIC SIGN TWO N54
125A5 CUNEIFORM NUMERIC SIGN THREE N54
125A6 CUNEIFORM NUMERIC SIGN FOUR N54
125A7 CUNEIFORM NUMERIC SIGN FIVE N54
125A8 CUNEIFORM NUMERIC SIGN ONE N56
125A9 CUNEIFORM NUMERIC SIGN TWO N56

Fourth millennium grain capacity measures

Used with N01, N14, N45, N34, and N48

125AA CUNEIFORM NUMERIC SIGN ONE N24
125AB CUNEIFORM NUMERIC SIGN ONE N26
125AC CUNEIFORM NUMERIC SIGN ONE N28
125AD CUNEIFORM NUMERIC SIGN ONE N29A
125AE CUNEIFORM NUMERIC SIGN ONE N29B
125AF CUNEIFORM NUMERIC SIGN ONE N30A
125B0 CUNEIFORM NUMERIC SIGN ONE N30C
125B1 CUNEIFORM NUMERIC SIGN ONE N30D
125B2 CUNEIFORM NUMERIC SIGN ONE N30E
125B3 CUNEIFORM NUMERIC SIGN ONE N31
125B4 CUNEIFORM NUMERIC SIGN ONE N32
125B5 CUNEIFORM NUMERIC SIGN ONE N33
125B6 CUNEIFORM NUMERIC SIGN ONE N39A
125B7 CUNEIFORM NUMERIC SIGN TWO N39A
125B8 CUNEIFORM NUMERIC SIGN THREE N39A
125B9 CUNEIFORM NUMERIC SIGN FOUR N39A
125BA CUNEIFORM NUMERIC SIGN ONE N39B
125BB CUNEIFORM NUMERIC SIGN TWO N39B
125BC CUNEIFORM NUMERIC SIGN THREE N39B
125BD CUNEIFORM NUMERIC SIGN FOUR N39B

Numerals of sexagesimal system S′

Used to count dead animals and jars of certain types of liquids

125BE CUNEIFORM NUMERIC SIGN ONE N02
125BF CUNEIFORM NUMERIC SIGN TWO N02
125C0 CUNEIFORM NUMERIC SIGN THREE N02
125C1 CUNEIFORM NUMERIC SIGN FOUR N02
125C2 CUNEIFORM NUMERIC SIGN FIVE N02
125C3 CUNEIFORM NUMERIC SIGN SIX N02
125C4 CUNEIFORM NUMERIC SIGN SEVEN N02
125C5 CUNEIFORM NUMERIC SIGN EIGHT N02
125C6 CUNEIFORM NUMERIC SIGN NINE N02
125C7 CUNEIFORM NUMERIC SIGN ONE N15
125C8 CUNEIFORM NUMERIC SIGN TWO N15
125C9 CUNEIFORM NUMERIC SIGN THREE N15
125CA CUNEIFORM NUMERIC SIGN FOUR N15
125CB CUNEIFORM NUMERIC SIGN FIVE N15
125CC CUNEIFORM NUMERIC SIGN ONE N35
125CD CUNEIFORM NUMERIC SIGN TWO N35
125CE CUNEIFORM NUMERIC SIGN THREE N35
125CF CUNEIFORM NUMERIC SIGN FOUR N35
125D0 CUNEIFORM NUMERIC SIGN FIVE N35

Numerals of bisexagesimal system B*

Used in the fourth millennium to count rations of an unclear nature

125D1 CUNEIFORM NUMERIC SIGN ONE N06
125D2 CUNEIFORM NUMERIC SIGN TWO N06
125D3 CUNEIFORM NUMERIC SIGN THREE N06
125D4 CUNEIFORM NUMERIC SIGN FOUR N06
125D5 CUNEIFORM NUMERIC SIGN FIVE N06
125D6 CUNEIFORM NUMERIC SIGN SIX N06
125D7 CUNEIFORM NUMERIC SIGN SEVEN N06
125D8 CUNEIFORM NUMERIC SIGN EIGHT N06
125D9 CUNEIFORM NUMERIC SIGN NINE N06
125DA CUNEIFORM NUMERIC SIGN ONE N21
125DB CUNEIFORM NUMERIC SIGN TWO N21
125DC CUNEIFORM NUMERIC SIGN THREE N21
125DD CUNEIFORM NUMERIC SIGN FOUR N21
125DE CUNEIFORM NUMERIC SIGN FIVE N21
125DF CUNEIFORM NUMERIC SIGN ONE N38
125E0 CUNEIFORM NUMERIC SIGN ONE N52
125E1 CUNEIFORM NUMERIC SIGN TWO N52
125E2 CUNEIFORM NUMERIC SIGN THREE N52
125E3 CUNEIFORM NUMERIC SIGN FOUR N52
125E4 CUNEIFORM NUMERIC SIGN FIVE N52
125E5 CUNEIFORM NUMERIC SIGN SIX N52
125E6 CUNEIFORM NUMERIC SIGN SEVEN N52
125E7 CUNEIFORM NUMERIC SIGN EIGHT N52
125E8 CUNEIFORM NUMERIC SIGN NINE N52
125E9 CUNEIFORM NUMERIC SIGN ONE N60

Numerals of capacity system Š′

Used in the fourth millennium to measure malted barley

125EA CUNEIFORM NUMERIC SIGN ONE N24A
125EB CUNEIFORM NUMERIC SIGN ONE N40
125EC CUNEIFORM NUMERIC SIGN TWO N40
125ED CUNEIFORM NUMERIC SIGN THREE N40
125EE CUNEIFORM NUMERIC SIGN FOUR N40
125EF CUNEIFORM NUMERIC SIGN ONE N03
125F0 CUNEIFORM NUMERIC SIGN TWO N03
125F1 CUNEIFORM NUMERIC SIGN THREE N03
125F2 CUNEIFORM NUMERIC SIGN FOUR N03
125F3 CUNEIFORM NUMERIC SIGN FIVE N03
125F4 CUNEIFORM NUMERIC SIGN ONE N18

125F5 CUNEIFORM NUMERIC SIGN TWO N18
125F6 CUNEIFORM NUMERIC SIGN THREE N18
125F7 CUNEIFORM NUMERIC SIGN FOUR N18
125F8 CUNEIFORM NUMERIC SIGN FIVE N18
125F9 CUNEIFORM NUMERIC SIGN SIX N18
125FA CUNEIFORM NUMERIC SIGN SEVEN N18
125FB CUNEIFORM NUMERIC SIGN EIGHT N18
125FC CUNEIFORM NUMERIC SIGN NINE N18
125FD CUNEIFORM NUMERIC SIGN ONE N45A

Numerals of capacity system Š″

Used in the fourth millennium to measure various kinds of emmer

125FE CUNEIFORM NUMERIC SIGN ONE N24B
125FF CUNEIFORM NUMERIC SIGN ONE N26B
12600 CUNEIFORM NUMERIC SIGN ONE N28B
12601 CUNEIFORM NUMERIC SIGN ONE N29AB
12602 CUNEIFORM NUMERIC SIGN ONE N41
12603 CUNEIFORM NUMERIC SIGN TWO N41
12604 CUNEIFORM NUMERIC SIGN THREE N41
12605 CUNEIFORM NUMERIC SIGN FOUR N41
12606 CUNEIFORM NUMERIC SIGN ONE N04
12607 CUNEIFORM NUMERIC SIGN TWO N04
12608 CUNEIFORM NUMERIC SIGN THREE N04
12609 CUNEIFORM NUMERIC SIGN FOUR N04
1260A CUNEIFORM NUMERIC SIGN FIVE N04
1260B CUNEIFORM NUMERIC SIGN ONE N19
1260C CUNEIFORM NUMERIC SIGN TWO N19
1260D CUNEIFORM NUMERIC SIGN THREE N19
1260E CUNEIFORM NUMERIC SIGN FOUR N19
1260F CUNEIFORM NUMERIC SIGN FIVE N19
12610 CUNEIFORM NUMERIC SIGN SIX N19
12611 CUNEIFORM NUMERIC SIGN SEVEN N19
12612 CUNEIFORM NUMERIC SIGN EIGHT N19
12613 CUNEIFORM NUMERIC SIGN NINE N19
12614 CUNEIFORM NUMERIC SIGN ONE N46
12615 CUNEIFORM NUMERIC SIGN TWO N46
12616 CUNEIFORM NUMERIC SIGN ONE N36
12617 CUNEIFORM NUMERIC SIGN TWO N36
12618 CUNEIFORM NUMERIC SIGN THREE N36
12619 CUNEIFORM NUMERIC SIGN FOUR N36
1261A CUNEIFORM NUMERIC SIGN FIVE N36
1261B CUNEIFORM NUMERIC SIGN SIX N36
1261C CUNEIFORM NUMERIC SIGN SEVEN N36
1261D CUNEIFORM NUMERIC SIGN EIGHT N36
1261E CUNEIFORM NUMERIC SIGN NINE N36
1261F CUNEIFORM NUMERIC SIGN ONE N49
12620 CUNEIFORM NUMERIC SIGN TWO N49
12621 CUNEIFORM NUMERIC SIGN THREE N49
12622 CUNEIFORM NUMERIC SIGN FOUR N49

Numerals of capacity system Š*

Used in the fourth millennium to measure barley groats

12623 CUNEIFORM NUMERIC SIGN ONE N25
12624 CUNEIFORM NUMERIC SIGN ONE N27
12625 CUNEIFORM NUMERIC SIGN ONE N28C
12626 CUNEIFORM NUMERIC SIGN ONE N29AC
12627 CUNEIFORM NUMERIC SIGN ONE N30AC
12628 CUNEIFORM NUMERIC SIGN ONE N30CC
12629 CUNEIFORM NUMERIC SIGN ONE N42A
1262A CUNEIFORM NUMERIC SIGN TWO N42A
1262B CUNEIFORM NUMERIC SIGN THREE N42A
1262C CUNEIFORM NUMERIC SIGN FOUR N42A
1262D CUNEIFORM NUMERIC SIGN ONE N42B
1262E CUNEIFORM NUMERIC SIGN TWO N42B
1262F CUNEIFORM NUMERIC SIGN THREE N42B
12630 CUNEIFORM NUMERIC SIGN FOUR N42B
12631 CUNEIFORM NUMERIC SIGN ONE N05
12632 CUNEIFORM NUMERIC SIGN TWO N05
12633 CUNEIFORM NUMERIC SIGN THREE N05
12634 CUNEIFORM NUMERIC SIGN FOUR N05
12635 CUNEIFORM NUMERIC SIGN FIVE N05
12636 CUNEIFORM NUMERIC SIGN ONE N20
12637 CUNEIFORM NUMERIC SIGN TWO N20
12638 CUNEIFORM NUMERIC SIGN THREE N20
12639 CUNEIFORM NUMERIC SIGN FOUR N20
1263A CUNEIFORM NUMERIC SIGN FIVE N20
1263B CUNEIFORM NUMERIC SIGN SIX N20
1263C CUNEIFORM NUMERIC SIGN SEVEN N20
1263D CUNEIFORM NUMERIC SIGN EIGHT N20
1263E CUNEIFORM NUMERIC SIGN NINE N20
1263F CUNEIFORM NUMERIC SIGN ONE N47
12640 CUNEIFORM NUMERIC SIGN TWO N47
12641 CUNEIFORM NUMERIC SIGN ONE N37
12642 CUNEIFORM NUMERIC SIGN TWO N37

Numerals of system EN

Only attested in the Uruk IV period

12643 CUNEIFORM NUMERIC SIGN ONE N09
12644 CUNEIFORM NUMERIC SIGN ONE N11
12645 CUNEIFORM NUMERIC SIGN ONE N12
12646 CUNEIFORM NUMERIC SIGN ONE N07A
12647 CUNEIFORM NUMERIC SIGN TWO N07A
12648 CUNEIFORM NUMERIC SIGN THREE N07A
12649 CUNEIFORM NUMERIC SIGN ONE N07B
1264A CUNEIFORM NUMERIC SIGN TWO N07B
1264B CUNEIFORM NUMERIC SIGN THREE N07B

Flat numerals

Rectangular numerals impressed with a flat tool, used in Ur in the Early Dynastic I–II period

1264C CUNEIFORM NUMERIC SIGN ONE N01 FLAT
= 1 aš flat
→ 12038 ← cuneiform sign ash
1264D CUNEIFORM NUMERIC SIGN TWO N01 FLAT
1264E CUNEIFORM NUMERIC SIGN THREE N01 FLAT
1264F CUNEIFORM NUMERIC SIGN FOUR N01 FLAT
12650 CUNEIFORM NUMERIC SIGN FIVE N01 FLAT
12651 CUNEIFORM NUMERIC SIGN SIX N01 FLAT
12652 CUNEIFORM NUMERIC SIGN SEVEN N01 FLAT
12653 CUNEIFORM NUMERIC SIGN EIGHT N01 FLAT
12654 CUNEIFORM NUMERIC SIGN NINE N01 FLAT
12655 CUNEIFORM NUMERIC SIGN ONE N08 FLAT
12656 CUNEIFORM NUMERIC SIGN ONE N14 FLAT
= 1 u flat
→ 1230B ᚲ cuneiform sign u
12657 CUNEIFORM NUMERIC SIGN TWO N14 FLAT
12658 CUNEIFORM NUMERIC SIGN THREE N14 FLAT
12659 CUNEIFORM NUMERIC SIGN FOUR N14 FLAT
1265A CUNEIFORM NUMERIC SIGN FIVE N14 FLAT
1265B CUNEIFORM NUMERIC SIGN SIX N14 FLAT
1265C CUNEIFORM NUMERIC SIGN SEVEN N14 FLAT
1265D CUNEIFORM NUMERIC SIGN EIGHT N14 FLAT
1265E CUNEIFORM NUMERIC SIGN NINE N14 FLAT
1265F CUNEIFORM NUMERIC SIGN ONE N34 FLAT
12660 CUNEIFORM NUMERIC SIGN TWO N34 FLAT
12661 CUNEIFORM NUMERIC SIGN THREE N34 FLAT
12662 CUNEIFORM NUMERIC SIGN FOUR N34 FLAT
12663 CUNEIFORM NUMERIC SIGN FIVE N34 FLAT
12664 CUNEIFORM NUMERIC SIGN SIX N34 FLAT
12665 CUNEIFORM NUMERIC SIGN SEVEN N34 FLAT
12666 CUNEIFORM NUMERIC SIGN EIGHT N34 FLAT
12667 CUNEIFORM NUMERIC SIGN NINE N34 FLAT
12668 CUNEIFORM NUMERIC SIGN ONE N45 FLAT
12669 CUNEIFORM NUMERIC SIGN TWO N45 FLAT
1266A CUNEIFORM NUMERIC SIGN ONE N22 FLAT
1266B CUNEIFORM NUMERIC SIGN TWO N22 FLAT
1266C CUNEIFORM NUMERIC SIGN ONE N51 FLAT
1266D CUNEIFORM NUMERIC SIGN TWO N51 FLAT

1266E CUNEIFORM NUMERIC SIGN THREE N51 FLAT
1266F CUNEIFORM NUMERIC SIGN FOUR N51 FLAT
12670 CUNEIFORM NUMERIC SIGN FIVE N51 FLAT
12671 CUNEIFORM NUMERIC SIGN SIX N51 FLAT
12672 CUNEIFORM NUMERIC SIGN SEVEN N51 FLAT
12673 CUNEIFORM NUMERIC SIGN EIGHT N51 FLAT
12674 CUNEIFORM NUMERIC SIGN NINE N51 FLAT
12675 CUNEIFORM NUMERIC SIGN ONE N34 FLAT TENU
= 1 n39a flat
12676 CUNEIFORM NUMERIC SIGN ONE N04 FLAT
12677 CUNEIFORM NUMERIC SIGN TWO N04 FLAT
12678 CUNEIFORM NUMERIC SIGN THREE N04 FLAT
12679 CUNEIFORM NUMERIC SIGN FOUR N04 FLAT
1267A CUNEIFORM NUMERIC SIGN FIVE N04 FLAT
1267B CUNEIFORM NUMERIC SIGN ONE N19 FLAT
1267C CUNEIFORM NUMERIC SIGN TWO N19 FLAT
1267D CUNEIFORM NUMERIC SIGN THREE N19 FLAT
1267E CUNEIFORM NUMERIC SIGN FOUR N19 FLAT
1267F CUNEIFORM NUMERIC SIGN FIVE N19 FLAT
12680 CUNEIFORM NUMERIC SIGN SIX N19 FLAT
12681 CUNEIFORM NUMERIC SIGN SEVEN N19 FLAT
12682 CUNEIFORM NUMERIC SIGN EIGHT N19 FLAT
12683 CUNEIFORM NUMERIC SIGN NINE N19 FLAT
12684 CUNEIFORM NUMERIC SIGN ONE N46 FLAT
12685 CUNEIFORM NUMERIC SIGN TWO N46 FLAT
12686 CUNEIFORM NUMERIC SIGN ONE N36 FLAT

2.3 Properties

Add to the respective UCD files the lines given in this section. These are available as plain text files attached to this document. Changes to derived files are not listed.

2.3.1 Name, General_Category, Numeric_Value, etc.

Attached: UnicodeData.txt.

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12550;CUNEIFORM NUMERIC SIGN ONE N01;Nl;0;L;;;;1;N;;;;;
12551;CUNEIFORM NUMERIC SIGN TWO N01;Nl;0;L;;;;2;N;;;;;
12552;CUNEIFORM NUMERIC SIGN THREE N01;Nl;0;L;;;;3;N;;;;;
12553;CUNEIFORM NUMERIC SIGN FOUR N01;Nl;0;L;;;;4;N;;;;;
12554;CUNEIFORM NUMERIC SIGN FIVE N01;Nl;0;L;;;;5;N;;;;;
12555;CUNEIFORM NUMERIC SIGN SIX N01;Nl;0;L;;;;6;N;;;;;
12556;CUNEIFORM NUMERIC SIGN SEVEN N01;Nl;0;L;;;;7;N;;;;;
12557;CUNEIFORM NUMERIC SIGN EIGHT N01;Nl;0;L;;;;8;N;;;;;
12558;CUNEIFORM NUMERIC SIGN NINE N01;Nl;0;L;;;;9;N;;;;;
12559;CUNEIFORM NUMERIC SIGN ONE N08;Nl;0;L;;;;1;N;;;;;
1255A;CUNEIFORM NUMERIC SIGN TWO N08;Nl;0;L;;;;2;N;;;;;
1255B;CUNEIFORM NUMERIC SIGN THREE N08;Nl;0;L;;;;3;N;;;;;
1255C;CUNEIFORM NUMERIC SIGN FOUR N08;Nl;0;L;;;;4;N;;;;;
1255D;CUNEIFORM NUMERIC SIGN FIVE N08;Nl;0;L;;;;5;N;;;;;
1255E;CUNEIFORM NUMERIC SIGN SIX N08;Nl;0;L;;;;6;N;;;;;
1255F;CUNEIFORM NUMERIC SIGN SEVEN N08;Nl;0;L;;;;7;N;;;;;
12560;CUNEIFORM NUMERIC SIGN EIGHT N08;Nl;0;L;;;;8;N;;;;;
12561;CUNEIFORM NUMERIC SIGN NINE N08;Nl;0;L;;;;9;N;;;;;
12562;CUNEIFORM NUMERIC SIGN ONE N14;Nl;0;L;;;;1;N;;;;;
12563;CUNEIFORM NUMERIC SIGN TWO N14;Nl;0;L;;;;2;N;;;;;
12564;CUNEIFORM NUMERIC SIGN THREE N14;Nl;0;L;;;;3;N;;;;;
12565;CUNEIFORM NUMERIC SIGN FOUR N14;Nl;0;L;;;;4;N;;;;;
12566;CUNEIFORM NUMERIC SIGN FIVE N14;Nl;0;L;;;;5;N;;;;;
12567;CUNEIFORM NUMERIC SIGN SIX N14;Nl;0;L;;;;6;N;;;;;
12568;CUNEIFORM NUMERIC SIGN SEVEN N14;Nl;0;L;;;;7;N;;;;;
12569;CUNEIFORM NUMERIC SIGN EIGHT N14;Nl;0;L;;;;8;N;;;;;
1256A;CUNEIFORM NUMERIC SIGN NINE N14;Nl;0;L;;;;9;N;;;;;
1256B;CUNEIFORM NUMERIC SIGN ONE N34;Nl;0;L;;;;1;N;;;;;
1256C;CUNEIFORM NUMERIC SIGN TWO N34;Nl;0;L;;;;2;N;;;;;
1256D;CUNEIFORM NUMERIC SIGN THREE N34;Nl;0;L;;;;3;N;;;;;
1256E;CUNEIFORM NUMERIC SIGN FOUR N34;Nl;0;L;;;;4;N;;;;;
1256F;CUNEIFORM NUMERIC SIGN FIVE N34;Nl;0;L;;;;5;N;;;;;
12570;CUNEIFORM NUMERIC SIGN SIX N34;Nl;0;L;;;;6;N;;;;;
12571;CUNEIFORM NUMERIC SIGN SEVEN N34;Nl;0;L;;;;7;N;;;;;
12572;CUNEIFORM NUMERIC SIGN EIGHT N34;Nl;0;L;;;;8;N;;;;;
12573;CUNEIFORM NUMERIC SIGN NINE N34;Nl;0;L;;;;9;N;;;;;
12574;CUNEIFORM NUMERIC SIGN ONE N48;Nl;0;L;;;;1;N;;;;;
12575;CUNEIFORM NUMERIC SIGN TWO N48;Nl;0;L;;;;2;N;;;;;
12576;CUNEIFORM NUMERIC SIGN THREE N48;Nl;0;L;;;;3;N;;;;;
12577;CUNEIFORM NUMERIC SIGN FOUR N48;Nl;0;L;;;;4;N;;;;;
12578;CUNEIFORM NUMERIC SIGN FIVE N48;Nl;0;L;;;;5;N;;;;;
12579;CUNEIFORM NUMERIC SIGN ONE N45;Nl;0;L;;;;1;N;;;;;
1257A;CUNEIFORM NUMERIC SIGN TWO N45;Nl;0;L;;;;2;N;;;;;
1257B;CUNEIFORM NUMERIC SIGN THREE N45;Nl;0;L;;;;3;N;;;;;
1257C;CUNEIFORM NUMERIC SIGN FOUR N45;Nl;0;L;;;;4;N;;;;;
1257D;CUNEIFORM NUMERIC SIGN FIVE N45;Nl;0;L;;;;5;N;;;;;
1257E;CUNEIFORM NUMERIC SIGN SIX N45;Nl;0;L;;;;6;N;;;;;
1257F;CUNEIFORM NUMERIC SIGN SEVEN N45;Nl;0;L;;;;7;N;;;;;
12580;CUNEIFORM NUMERIC SIGN EIGHT N45;Nl;0;L;;;;8;N;;;;;
12581;CUNEIFORM NUMERIC SIGN NINE N45;Nl;0;L;;;;9;N;;;;;
12582;CUNEIFORM NUMERIC SIGN ONE N50;Nl;0;L;;;;1;N;;;;;
12583;CUNEIFORM NUMERIC SIGN TWO N50;Nl;0;L;;;;2;N;;;;;
12584;CUNEIFORM NUMERIC SIGN THREE N50;Nl;0;L;;;;3;N;;;;;
12585;CUNEIFORM NUMERIC SIGN FOUR N50;Nl;0;L;;;;4;N;;;;;
12586;CUNEIFORM NUMERIC SIGN FIVE N50;Nl;0;L;;;;5;N;;;;;
12587;CUNEIFORM NUMERIC SIGN ONE EIGHTH IKU CURVED;Nl;0;L;;;;1/8;N;;;;;
12588;CUNEIFORM NUMERIC SIGN ONE EIGHTH IKU CURVED VARIANT FORM;Nl;0;L;;;;1/8;N;;;;;
12589;CUNEIFORM NUMERIC SIGN ONE N01 REVERSED;Nl;0;L;;;;1/4;N;;;;;
1258A;CUNEIFORM NUMERIC SIGN ONE QUARTER IKU CURVED VARIANT FORM;Nl;0;L;;;;1/4;N;;;;;
1258B;CUNEIFORM NUMERIC SIGN ONE HALF IKU CURVED VARIANT FORM;Nl;0;L;;;;1/2;N;;;;;
1258C;CUNEIFORM NUMERIC SIGN ONE N22;Nl;0;L;;;;1;N;;;;;
1258D;CUNEIFORM NUMERIC SIGN TWO N22;Nl;0;L;;;;2;N;;;;;
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1258E;CUNEIFORM NUMERIC SIGN ONE BURU CURVED;Nl;0;L;;;;1;N;;;;;
1258F;CUNEIFORM NUMERIC SIGN TWO BURU CURVED;Nl;0;L;;;;2;N;;;;;
12590;CUNEIFORM NUMERIC SIGN THREE BURU CURVED;Nl;0;L;;;;3;N;;;;;
12591;CUNEIFORM NUMERIC SIGN FOUR BURU CURVED;Nl;0;L;;;;4;N;;;;;
12592;CUNEIFORM NUMERIC SIGN FIVE BURU CURVED;Nl;0;L;;;;5;N;;;;;
12593;CUNEIFORM NUMERIC SIGN ONE BAN2 CURVED;Nl;0;L;;;;1;N;;;;;
12594;CUNEIFORM NUMERIC SIGN TWO BAN2 CURVED;Nl;0;L;;;;2;N;;;;;
12595;CUNEIFORM NUMERIC SIGN THREE BAN2 CURVED;Nl;0;L;;;;3;N;;;;;
12596;CUNEIFORM NUMERIC SIGN FOUR BAN2 CURVED;Nl;0;L;;;;4;N;;;;;
12597;CUNEIFORM NUMERIC SIGN FIVE BAN2 CURVED;Nl;0;L;;;;5;N;;;;;
12598;CUNEIFORM NUMERIC SIGN NINDA2 TIMES SHE PLUS ONE ASH CURVED;Nl;0;L;;;;1/3;N;;;;;
12599;CUNEIFORM NUMERIC SIGN NINDA2 TIMES SHE PLUS TWO ASH CURVED;Nl;0;L;;;;2/3;N;;;;;
1259A;CUNEIFORM NUMERIC SIGN ONE N51;Nl;0;L;;;;1;N;;;;;
1259B;CUNEIFORM NUMERIC SIGN TWO N51;Nl;0;L;;;;2;N;;;;;
1259C;CUNEIFORM NUMERIC SIGN THREE N51;Nl;0;L;;;;3;N;;;;;
1259D;CUNEIFORM NUMERIC SIGN FOUR N51;Nl;0;L;;;;4;N;;;;;
1259E;CUNEIFORM NUMERIC SIGN FIVE N51;Nl;0;L;;;;5;N;;;;;
1259F;CUNEIFORM NUMERIC SIGN SIX N51;Nl;0;L;;;;6;N;;;;;
125A0;CUNEIFORM NUMERIC SIGN SEVEN N51;Nl;0;L;;;;7;N;;;;;
125A1;CUNEIFORM NUMERIC SIGN EIGHT N51;Nl;0;L;;;;8;N;;;;;
125A2;CUNEIFORM NUMERIC SIGN NINE N51;Nl;0;L;;;;9;N;;;;;
125A3;CUNEIFORM NUMERIC SIGN ONE N54;Nl;0;L;;;;1;N;;;;;
125A4;CUNEIFORM NUMERIC SIGN TWO N54;Nl;0;L;;;;2;N;;;;;
125A5;CUNEIFORM NUMERIC SIGN THREE N54;Nl;0;L;;;;3;N;;;;;
125A6;CUNEIFORM NUMERIC SIGN FOUR N54;Nl;0;L;;;;4;N;;;;;
125A7;CUNEIFORM NUMERIC SIGN FIVE N54;Nl;0;L;;;;5;N;;;;;
125A8;CUNEIFORM NUMERIC SIGN ONE N56;Nl;0;L;;;;1;N;;;;;
125A9;CUNEIFORM NUMERIC SIGN TWO N56;Nl;0;L;;;;2;N;;;;;
125AA;CUNEIFORM NUMERIC SIGN ONE N24;Nl;0;L;;;;1;N;;;;;
125AB;CUNEIFORM NUMERIC SIGN ONE N26;Nl;0;L;;;;1;N;;;;;
125AC;CUNEIFORM NUMERIC SIGN ONE N28;Nl;0;L;;;;1;N;;;;;
125AD;CUNEIFORM NUMERIC SIGN ONE N29A;Nl;0;L;;;;1;N;;;;;
125AE;CUNEIFORM NUMERIC SIGN ONE N29B;Nl;0;L;;;;1;N;;;;;
125AF;CUNEIFORM NUMERIC SIGN ONE N30A;Nl;0;L;;;;1;N;;;;;
125B0;CUNEIFORM NUMERIC SIGN ONE N30C;Nl;0;L;;;;1;N;;;;;
125B1;CUNEIFORM NUMERIC SIGN ONE N30D;Nl;0;L;;;;1;N;;;;;
125B2;CUNEIFORM NUMERIC SIGN ONE N30E;Nl;0;L;;;;1;N;;;;;
125B3;CUNEIFORM NUMERIC SIGN ONE N31;Nl;0;L;;;;1;N;;;;;
125B4;CUNEIFORM NUMERIC SIGN ONE N32;Nl;0;L;;;;1;N;;;;;
125B5;CUNEIFORM NUMERIC SIGN ONE N33;Nl;0;L;;;;1;N;;;;;
125B6;CUNEIFORM NUMERIC SIGN ONE N39A;Nl;0;L;;;;1;N;;;;;
125B7;CUNEIFORM NUMERIC SIGN TWO N39A;Nl;0;L;;;;2;N;;;;;
125B8;CUNEIFORM NUMERIC SIGN THREE N39A;Nl;0;L;;;;3;N;;;;;
125B9;CUNEIFORM NUMERIC SIGN FOUR N39A;Nl;0;L;;;;4;N;;;;;
125BA;CUNEIFORM NUMERIC SIGN ONE N39B;Nl;0;L;;;;1;N;;;;;
125BB;CUNEIFORM NUMERIC SIGN TWO N39B;Nl;0;L;;;;2;N;;;;;
125BC;CUNEIFORM NUMERIC SIGN THREE N39B;Nl;0;L;;;;3;N;;;;;
125BD;CUNEIFORM NUMERIC SIGN FOUR N39B;Nl;0;L;;;;4;N;;;;;
125BE;CUNEIFORM NUMERIC SIGN ONE N02;Nl;0;L;;;;1;N;;;;;
125BF;CUNEIFORM NUMERIC SIGN TWO N02;Nl;0;L;;;;2;N;;;;;
125C0;CUNEIFORM NUMERIC SIGN THREE N02;Nl;0;L;;;;3;N;;;;;
125C1;CUNEIFORM NUMERIC SIGN FOUR N02;Nl;0;L;;;;4;N;;;;;
125C2;CUNEIFORM NUMERIC SIGN FIVE N02;Nl;0;L;;;;5;N;;;;;
125C3;CUNEIFORM NUMERIC SIGN SIX N02;Nl;0;L;;;;6;N;;;;;
125C4;CUNEIFORM NUMERIC SIGN SEVEN N02;Nl;0;L;;;;7;N;;;;;
125C5;CUNEIFORM NUMERIC SIGN EIGHT N02;Nl;0;L;;;;8;N;;;;;
125C6;CUNEIFORM NUMERIC SIGN NINE N02;Nl;0;L;;;;9;N;;;;;
125C7;CUNEIFORM NUMERIC SIGN ONE N15;Nl;0;L;;;;1;N;;;;;
125C8;CUNEIFORM NUMERIC SIGN TWO N15;Nl;0;L;;;;2;N;;;;;
125C9;CUNEIFORM NUMERIC SIGN THREE N15;Nl;0;L;;;;3;N;;;;;
125CA;CUNEIFORM NUMERIC SIGN FOUR N15;Nl;0;L;;;;4;N;;;;;
125CB;CUNEIFORM NUMERIC SIGN FIVE N15;Nl;0;L;;;;5;N;;;;;
125CC;CUNEIFORM NUMERIC SIGN ONE N35;Nl;0;L;;;;1;N;;;;;
125CD;CUNEIFORM NUMERIC SIGN TWO N35;Nl;0;L;;;;2;N;;;;;
125CE;CUNEIFORM NUMERIC SIGN THREE N35;Nl;0;L;;;;3;N;;;;;
125CF;CUNEIFORM NUMERIC SIGN FOUR N35;Nl;0;L;;;;4;N;;;;;
125D0;CUNEIFORM NUMERIC SIGN FIVE N35;Nl;0;L;;;;5;N;;;;;
125D1;CUNEIFORM NUMERIC SIGN ONE N06;Nl;0;L;;;;1;N;;;;;
125D2;CUNEIFORM NUMERIC SIGN TWO N06;Nl;0;L;;;;2;N;;;;;
125D3;CUNEIFORM NUMERIC SIGN THREE N06;Nl;0;L;;;;3;N;;;;;
125D4;CUNEIFORM NUMERIC SIGN FOUR N06;Nl;0;L;;;;4;N;;;;;
125D5;CUNEIFORM NUMERIC SIGN FIVE N06;Nl;0;L;;;;5;N;;;;;
125D6;CUNEIFORM NUMERIC SIGN SIX N06;Nl;0;L;;;;6;N;;;;;
125D7;CUNEIFORM NUMERIC SIGN SEVEN N06;Nl;0;L;;;;7;N;;;;;
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125D8;CUNEIFORM NUMERIC SIGN EIGHT N06;Nl;0;L;;;;8;N;;;;;
125D9;CUNEIFORM NUMERIC SIGN NINE N06;Nl;0;L;;;;9;N;;;;;
125DA;CUNEIFORM NUMERIC SIGN ONE N21;Nl;0;L;;;;1;N;;;;;
125DB;CUNEIFORM NUMERIC SIGN TWO N21;Nl;0;L;;;;2;N;;;;;
125DC;CUNEIFORM NUMERIC SIGN THREE N21;Nl;0;L;;;;3;N;;;;;
125DD;CUNEIFORM NUMERIC SIGN FOUR N21;Nl;0;L;;;;4;N;;;;;
125DE;CUNEIFORM NUMERIC SIGN FIVE N21;Nl;0;L;;;;5;N;;;;;
125DF;CUNEIFORM NUMERIC SIGN ONE N38;Nl;0;L;;;;1;N;;;;;
125E0;CUNEIFORM NUMERIC SIGN ONE N52;Nl;0;L;;;;1;N;;;;;
125E1;CUNEIFORM NUMERIC SIGN TWO N52;Nl;0;L;;;;2;N;;;;;
125E2;CUNEIFORM NUMERIC SIGN THREE N52;Nl;0;L;;;;3;N;;;;;
125E3;CUNEIFORM NUMERIC SIGN FOUR N52;Nl;0;L;;;;4;N;;;;;
125E4;CUNEIFORM NUMERIC SIGN FIVE N52;Nl;0;L;;;;5;N;;;;;
125E5;CUNEIFORM NUMERIC SIGN SIX N52;Nl;0;L;;;;6;N;;;;;
125E6;CUNEIFORM NUMERIC SIGN SEVEN N52;Nl;0;L;;;;7;N;;;;;
125E7;CUNEIFORM NUMERIC SIGN EIGHT N52;Nl;0;L;;;;8;N;;;;;
125E8;CUNEIFORM NUMERIC SIGN NINE N52;Nl;0;L;;;;9;N;;;;;
125E9;CUNEIFORM NUMERIC SIGN ONE N60;Nl;0;L;;;;1;N;;;;;
125EA;CUNEIFORM NUMERIC SIGN ONE N24A;Nl;0;L;;;;1;N;;;;;
125EB;CUNEIFORM NUMERIC SIGN ONE N40;Nl;0;L;;;;1;N;;;;;
125EC;CUNEIFORM NUMERIC SIGN TWO N40;Nl;0;L;;;;2;N;;;;;
125ED;CUNEIFORM NUMERIC SIGN THREE N40;Nl;0;L;;;;3;N;;;;;
125EE;CUNEIFORM NUMERIC SIGN FOUR N40;Nl;0;L;;;;4;N;;;;;
125EF;CUNEIFORM NUMERIC SIGN ONE N03;Nl;0;L;;;;1;N;;;;;
125F0;CUNEIFORM NUMERIC SIGN TWO N03;Nl;0;L;;;;2;N;;;;;
125F1;CUNEIFORM NUMERIC SIGN THREE N03;Nl;0;L;;;;3;N;;;;;
125F2;CUNEIFORM NUMERIC SIGN FOUR N03;Nl;0;L;;;;4;N;;;;;
125F3;CUNEIFORM NUMERIC SIGN FIVE N03;Nl;0;L;;;;5;N;;;;;
125F4;CUNEIFORM NUMERIC SIGN ONE N18;Nl;0;L;;;;1;N;;;;;
125F5;CUNEIFORM NUMERIC SIGN TWO N18;Nl;0;L;;;;2;N;;;;;
125F6;CUNEIFORM NUMERIC SIGN THREE N18;Nl;0;L;;;;3;N;;;;;
125F7;CUNEIFORM NUMERIC SIGN FOUR N18;Nl;0;L;;;;4;N;;;;;
125F8;CUNEIFORM NUMERIC SIGN FIVE N18;Nl;0;L;;;;5;N;;;;;
125F9;CUNEIFORM NUMERIC SIGN SIX N18;Nl;0;L;;;;6;N;;;;;
125FA;CUNEIFORM NUMERIC SIGN SEVEN N18;Nl;0;L;;;;7;N;;;;;
125FB;CUNEIFORM NUMERIC SIGN EIGHT N18;Nl;0;L;;;;8;N;;;;;
125FC;CUNEIFORM NUMERIC SIGN NINE N18;Nl;0;L;;;;9;N;;;;;
125FD;CUNEIFORM NUMERIC SIGN ONE N45A;Nl;0;L;;;;1;N;;;;;
125FE;CUNEIFORM NUMERIC SIGN ONE N24B;Nl;0;L;;;;1;N;;;;;
125FF;CUNEIFORM NUMERIC SIGN ONE N26B;Nl;0;L;;;;1;N;;;;;
12600;CUNEIFORM NUMERIC SIGN ONE N28B;Nl;0;L;;;;1;N;;;;;
12601;CUNEIFORM NUMERIC SIGN ONE N29AB;Nl;0;L;;;;1;N;;;;;
12602;CUNEIFORM NUMERIC SIGN ONE N41;Nl;0;L;;;;1;N;;;;;
12603;CUNEIFORM NUMERIC SIGN TWO N41;Nl;0;L;;;;2;N;;;;;
12604;CUNEIFORM NUMERIC SIGN THREE N41;Nl;0;L;;;;3;N;;;;;
12605;CUNEIFORM NUMERIC SIGN FOUR N41;Nl;0;L;;;;4;N;;;;;
12606;CUNEIFORM NUMERIC SIGN ONE N04;Nl;0;L;;;;1;N;;;;;
12607;CUNEIFORM NUMERIC SIGN TWO N04;Nl;0;L;;;;2;N;;;;;
12608;CUNEIFORM NUMERIC SIGN THREE N04;Nl;0;L;;;;3;N;;;;;
12609;CUNEIFORM NUMERIC SIGN FOUR N04;Nl;0;L;;;;4;N;;;;;
1260A;CUNEIFORM NUMERIC SIGN FIVE N04;Nl;0;L;;;;5;N;;;;;
1260B;CUNEIFORM NUMERIC SIGN ONE N19;Nl;0;L;;;;1;N;;;;;
1260C;CUNEIFORM NUMERIC SIGN TWO N19;Nl;0;L;;;;2;N;;;;;
1260D;CUNEIFORM NUMERIC SIGN THREE N19;Nl;0;L;;;;3;N;;;;;
1260E;CUNEIFORM NUMERIC SIGN FOUR N19;Nl;0;L;;;;4;N;;;;;
1260F;CUNEIFORM NUMERIC SIGN FIVE N19;Nl;0;L;;;;5;N;;;;;
12610;CUNEIFORM NUMERIC SIGN SIX N19;Nl;0;L;;;;6;N;;;;;
12611;CUNEIFORM NUMERIC SIGN SEVEN N19;Nl;0;L;;;;7;N;;;;;
12612;CUNEIFORM NUMERIC SIGN EIGHT N19;Nl;0;L;;;;8;N;;;;;
12613;CUNEIFORM NUMERIC SIGN NINE N19;Nl;0;L;;;;9;N;;;;;
12614;CUNEIFORM NUMERIC SIGN ONE N46;Nl;0;L;;;;1;N;;;;;
12615;CUNEIFORM NUMERIC SIGN TWO N46;Nl;0;L;;;;2;N;;;;;
12616;CUNEIFORM NUMERIC SIGN ONE N36;Nl;0;L;;;;1;N;;;;;
12617;CUNEIFORM NUMERIC SIGN TWO N36;Nl;0;L;;;;2;N;;;;;
12618;CUNEIFORM NUMERIC SIGN THREE N36;Nl;0;L;;;;3;N;;;;;
12619;CUNEIFORM NUMERIC SIGN FOUR N36;Nl;0;L;;;;4;N;;;;;
1261A;CUNEIFORM NUMERIC SIGN FIVE N36;Nl;0;L;;;;5;N;;;;;
1261B;CUNEIFORM NUMERIC SIGN SIX N36;Nl;0;L;;;;6;N;;;;;
1261C;CUNEIFORM NUMERIC SIGN SEVEN N36;Nl;0;L;;;;7;N;;;;;
1261D;CUNEIFORM NUMERIC SIGN EIGHT N36;Nl;0;L;;;;8;N;;;;;
1261E;CUNEIFORM NUMERIC SIGN NINE N36;Nl;0;L;;;;9;N;;;;;
1261F;CUNEIFORM NUMERIC SIGN ONE N49;Nl;0;L;;;;1;N;;;;;
12620;CUNEIFORM NUMERIC SIGN TWO N49;Nl;0;L;;;;2;N;;;;;
12621;CUNEIFORM NUMERIC SIGN THREE N49;Nl;0;L;;;;3;N;;;;;
```

```
12622;CUNEIFORM NUMERIC SIGN FOUR N49;Nl;0;L;;;;4;N;;;;;
12623;CUNEIFORM NUMERIC SIGN ONE N25;Nl;0;L;;;;1;N;;;;;
12624;CUNEIFORM NUMERIC SIGN ONE N27;Nl;0;L;;;;1;N;;;;;
12625;CUNEIFORM NUMERIC SIGN ONE N28C;Nl;0;L;;;;1;N;;;;;
12626;CUNEIFORM NUMERIC SIGN ONE N29AC;Nl;0;L;;;;1;N;;;;;
12627;CUNEIFORM NUMERIC SIGN ONE N30AC;Nl;0;L;;;;1;N;;;;;
12628;CUNEIFORM NUMERIC SIGN ONE N30CC;Nl;0;L;;;;1;N;;;;;
12629;CUNEIFORM NUMERIC SIGN ONE N42A;Nl;0;L;;;;1;N;;;;;
1262A;CUNEIFORM NUMERIC SIGN TWO N42A;Nl;0;L;;;;2;N;;;;;
1262B;CUNEIFORM NUMERIC SIGN THREE N42A;Nl;0;L;;;;3;N;;;;;
1262C;CUNEIFORM NUMERIC SIGN FOUR N42A;Nl;0;L;;;;4;N;;;;;
1262D;CUNEIFORM NUMERIC SIGN ONE N42B;Nl;0;L;;;;1;N;;;;;
1262E;CUNEIFORM NUMERIC SIGN TWO N42B;Nl;0;L;;;;2;N;;;;;
1262F;CUNEIFORM NUMERIC SIGN THREE N42B;Nl;0;L;;;;3;N;;;;;
12630;CUNEIFORM NUMERIC SIGN FOUR N42B;Nl;0;L;;;;4;N;;;;;
12631;CUNEIFORM NUMERIC SIGN ONE N05;Nl;0;L;;;;1;N;;;;;
12632;CUNEIFORM NUMERIC SIGN TWO N05;Nl;0;L;;;;2;N;;;;;
12633;CUNEIFORM NUMERIC SIGN THREE N05;Nl;0;L;;;;3;N;;;;;
12634;CUNEIFORM NUMERIC SIGN FOUR N05;Nl;0;L;;;;4;N;;;;;
12635;CUNEIFORM NUMERIC SIGN FIVE N05;Nl;0;L;;;;5;N;;;;;
12636;CUNEIFORM NUMERIC SIGN ONE N20;Nl;0;L;;;;1;N;;;;;
12637;CUNEIFORM NUMERIC SIGN TWO N20;Nl;0;L;;;;2;N;;;;;
12638;CUNEIFORM NUMERIC SIGN THREE N20;Nl;0;L;;;;3;N;;;;;
12639;CUNEIFORM NUMERIC SIGN FOUR N20;Nl;0;L;;;;4;N;;;;;
1263A;CUNEIFORM NUMERIC SIGN FIVE N20;Nl;0;L;;;;5;N;;;;;
1263B;CUNEIFORM NUMERIC SIGN SIX N20;Nl;0;L;;;;6;N;;;;;
1263C;CUNEIFORM NUMERIC SIGN SEVEN N20;Nl;0;L;;;;7;N;;;;;
1263D;CUNEIFORM NUMERIC SIGN EIGHT N20;Nl;0;L;;;;8;N;;;;;
1263E;CUNEIFORM NUMERIC SIGN NINE N20;Nl;0;L;;;;9;N;;;;;
1263F;CUNEIFORM NUMERIC SIGN ONE N47;Nl;0;L;;;;1;N;;;;;
12640;CUNEIFORM NUMERIC SIGN TWO N47;Nl;0;L;;;;2;N;;;;;
12641;CUNEIFORM NUMERIC SIGN ONE N37;Nl;0;L;;;;1;N;;;;;
12642;CUNEIFORM NUMERIC SIGN TWO N37;Nl;0;L;;;;2;N;;;;;
12643;CUNEIFORM NUMERIC SIGN ONE N09;Nl;0;L;;;;1;N;;;;;
12644;CUNEIFORM NUMERIC SIGN ONE N11;Nl;0;L;;;;1;N;;;;;
12645;CUNEIFORM NUMERIC SIGN ONE N12;Nl;0;L;;;;1;N;;;;;
12646;CUNEIFORM NUMERIC SIGN ONE N07A;Nl;0;L;;;;1;N;;;;;
12647;CUNEIFORM NUMERIC SIGN TWO N07A;Nl;0;L;;;;2;N;;;;;
12648;CUNEIFORM NUMERIC SIGN THREE N07A;Nl;0;L;;;;3;N;;;;;
12649;CUNEIFORM NUMERIC SIGN ONE N07B;Nl;0;L;;;;1;N;;;;;
1264A;CUNEIFORM NUMERIC SIGN TWO N07B;Nl;0;L;;;;2;N;;;;;
1264B;CUNEIFORM NUMERIC SIGN THREE N07B;Nl;0;L;;;;3;N;;;;;
1264C;CUNEIFORM NUMERIC SIGN ONE N01 FLAT;Nl;0;L;;;;1;N;;;;;
1264D;CUNEIFORM NUMERIC SIGN TWO N01 FLAT;Nl;0;L;;;;2;N;;;;;
1264E;CUNEIFORM NUMERIC SIGN THREE N01 FLAT;Nl;0;L;;;;3;N;;;;;
1264F;CUNEIFORM NUMERIC SIGN FOUR N01 FLAT;Nl;0;L;;;;4;N;;;;;
12650;CUNEIFORM NUMERIC SIGN FIVE N01 FLAT;Nl;0;L;;;;5;N;;;;;
12651;CUNEIFORM NUMERIC SIGN SIX N01 FLAT;Nl;0;L;;;;6;N;;;;;
12652;CUNEIFORM NUMERIC SIGN SEVEN N01 FLAT;Nl;0;L;;;;7;N;;;;;
12653;CUNEIFORM NUMERIC SIGN EIGHT N01 FLAT;Nl;0;L;;;;8;N;;;;;
12654;CUNEIFORM NUMERIC SIGN NINE N01 FLAT;Nl;0;L;;;;9;N;;;;;
12655;CUNEIFORM NUMERIC SIGN ONE N08 FLAT;Nl;0;L;;;;1;N;;;;;
12656;CUNEIFORM NUMERIC SIGN ONE N14 FLAT;Nl;0;L;;;;1;N;;;;;
12657;CUNEIFORM NUMERIC SIGN TWO N14 FLAT;Nl;0;L;;;;2;N;;;;;
12658;CUNEIFORM NUMERIC SIGN THREE N14 FLAT;Nl;0;L;;;;3;N;;;;;
12659;CUNEIFORM NUMERIC SIGN FOUR N14 FLAT;Nl;0;L;;;;4;N;;;;;
1265A;CUNEIFORM NUMERIC SIGN FIVE N14 FLAT;Nl;0;L;;;;5;N;;;;;
1265B;CUNEIFORM NUMERIC SIGN SIX N14 FLAT;Nl;0;L;;;;6;N;;;;;
1265C;CUNEIFORM NUMERIC SIGN SEVEN N14 FLAT;Nl;0;L;;;;7;N;;;;;
1265D;CUNEIFORM NUMERIC SIGN EIGHT N14 FLAT;Nl;0;L;;;;8;N;;;;;
1265E;CUNEIFORM NUMERIC SIGN NINE N14 FLAT;Nl;0;L;;;;9;N;;;;;
1265F;CUNEIFORM NUMERIC SIGN ONE N34 FLAT;Nl;0;L;;;;1;N;;;;;
12660;CUNEIFORM NUMERIC SIGN TWO N34 FLAT;Nl;0;L;;;;2;N;;;;;
12661;CUNEIFORM NUMERIC SIGN THREE N34 FLAT;Nl;0;L;;;;3;N;;;;;
12662;CUNEIFORM NUMERIC SIGN FOUR N34 FLAT;Nl;0;L;;;;4;N;;;;;
12663;CUNEIFORM NUMERIC SIGN FIVE N34 FLAT;Nl;0;L;;;;5;N;;;;;
12664;CUNEIFORM NUMERIC SIGN SIX N34 FLAT;Nl;0;L;;;;6;N;;;;;
12665;CUNEIFORM NUMERIC SIGN SEVEN N34 FLAT;Nl;0;L;;;;7;N;;;;;
12666;CUNEIFORM NUMERIC SIGN EIGHT N34 FLAT;Nl;0;L;;;;8;N;;;;;
12667;CUNEIFORM NUMERIC SIGN NINE N34 FLAT;Nl;0;L;;;;9;N;;;;;
12668;CUNEIFORM NUMERIC SIGN ONE N45 FLAT;Nl;0;L;;;;1;N;;;;;
12669;CUNEIFORM NUMERIC SIGN TWO N45 FLAT;Nl;0;L;;;;2;N;;;;;
1266A;CUNEIFORM NUMERIC SIGN ONE N22 FLAT;Nl;0;L;;;;1;N;;;;;
1266B;CUNEIFORM NUMERIC SIGN TWO N22 FLAT;Nl;0;L;;;;2;N;;;;;
```

```
1266C;CUNEIFORM NUMERIC SIGN ONE N51 FLAT;Nl;0;L;;;;1;N;;;;;
1266D;CUNEIFORM NUMERIC SIGN TWO N51 FLAT;Nl;0;L;;;;2;N;;;;;
1266E;CUNEIFORM NUMERIC SIGN THREE N51 FLAT;Nl;0;L;;;;3;N;;;;;
1266F;CUNEIFORM NUMERIC SIGN FOUR N51 FLAT;Nl;0;L;;;;4;N;;;;;
12670;CUNEIFORM NUMERIC SIGN FIVE N51 FLAT;Nl;0;L;;;;5;N;;;;;
12671;CUNEIFORM NUMERIC SIGN SIX N51 FLAT;Nl;0;L;;;;6;N;;;;;
12672;CUNEIFORM NUMERIC SIGN SEVEN N51 FLAT;Nl;0;L;;;;7;N;;;;;
12673;CUNEIFORM NUMERIC SIGN EIGHT N51 FLAT;Nl;0;L;;;;8;N;;;;;
12674;CUNEIFORM NUMERIC SIGN NINE N51 FLAT;Nl;0;L;;;;9;N;;;;;
12675;CUNEIFORM NUMERIC SIGN ONE N34 FLAT TENU;Nl;0;L;;;;1;N;;;;;
12676;CUNEIFORM NUMERIC SIGN ONE N04 FLAT;Nl;0;L;;;;1;N;;;;;
12677;CUNEIFORM NUMERIC SIGN TWO N04 FLAT;Nl;0;L;;;;2;N;;;;;
12678;CUNEIFORM NUMERIC SIGN THREE N04 FLAT;Nl;0;L;;;;3;N;;;;;
12679;CUNEIFORM NUMERIC SIGN FOUR N04 FLAT;Nl;0;L;;;;4;N;;;;;
1267A;CUNEIFORM NUMERIC SIGN FIVE N04 FLAT;Nl;0;L;;;;5;N;;;;;
1267B;CUNEIFORM NUMERIC SIGN ONE N19 FLAT;Nl;0;L;;;;1;N;;;;;
1267C;CUNEIFORM NUMERIC SIGN TWO N19 FLAT;Nl;0;L;;;;2;N;;;;;
1267D;CUNEIFORM NUMERIC SIGN THREE N19 FLAT;Nl;0;L;;;;3;N;;;;;
1267E;CUNEIFORM NUMERIC SIGN FOUR N19 FLAT;Nl;0;L;;;;4;N;;;;;
1267F;CUNEIFORM NUMERIC SIGN FIVE N19 FLAT;Nl;0;L;;;;5;N;;;;;
12680;CUNEIFORM NUMERIC SIGN SIX N19 FLAT;Nl;0;L;;;;6;N;;;;;
12681;CUNEIFORM NUMERIC SIGN SEVEN N19 FLAT;Nl;0;L;;;;7;N;;;;;
12682;CUNEIFORM NUMERIC SIGN EIGHT N19 FLAT;Nl;0;L;;;;8;N;;;;;
12683;CUNEIFORM NUMERIC SIGN NINE N19 FLAT;Nl;0;L;;;;9;N;;;;;
12684;CUNEIFORM NUMERIC SIGN ONE N46 FLAT;Nl;0;L;;;;1;N;;;;;
12685;CUNEIFORM NUMERIC SIGN TWO N46 FLAT;Nl;0;L;;;;2;N;;;;;
12686;CUNEIFORM NUMERIC SIGN ONE N36 FLAT;Nl;0;L;;;;1;N;;;;;
```

2.3.2 Line_Break

Attached: LineBreak.txt.

```
12550..12686  ; AL # Nl [311] CUNEIFORM NUMERIC SIGN ONE N01..CUNEIFORM NUMERIC SIGN ONE N36
↪  FLAT
```

2.3.3 Script

Attached: Scripts.txt.

```
12550..125A7  ; Cuneiform # Nl  [88] CUNEIFORM NUMERIC SIGN ONE N01..CUNEIFORM NUMERIC SIGN
↪  FIVE N54
1264C..12686  ; Cuneiform # Nl  [59] CUNEIFORM NUMERIC SIGN ONE N01 FLAT..CUNEIFORM NUMERIC
↪  SIGN ONE N36 FLAT
125A8..1264B  ; Proto_Cuneiform # Nl [164] CUNEIFORM NUMERIC SIGN ONE N56..CUNEIFORM NUMERIC
↪  SIGN THREE N07B
```

2.3.4 Script_Extensions

Attached: ScriptExtensions.txt.

```
12550..12586  ; Pcun Xsux                    # Nl [55] CUNEIFORM NUMERIC SIGN ONE
↪  N01..CUNEIFORM NUMERIC SIGN FIVE N50
1258C..1258D  ; Pcun Xsux                    # Nl  [2] CUNEIFORM NUMERIC SIGN ONE
↪  N22..CUNEIFORM NUMERIC SIGN TWO N22
1259A..125A7  ; Pcun Xsux                    # Nl [14] CUNEIFORM NUMERIC SIGN ONE
↪  N51..CUNEIFORM NUMERIC SIGN FIVE N54
```

2.3.5 Block

Attached: Blocks.txt.

```
12550..1268F; Archaic Cuneiform Numerals
```

3 Rationale for curviform–cuneiform disunification

The numbering systems that use cuneiform numerals are descended from the ones that use curviform numerals, and many of the cuneiform signs have clear curviform counterparts across this transition. Co-occurrences are sometimes described by analogy to distinctions that are not the realm of plain text, as in [Pow72, p. 215] “in the same fashion as we use black and red ink”; however, we must bear in mind that such analogies are not made in the context of character encoding discussions. In 2004, the curviform numerals were deemed unencodable for the time being; however, closer inspection reveals that the distinction functions less like markup than was argued at the time, and that the unification is problematic.

3.1 The cuneiform encoding model

As outlined in, *e.g.*, [UTR56], the cuneiform encoding model is diachronic; each character may have wildly different glyphs depending on time period and region. For instance, the sign IM may resemble 𒅎 in texts from Early Dynastic IIIa Šuruppag as in the character code charts, 𒅎 later in the third millennium[6], 𒅎 in Old Babylonian cursive, 𒅎 in Neo-Assyrian, but is always encoded as U+1214E CUNEIFORM SIGN IM.

This encoding model allows for the interoperable representation of editions of diachronic reference works such as sign lists[7] and dictionaries[8], and of composite texts[9]. By being compatible with similarly diachronic transliteration practice, *i.e.*, by avoiding distinctions finer than those made in transliteration, the encoding model also allows for automated conversion of transliterated corpora to cuneiform, which has proven useful as a processing step in analyses such as [Rom24; JJ24][10]. The diachronic approach is also useful for pedagogic applications[11].

3.2 Arguments for curviform–cuneiform unification

In this context, the argument was made in [L2/04-099], as part of discussion of the cuneiform encoding[12] that the curviform numerals, which occasionally appear in the Ur III period and are used heavily in the Early Dynastic period, were a stylistic distinction unifiable with the cuneiform digits, and that an archaizing Ur III font or an Early Dynastic font could have curviform glyphs for the appropriate characters.

Some co-occurrence of curviform and cuneiform digits was known and acknowledged. [L2/04-099, p. 3] cites [NDE93, p. 62], which is a copy of [P020054], an Early Dynastic IIIb administrative tablet from Ŋirsu. The excerpt cited, lines 1–3 of column 1 of the obverse, is as follows:

---

[6] Merging with U+1224E CUNEIFORM SIGN NI2.

[7] Notably [OSL] and the online edition of [Bor10] in [eBL, Signs].

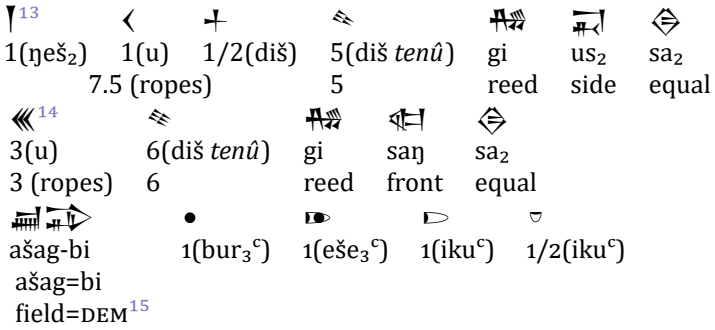
[8] Notably [ePSD2] and the online edition of [Sch10] in [eBL, Dictionary].

[9] For example, there are Neo-Assyrian and Neo-Babylonian copies of parts of the laws of 𒄩𒄠𒈬𒊏𒁉, as well as Old Babylonian copies in both archaizing and cursive styles. Because of damage on the stele [P249253], some sections are known only from those copies. See [Oel22, pp. 110 sqq.].

[10] Attendees may recall the summary given on the third day of UTC #180, as recorded in [L2/24-159]. Other readers may refer to [Svä+24, pp. 242, 148].

[11] For instance, Old Babylonian grammar may be taught in the Neo-Assyrian script, as in [Cap02].

[12] At that time scoped to the répertoire of the Ur III period and later, see [L2/03-162, p. 1], although many disunifications, such as 𒅎 ≠ 𒉎, were informed by Early Dynastic distinctions.



The argument made in [L2/04-099, p. 4] is that this is comparable to a stylistic distinction such as[16]

> 465 metres, equal lengths
> 198 metres, equal widths
> this field is ৯, ১৪ hectares of ploughed land

where the numerals have the same structure ([L2/04-099] contrasts this to the different structures of ASCII digits and roman numerals). That document further claims that "the number signs do not normally carry in their individual signs the meaning of what they are used to measure", and that curviform and cuneiform numerals "are not normally mixed together in a single numerical expression", noting the exceptions of [P232278; P232280]. In addition, [L2/04-099, p. 4] points out that the cuneiform numeric signs are descended from the curviform ones (this is undisputed), and claims there is only a small re-allocation of the function of signs (from 𒁹 to 𒐐 numerals). It therefore comes to the conclusion that the use of curviform numerals should be seen as a formatting distinction, rather than one that should be represented in plain text, and insists that the encoding should capture the lineal historical descent of those signs, presumably to take advantage of the benefits of diachronic encoding described in §3.1.

Although they had been part of the preliminary proposal [L2/03-393R], the curviform numerals were therefore removed from [L2/04-036] and [L2/04-189], which both state that "The distinction between curved numerals and their cuneiform descendants is treated as glyphic for the purposes of the present proposal; this issue will need to be revisited in subsequent encoding phases[17]."

[13] As noted in [Pow87, p. 466], this sign has a very short "tail" in this period, so that it is wider than it is tall, and can at first seem like a large 𒐕 in copies. The photos in [CDLI] clearly show that this is in fact a vertical wedge.

[14] Note that ED IIIb 𒌋 numerals have a somewhat different appearance from those of the Ur III period used in this transcription; the sign 𒐋 in [P020054] looks more like Ur III 𒐋.

[15] Alternatively: area=POSS.3.SG.NH, "its area".

[16] We have taken the liberty of adjusting the analogy to use measures approximately equal to those in [P020054], instead of a field of five by twenty-five metres.

[17] The cuneiform encoding process was planned in *stages* in [L2/03-162]. One might expect the second stage of encoding, which led to the creation of the Early Dynastic Cuneiform block, to incorporate the

The time has come to revisit this issue. As we will see in §3.3, numerals can only be interpreted in the context of what they measure, *i.e.*, as part of a metrological system. In §3.4 we will see that in some periods:

— the functions and use of the numerals vary beyond the mere 𒁹/𒁺 switch;
— the contrast between curviform and cuneiform numerals is commonly used to distinguish metrological systems;
— some metrological systems commonly mix curviform and cuneiform in single numerical expressions.

3.3 A primer on classic Ur III and Old Babylonian metrologies


I want to write tablets: the tablet of 1 cor of barley to 600 cor; the tablet of 1 shekel of silver to 10 minas [...]

Edubba'a D[18]

Before diving into the usage of the curviform numerals in the Early Dynastic period to explain the constrast with cuneiform numerals, it is useful to understand the usage of the already-encoded characters in the Ur III and Old Babylonian periods.

As is well known[19] a sexagesimal place value system (SPVS) was used in Mesopotamia from the late third millennium onwards. One should bear in mind, however, that other systems were used; the SPVS was primarily used in calculations, with results being expressed in non-positional systems [Rob08, p. 76; Rob22]. The digits 1–59 of the SPVS have inner structure which is reflected in the encoding: the digits 1–9 are the individual characters 𒁹–𒐚, the multiples of ten (10–50) are 𒌋–𒐘, but the other digits 11–59 are sequences 𒌋𒁹–𒐘𒐚; in effect the base-sixty digits are themselves written in base ten, with a different set of symbols for the tens place. This reflects the origin of the sexagesimal place value system; it derives from a *non-positional* system, hereafter the *cuneiform discrete counting system* $S_{\text{Ur III/OB}}$, which had different signs for the units 𒁹–𒐚, tens 𒌋–𒐘, sixties 𒁹–𒐚 (with larger wedges than the units), multiples of six hundred 𒐼–𒐽, multiples of three thousand six hundreds 𒊹–𒐼, and multiples of thirty-six thousand 𒊹–𒐽.

3.3.1 The discrete counting system

The relations between the values of the signs in the cuneiform discrete counting system may be summarized by the following factor diagram[20], where the number over arrow indicates the multiple of the preceding sign (right of the arrow)

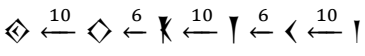
numerals needed for the representation and discussion of Early Dynastic texts; however, the proposal [L2/12-208] stated that "numerals have been omitted due to the complexity of numeral signs from this period. An expert in the metrology of this period must be consulted before these can be properly included."

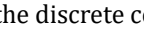
[18] See [Civ85].

[19] See, *e.g.*, [Uni16, §22.3.3, *sub* "Cuneiform Numerals"].

[20] These diagrams, which have become standard in discussions of Mesopotamian metrology, originate with [Fri78, p. 10], where they are called *step-diagrams*, see Figure 4.

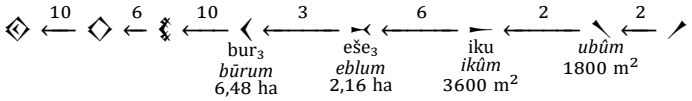
corresponding to the following sign (left).


($S_{\text{Ur III/OB}}$)

For example, the number $1729 = ((2 \times 10 + 8) \times 6 + 4) \times 10 + 9 = 28 \times 60 + 49$ would be written  in the discrete counting system, and  in the sexagesimal place value system.

3.3.2 The area system

The discrete counting system was not the only non-positional system in use in the Ur III and Old Babylonian periods; different systems were in use depending on what was being counted or measured. For instance, field areas were measured using the following system, where for the named units we have provided the name of the unit in transliterated Sumerian, normalized Old Babylonian Akkadian, and the approximate metric equivalent [Fri07, p. 378; Rob19]:

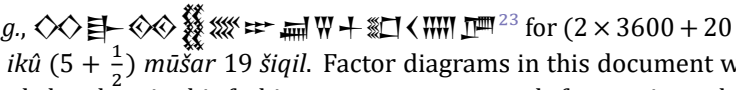


($G_{\text{Ur III/OB}}$)

Note that for the range of areas given above, this system does not use any symbols separate from the numerals for the individual units (*ubûm*, *ikûm*, *eblum*, and *būrum*). As mentioned in [Rob19], the whole numeric expression for the area would be followed by the sign  functioning as punctuation[21], but the numerals are tied to the metrology; thus a surface of 5 *būr* 1 *ebel* 4 *ikû* (100 *ikû*, 36 ha) would be written[22]  . Contrast this with systems where the same numerals are used for different units, and overt units are used, as in "88 acres 3 roods 33 perches" or 五頃八畝五分九厘. Note also that the same signs are shared between multiple systems, with different relations; the sign  is equal to sixty times  in the area system, but to three hundred and sixty times in the discrete counting system.

For areas smaller than a quarter *ikûm*, an overt unit is used, with one  (sar, *mūšarum*), approximately 36 m^2, written , equal to one hundredth of an *ikîm*, then sexigesimally subdivided in 60  (gin_4, *šiqlum*, "shekel"). For areas greater than 3600 *būr*, the and numerals are reused with a suffix  (gal, "big"), as follows [Rob08, p. 295 nn. b, c; Fri07, p. 378; Rob19]:

($G_{\text{Ur III/OB}}$)

e.g.,  for $(2 \times 3600 + 20 \times 60 + 49)$ *būr* 5 *ikû* $(5 + \frac{1}{2})$ *mūšar* 19 *šiqil*. Factor diagrams in this document will use bottom curly brackets in this fashion to separate numerals from units and other suffixes.

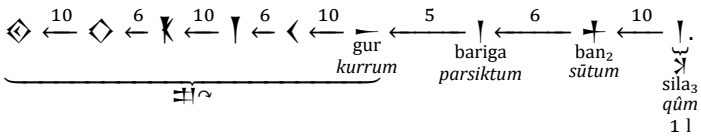
[21] This sign is sometimes interpreted as a measurement unit, and transliterated iku, see, *e.g.*, [Pro20, pp. 385 sqq.], or transliterations in [Feu04] discussed in §3.7.2. Even with this interpretation, the sequence of numerals used, and the interpretation of numerals shared with other metrological systems, is specific to system $G_{\text{Ur III/OB}}$.

[22] As in the surface of the field of  (the city of Apisal) reported on [P102305, rev. 1]

[23] From [P213162, obv. 2], which has an additional , two thirds (of a shekel), see §3.3.5.

3.3.3 The capacity system

Another such system of note is the one for capacities[24] [Fri07, p. 376; Rob19],



$(C_{\text{Ur III/OB}})$

In the above diagram, the numerals for ban_2 are 𒁾, 𒁿, 𒂀, 𒂁, and 𒂂, and those for bariga are 𒁹, 𒁺, 𒁻, and 𒁼 (contrast ordinary 𒁻 and 𒁽 otherwise used with 𒁹 numerals). Further, we have used the symbol ↷ to express that, as described in [Hue11, p. 585 nn. (b), (f)], the sign 𒄑 GUR, while it is used only with volumes in excess of one gur, is written after the whole expression, after the overt unit sign 𒋗 if present, and after the word for "grain" if present, as in the following capacity:

[25]

Observe that while large numbers of gur follow[26] system $S_{\text{Ur III/OB}}$, the use of horizontal (AŠ) numerals for the gur disambiguates from the vertical bariga, as 𒌋𒁹𒄑 would be 10 gur 1 bariga, and 𒌋𒁔𒄑 would be 11 gur; again even with some overt units, most of the numerals that participate in a metrological system have an interpretation dependent on that system.

This intertwining of units and numerals explains the large number of already-encoded numeral series:

— 𒁹–𒁽 used in $S_{\text{Ur III/OB}}$ and the SPVS as well as with overt units;
— 𒌋–𒐼 used in $G_{\text{Ur III/OB}}$, of which 𒌋–𒐐 are also used in $S_{\text{Ur III/OB}}$ and the SPVS as well as with overt units;
— 𒁹–𒁽 used in $S_{\text{Ur III/OB}}$, and sometimes with overt units;
— 𒁾–𒂂 used in $S_{\text{Ur III/OB}}$;
— 𒃻– used in $S_{\text{Ur III/OB}}$ and $G_{\text{Ur III/OB}}$;
— 𒄀– used in $S_{\text{Ur III/OB}}$ and $G_{\text{Ur III/OB}}$;
— 𒁔–𒐈 used in $C_{\text{Ur III/OB}}$ as well as with overt units of the weight system;
— 𒁾, 𒁿, 𒂀, 𒂁, 𒂂 used in $C_{\text{Ur III/OB}}$;
— 𒁹, 𒁺, 𒁻, 𒁼 used in $C_{\text{Ur III/OB}}$—note the overlap with 𒁹–𒁽;
— 𒁓 and 𒁕 used in $G_{\text{Ur III/OB}}$.

Only in the SPVS did numerals exist truly independently of metrology; to quote [Rob08, p. 78]: "The SPVS temporarily changed the status of numbers from properties of real-world objects to independent entities that could be manipulated without regard to [...] metrological system. [...] Once the calculation was done, the result was expressed in the most appropriate metrological units and thus re-entered the natural world as a concrete quantity."

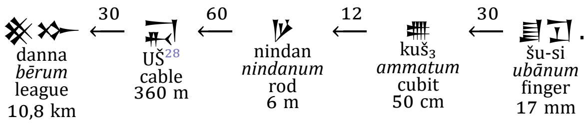
[24] Used for volumes of grain, but also oil, dairy products, beer, etc., as well as to express the capacity of boats; volumes of earthworks instead use system $G_{\text{Ur III/OB}}$ based on a height of one cubit, see[Pow87, p. 488; Rob08, p. 294; Rob19].

[25] From [P309594, obv. 1].

[26] A larger unit, the guru_7 (*karûm*, grain heap), is sometimes used instead, with 𒁓𒁕𒄀=𒃻𒄑 (1 *karûm* = 3600 kurrū). See [Fri07, p. 415; Rob19].

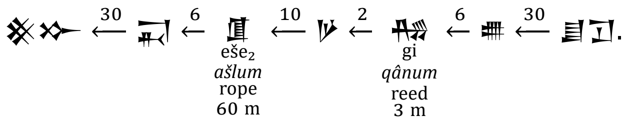
3.3.4 The length system

In the Ur III and Old Babylonian periods, lengths are expressed using overt units counted with 𒁹 and 𒌋 numerals with their system $S_{\text{Ur III/OB}}$ values. Since it does not have any unusual numerals, this system would not in itself be of much relevance to character encoding, but we present it here as background for its Early Dynastic counterpart presented in §3.4. Metrological tables use the following units[27] [Fri07, p. 118; Rob19]:



($L_{\text{Ur III/OB}}$)

Two more units appear occasionally [Pow87, p. 459; Fri07, p. 118; Rob19]:



($\bar{L}_{\text{Ur III/OB}}$)

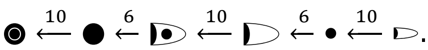
In addition, there are Akkadian names for the half-rope and half-reed, see [Pow87, pp. 463 sq.].

3.3.5 Fractions

Fractions of the *ikîm*, = $\frac{1}{2}$ and = $\frac{1}{4}$, have already been encountered. In other contexts, the fraction $\frac{1}{2}$ is written, as in . The fractions $\frac{1}{3}$ and $\frac{2}{3}$ are written 𒑚 and 𒑛. The latter two signs are derived from curviform signs and, which are already separately encoded; these are in turn derived from the sign 𒋙 (ŠU$_2$), whose Early dynastic form resembles, and numerals; see [Pow71, pp. 113, 134]. The 𒋙 is sometimes omitted, as in [P240545, *verso* 6 9; P221530; P221531; P271238; P274845].

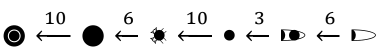
3.4 Curviform numerals in early metrologies

At first sight, the metrological systems from the Early Dynastic period resemble the ones previously mentioned. In particular, the discrete counting system used in the Early Dynastic period (and earlier in the fourth millennium) clearly mirrors system $S_{\text{Ur III/OB}}$ [Fri07, p. 374; DE87, pp. 127, 165]:



(S)

Likewise the area system used in the Early Dynastic IIIb period for areas of one iku and greater [Dei22, p. 72; NDE93, p. 63; Fri07, p. 378; Lec16],



($G_{\text{ED IIIb}}$)

[27] In this factor diagram and the next, we do not include the numerals. The units are no more than a factor of 60 apart, so higher numerals such as or are not used.

[28] As indicated by the capitalization, the reading of this sign is unknown; see [Pow87, pp. 465 sqq.] for a discussion of various hypotheses.

mirrors system $G_{\text{Ur III/OB}}$, with consistent use of the numerals: • corresponds to 𒐜, ● to ◇, and ◎ to ◈. An exception to this correspondence, noted in [L2/04-099, p. 4] (see §3.2), is that the vertical 𒁹 from $S_{\text{Ur III/OB}}$ corresponds to a horizontal 𒁺 in system S. This is however far from the only case of such a reallocation of function. The earlier form of the area system is [DE87, pp. 141, 165; Fri07, p. 378]:

$$● \xleftarrow{6} ◎ \xleftarrow{10} • \xleftarrow{3} 𒁹 \xleftarrow{6} 𒁺, \qquad (G)$$

Observe that, as noted in [DE87, p. 142], ◎ changes meaning from 10• in system G to 600• in system $G_{\text{ED IIIb}}$. System G is used in the fourth millennium, but also in the ED I–II period (it is the "area 2" system in [Cha03], whereas $G_{\text{ED IIIb}}$ is the "area 1" system).

Another example of nontrivial correspondence between cuneiform and curviform numerals may be found by comparing the fractions the Early Dynastic IIIb area system[29],

$$◎ \xleftarrow{10} ● \xleftarrow{6} ✸ \xleftarrow{10} • \xleftarrow{3} 𒁹 \xleftarrow{6} 𒁺 \xleftarrow{2} 𒌍 \xleftarrow{2} 𒍪 \xleftarrow{2} 𒄩^{30}, \qquad (G_{\text{ED IIIb}})$$

with the numerals of a contemporaneous capacity system:

$$\underbrace{𒁹 \xleftarrow{10} 𒁺 \xleftarrow{6} • \xleftarrow{10} 𒁺}_{𒆥𒄀𒃻} \xleftarrow{4} 𒌍 \xleftarrow{6} 𒍪, \qquad (C_{𒆥𒄀𒃻})$$

both described in [Lec16]. While the size of the 𒆥𒄀𒃻 (gur saŋ ŋal$_2$) in bariga is different from that of the Old Babylonian 𒆥, the basic structure of the capacity system is recognizable, with 𒌍 corresponding to 𒁹 for bariga, 𒍪–𒃻 corresponding to 𒐼–𒃻 for ban$_2$, and the 𒆥 counted with 𒁺 rather than 𒐼 numerals. However, the half-iku is counted with the same 𒌍 as the bariga, whereas it uses a different sign, 𒐕, in the Old Babylonian system. As we will see, this is cannot be handled as a split, by giving 𒐕 the glyph 𒌍 in an Early Dynastic IIIb font, as the 𒐕 numeral series is also in use in that period.

3.4.1 Field lengths in Ŋirsu

The length system of the Early Dynastic IIIb state of Lagaš is of particular interest. As described in [Pow87, p. 466; Lec20, pp. 289 sq.], lengths are expressed in rods, but the unit sign 𒂵 is generally omitted; in addition, only tens of rods are used; these are equal to one rope, but the sign 𒈨 is not written either. Lengths shorter than one rope are expressed in half-ropes using the $\frac{1}{2}$ sign 𒐼 (again with no 𒈨), and then in reeds, *with* the sign 𒄀𒂗, as follows:

$$𒁹 \xleftarrow[\substack{1\ \text{eše}_2\text{=10 nindan}\\ 1\ \text{rope=10 rods}\\ 60\ \text{m}}]{6} 𒐜 \xleftarrow{2} 𒐼 \xleftarrow{10} \underbrace{𒐕^{31}}_{\substack{𒄀𒂗\\ \text{gi}\\ \text{reed}\\ 3\ \text{m}}}. \qquad (L_{\text{ED IIIb}})$$

This is the system that was used to express the sides of the field in [P020054] discussed in §3.2. In that tablet and most others from the same period, such as the

[29] A variant is ◎ $\xleftarrow{10}$ ● $\xleftarrow{6}$ ✸ $\xleftarrow{10}$ • $\xleftarrow{3}$ 𒁹 $\xleftarrow{6}$ 𒁺 $\xleftarrow{2}$ 𒄭 $\xleftarrow{2}$ 𒌋 $\xleftarrow{2}$ 𒁾, see [Pow72, p. 218].

[30] The (fairly rare) cuneiform counterpart is 𒁾.

[31] The reeds are counted using *tenû* numerals, 𒐕, 𒐖, 𒐗, etc.

ones discussed in [Lec20], areas are expressed in system $G_{\text{ED IIIb}}$, with curviform numerals[32]; in the absence of overt units, such as when dealing with length that are integer multiples of a half-rope[33], the use of curviform or cuneiform numerals therefore disambiguates a numeric expression between an area and a length, and thus the interpretation of its numerals between systems $G_{\text{ED IIIb}}$ and $L_{\text{ED IIIb}}$. The sign , which would also disambiguate the interpretation as an area, is sometimes used after areas in ED IIIb Lagaš, but not systematically; in particular the area of the first field in [P020054] does not use this suffix. See [Lec20] for many examples with and without . There are other such co-occurrences contrasting between metrological systems; for instance, [Kre98, p. 303 n. 686] mentions the use of cuneiform numerals for days and months[34].

3.4.2 Dyke lengths in Ŋirsu

[Pow87, p. 466] notes that reeds "are regularly written with the normal, cuneiform end of the stylus. Higher units are usually written with the reversed (round) end of the stylus." Powell does not elaborate on the specifics of this mixed use of numerals, but a cursory search in [CDLI] finds many occurrences[35], such as:

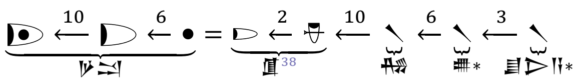
— [P221305, obv. 1 4][36]

— [P020129, rev. 2 1]

— [P221291, rev. 5 1][37]

— [P221266, rev. 2 1]

These expressions use an explicit sign (counted in multiples of ten) or . This notation—but not its use of curviform numerals—is remarked on in [Lec20, p. 290 n. 27], which cites several of the instances listed above. It seems to be typical of texts about dykes. The notation can be summarized by the following factor diagram, where prefix units have been marked by an asterisk:



($L'_{\text{ED IIIb}}$)

3.4.3 Butter, cheese and wheat in Ŋirsu

A similar mixture of cuneiform and curviform numerals may be observed with the capacity system; indeed, the previously described system uses

[32]A [CDLI] search for "(bur3)" (numerals used for areas) currently returns 15 ED IIIb results, whereas one for "(bur3@c)" (● numerals used for areas) returns 206. Further, when dated, the tablets with cuneiform bur₃ are from the reigns of (variously transliterated iri-inim-gi-na, uru-ka-gi-na, etc.) and (lugal-zag-ge-si), the last two kings of ED IIIb Lagaš.

[33]This is the case of the sides of the field in [P020054, obv. 2 2–3].

[34]That note also mentions a contrast between the use of curviform numerals to count people and curviform numerals to count bread alotted to them in [P010876]; such contrasts are more akin to styling, and might not, on their own, justify the disunification.

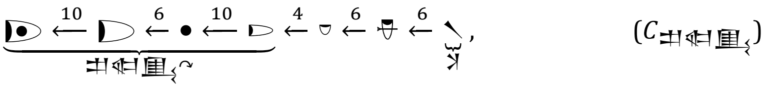
[35]A search for curviform numerals followed by some number of reeds counted in (*tenû*) cuneiform numerals currently finds 125 occurrences across 47 tablets.

[36][CDLI] only has a copy, but a photo may be found in [Lec12, p. 82]. On that photo the is not visible. Lecompte notes that the copy is faithful; indeed another can be seen both on the copy and the photo on obv. 2 2.

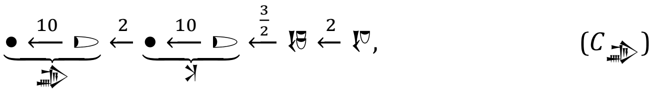
[37]From copy.

[38]With either unit omitted, as in the examples above, or both, as in [P020129, obv. 3 3] .

numerals for 𒋡 [Fri78, p. 43; Lec16]:



as in [P020016, rev. 1 4; P020065; P020090, obv. 1 3, rev. 2 1; P020092, rev. 3 1; P020137, obv. 1 2] and others, where ban₂ counted with 𒑏 numerals are followed by sila₃ counted with 𒀹 numerals. Curviform numerals are also used to count sila₃, but not[39] as part of the 𒄥 systems. This contrast can be seen in [P220927], which measures butter (𒉌, i₃) with a different capacity system, using the 𒂁 (dug, "pot") of 20 𒋡, with ⊃ and ● numerals[40] for both the 𒂁 and the 𒋡, thus [Pow87, pp. 504 sq.]



but counts cheese (𒂵𒅕, ga'ar) using the 𒄥𒊕𒅅 capacity system, with 𒀹 numerals for the 𒋡.

Another capacity system in ED IIIb Ŋirsu is the 𒄥𒈫𒌌, the gur of two ul [Lec16]:

Here the ⊃–𒀹–▽ contrast occurs not only within the numerals of the system, but with its units; this is perhaps best illustrated by the expressions 𒐏 𒄷𒄭 𒄷 ●▽𒑏𒐂𒋡 𒄥𒈫𒌌 in [P221746, rev. 2 2] and 𒐏 𒄷 ●𒑏𒐂𒋡 𒄥𒈫𒌌 in [P221814, rev. 1 5].

3.4.4 Grain in Ebla

The mixing of curviform and cuneiform numerals within a metrological system is not specific to Ŋirsu.

[39] As of this writing, the single occurrence of (ban2@c) followed by curviform numerals and sila3 in ED IIIb Ŋirsu transliterations on [CDLI], 4(ban2@c) 3(asz@c) sila3 in [P221815, obv. 4 7], is incorrect: it should be 4(ban2@c) 3(disz@t) sila3.

[40] This tablet also uses subtractive notation: ⊃⊃𒂁𒇲𒋡 "two pots minus two thirds (sila₃)", ●𒇲⊃𒂁𒐁𒋡 "ten minus one pots, six sila₃". Such subtractive notation is common in most of the metrological systems discussed here; it appears in the ED IIIa period [Rob08, p. 77]. It presents no complexity for character encoding, but it is noteworthy that the sign 𒇲 (lal, "minus") is often ligated with the following numerals, with the subtrahend placed under a sometimes considerably enlarged 𒇲, similar to the layout of the radical in modern mathematical notation, see, *e.g.*, [P020092, rev. 3 1, 2]. A good font could handle the very common −1 case, perhaps even −2 and −3; setting arbitrary numeric expressions under the 𒇲, or more generally replicating the layout of Early Dynastic tablets, is outside the realm of plain text; see also §6.3.

The system of grain[41] capacities in Ebla uses the following units[42]:

$$\underset{\text{gu}_2\text{-bar}}{𒄘𒁇} \overset{2}{\longleftarrow} \underset{\text{ba-ri}_2\text{-zu}}{𒁀𒋛𒍪} \overset{\frac{5}{2}}{\longleftarrow} \underset{\text{gi}\eta_4}{𒂅} \overset{4}{\longleftarrow} \underset{\text{ni}\eta_2\text{-sa}\eta\text{šu}}{𒃻𒊕𒋗} \overset{6}{\longleftarrow} \underset{\text{an-zam}_x}{𒀭𒍝}.$$

The 𒄘𒁇 and 𒁀𒋛𒍪 are generally counted using curviform numerals, and the smaller units using cuneiform 𒁹 numerals[43]. Indeed, a search on [EbDA] for co-occurrences of either 𒀭𒍝 or 𒃻𒊕𒋗 with either of 𒄘𒁇 or 𒁀𒋛𒍪 finds the following expressions[44]:

1. [P240532, *verso* 4 9] ⊃𒌍 𒁀𒋛𒍪[46] 𒐊𒃻𒊕𒋗
2. [P240548, *verso* 1 1] ⊃𒁀𒋛𒍪 𒐈𒀭𒍝
3. [P240655, *recto* 7 9] ⊃⊃𒌍𒁇[47] 𒐊𒃻𒊕𒋗
4. [P240579, *verso* 4 3] ⊃⊃⊃⊃⊃▽𒄘𒁇 𒈫𒃻𒊕𒋗
5. [P240675, *verso* 2 2] ⊃𒌍 𒁀𒋛𒍪 𒐊𒃻𒊕𒋗
6. [P240609, *verso* 3 1] ⊃𒁀𒋛𒍪 𒐈𒀭𒍝
7. [P240533, *recto* 3 3] ●⊃▽𒄘𒁇 𒐋𒃻𒊕𒋗 𒈫𒑆𒀭𒍝𒐉
8. [P240697, *recto* 1 5] ⊃▽[48]𒈫𒂅 𒐈𒀭𒍝
9. [P240653, *recto* 6 2] ●⊃⊃⊃▽𒄘𒁇𒁹𒃻𒊕𒋗 𒈫𒑆𒀭𒍝
10. [P240654, *recto* 2 6] ⊃𒁀𒋛𒍪 𒐋𒋡[49] 𒐈𒀭𒍝[50]
11. [P240531, *recto* 1 8] ⊃𒁀𒋛𒍪 𒐋𒃻𒊕𒋗 𒌍𒂷𒁺
12. [P241708, *recto* 1 1][51] ⊃⊃▽𒂔 𒄘𒁇 𒐋𒃻𒊕𒋗

[41]Liquid capacities use a different system [Arc15, p. 229 n. 12]:

$$\underset{\text{la-ḫa}}{𒆷𒄩} \overset{30}{\longleftarrow} \underset{\text{sila}_3}{𒋡} \overset{6}{\longleftarrow} \underset{\text{an-zam}_x}{𒀭𒍝}.$$

A glance it seems that 𒋡 are counted with cuneiform numerals and higher units with curviform ones, thus

$$\underbrace{\underset{𒌋𒁀𒋛𒍪}{\underbrace{⊃}} \overset{\frac{5}{3}}{\longleftarrow} ⊃ \overset{6}{\longleftarrow} • \overset{10}{\longleftarrow} ⊃}_{𒆷𒄩} \overset{3}{\longleftarrow} \underset{𒋡}{\underbrace{𒌋 \overset{10}{\longleftarrow} 𒁹}} \overset{6}{\longleftarrow} \underset{𒀭𒍝}{\underbrace{𒁹}},$$

but we have not investigated this thoroughly.

[42]Another system uses different values for the 𒂅 and 𒃻𒊕𒋗, see [Cha12, p. 62; Arc15, p. 229 n. 12]:

$$𒄘𒁇 \overset{2}{\longleftarrow} 𒁀𒋛𒍪 \overset{3}{\longleftarrow} 𒂅 \overset{4}{\longleftarrow} 𒃻𒊕𒋗 \overset{5}{\longleftarrow} 𒀭𒍝.$$

[43]For a more comprehensive overview of numeral usage in Ebla which we unfortunately found late in the preparation of this proposal, see [Gor24]; exceptions exist. Note that the example for ⊃ numerals counting 𒃻𒊕𒋗 cited in [Gor24, p. 143 n. 592], [P240532, *recto* 1 7] ⊃⊃⊃⊃𒃻𒊕𒋗, does not use the higher units; on the same tablet, [P240532, *verso* 4 9] (item 1), which does, uses 𒁹 numerals for the 𒃻𒊕𒋗. [Gor24, pp. 141–143] cites only 𒁹 for 𒀭𒍝 and only curviform numerals for integer 𒄘𒁇. As mentioned in [Cha12, p. 63], the 𒂅 is also counted using the 𒑏–𒑒 numeral series. Some instances of that usage are found transliterated $n/6$ in [EbDA]; in some cases the 𒂅 sign is omitted, and the 𒑏 numeral is then written before the 𒁇 unit, as in ⊃⊃𒑏𒌍𒁇 from [P240545, *verso* 1 3].

[44]We cite here only one attestation per tablet; most tablets contain several expressions mixing curviform 𒁀𒋛𒍪 and larger with cuneiform 𒂅 and smaller. In all cases the transcriptions given here are based on the [EbDA] transliterations, but the shape and orientation of the numerals was checked[45] on a photograph (from [EbDA] unless noted otherwise).

[45]As we will see in §3.7.2, [CDLI] transliterations indicate numeral shape; however, as of this writing, they do so incorrectly on the Ebla corpus, claiming that all numerals are curviform, so we were not able to rely on them in this specific case.

[46]ba-ri$_2$-zu$_2$, a variant spelling.

[47]Short for 𒄘𒁇.

[48]Note the omitted 𒄘𒁇.

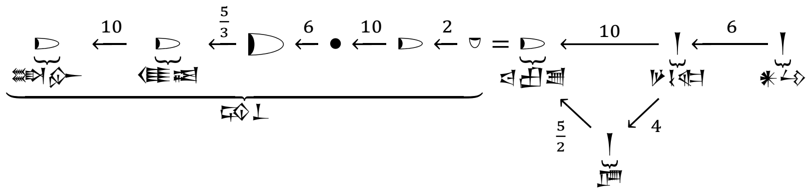
[49]Instead of the expected 𒃻𒊕𒋗.

[50]𒐈𒀭𒍝 not legible on the [EbDA] photo.

[51]From [CDLI] photo.

13. [P241904, *recto* 1 1][52]
14. [P240964, *recto* 3 2][54] [55] [56]

Note that higher numbers of are expressed in hundreds (*mi-at*) and then thousands (*li-im*), as is typical in Ebla [Arc15, p. 33], *e.g.*, in the last example above or in [P240532, *verso* 2 3], (100 + 60 + 30 + 5 = 195 of grain). These expressions correspond to the following factor diagram:



(C_{Ebla})

3.4.5 Use in modern publications

Because of their prevalence in the fourth millennium and Early Dynastic period, the proposed numerals are widely used in modern publications discussing metrology in those periods, as illustrated in Figures 1–21.

Since they contrast with the cuneiform numerals, they likewise appear contrastively in such publications. A remarkable example of that is found in Figure 21. The partial[57] transliteration "4 *ʾa$_3$-da-um* 4 *aktum* 4 ib$_2^{\text{tu}_9}$×3 sa$_6$ gunu$_3$" is used to illustrate a discussion of the interpretation of the contrast between and numerals. More conventional transliterations might omit the numeral shapes entirely, *e.g.*, 4 *ʾa$_3$-da-um* 4 *aktum* 4 ib$_2^{\text{tu}_9}$×3 sa$_6$ gunu$_3$, which would obviously be inadequate in this context. There are transliteration conventions that are more explicit about numeral shape, *e.g.*, 4(aš^c) *ʾa$_3$-da-um* 4(diš^c) *aktum* 4(aš^c) ib$_2^{\text{tu}_9}$×3(diš) sa$_6$ gunu$_3$, but the result would be less readable. See §3.7.2 for a discussion of transliteration conventions for numerals.

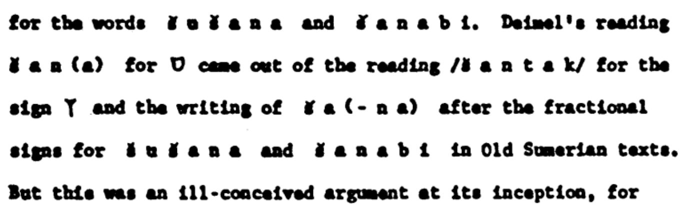

for the words š u š a n a and š a n a b i. Deimel's reading š a n (a) for came out of the reading /š a n t a k/ for the sign and the writing of š a (- n a) after the fractional signs for š u š a n a and š a n a b i in Old Sumerian texts. But this was an ill-conceived argument at its inception, for

Figure 1: Discussion of the readings of proposed and already-encoded in [Pow71, p. 107].

[52] From photo in [Arc89, p. 6].
[53] Laid out as ; on stacking patterns see §6.3.
[54] From photo in [Arc89, p. 6]; see also the [CDLI] photo and the copy in [Fri86, p. 17]. This tablet features unusual usage of vertical numerals—"somewhat unorganized", as described by [Fri86, p. 16]—, such as or , but its and are consistently counted with cuneiform numerals, and the higher units with cuneiform numerals.
[55] Short for .
[56] ŠU$_2$+NIŊ$_2$-saŋ, an unusual variant spelling.
[57] The untransliterated text would be ; note the atomically encoded ib$_2$ × 3 = × = .

sions also. In example 6, the writing 𒄑 may imply a reading /š a n a b i/,[1] whereas 𒄑 in example 11 should be read */š u š a n a m i n/. Moreover, the question must be raised as to whether such writings as <𒌑/<𒍪 k ù - b a b b a r + š a - a[2] do not perhaps imply a linguistic resolution of */š u š a n a m i n/ rather than /š a n a b i/. I see no way of answering this question at present, but it is one which one

Figure 2: Discussion of the readings of proposed 𒄑 and 𒄑 as well as already-encoded 𒌑 and 𒍪 in [Pow71, p. 138].

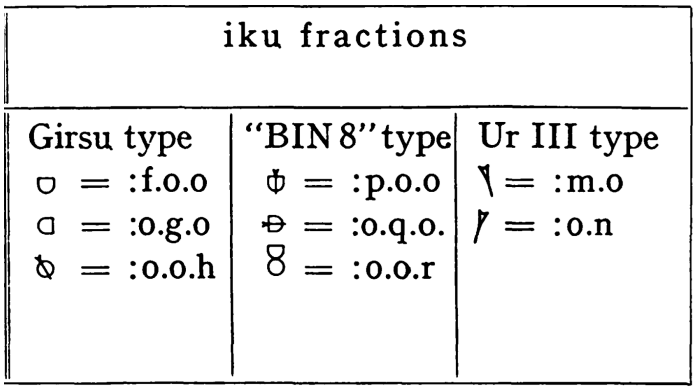


Figure 3: A transliteration system for the fractions of the iku in [Pow72, p. 216].

1 "big cup" = 3 "big disks". Hence we can infer from the two ŠE-texts BIN 8,4 and BIN 8,5 together, that the "ŠE-system" makes use of number signs whose values are related to each other through the equations

1𒌑 = 3 𒃻?,1𒃻 = 10 𒂊?, 1 𒂊 = 6 𒌑, 1 𒌑 = ? 𒃻

A more convenient way of saying the same thing is to write out the "steps" between the various ŠE-units in what we shall call a "step-diagram" for the "ŠE-system":

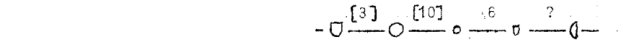


Figure 4: The first factor diagram, in [Fri78, p. 10].

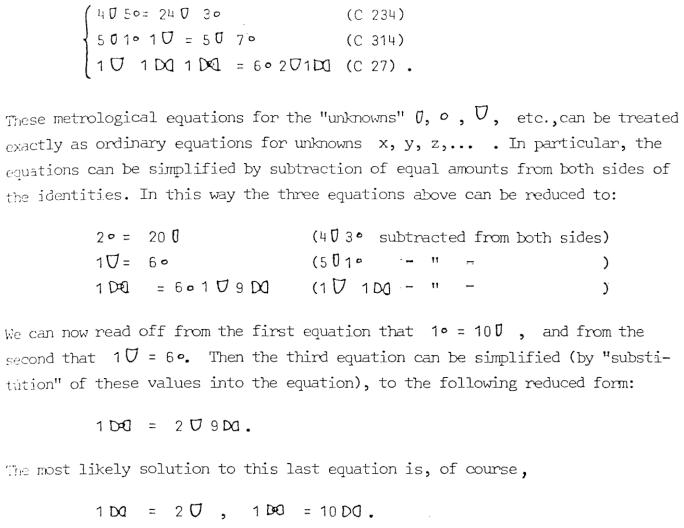


Figure 5: Derivation of the factors of the bisexagesimal system in [Fri78, p. 15][58].

[58]The bisexagesimal system is used alike in proto-Elamite and proto-cuneiform texts, see [Fri78, p. 38]; the derivation in [Fri78, p. 15] is based on proto-Elamite artefacts. There is a typo in the equation for C 27: the right-hand side should have 10 rather than 1, otherwise nothing could be deduced about . Note that in Friberg's early works [Fri78; Fri79; Fri86; Fri87], copies of fourth millennium and sometimes third millennium tablets are shown as vertical text (which they were for the scribes), and their numerals are written within horizontal text in the same orientation that they have if the tablet is taken as vertical text; in [UAX50] parlance, as if they had Vertical_Orientation=Upright. In addition, they are listed in these equations in the horizontal order in which they appear as vertical text (thus the rightmost numeral is the most significant, read first). Cuneiform is correctly Vertical_Orientation=Rotated, consistently both with modern practice and with the rotation between earlier vertical and later horizontal monumental inscriptions. Friberg's early conventions are not followed in later scholarship, and are abandoned in his own more recent works, such as [Fri07]; a more typical way to express the first equations might be

$$5\bullet + 4\triangleright = 3\bullet + 24\triangleright \quad \text{(C 234)}$$

$$1\rhd + 1\bullet + 5\triangleright = 7\bullet + 5\triangleright \quad \text{(C 314)}$$

$$1\boxtimes + 1\boxtimes + 1\rhd = 10\boxtimes + 2\rhd + 6\bullet. \quad \text{(C 27)}$$

A diplomatic edition of [Fri78] could rotate the numerals using a higher-level protocol:

$$\begin{cases} 4\triangledown 5\bullet = 24\triangledown 3\bullet & \text{(C 234)} \\ 5\triangledown 1\bullet 1\overline{\triangledown} = 5\triangledown 7\bullet & \text{(C 314)} \\ 1\overline{\triangledown} 1 \; 1\bullet = 6\bullet 2\overline{\triangledown} 1 & \text{(C 27).} \end{cases}$$

Thus, for instance, the original set of fractions 𒌍, 𒌋, and 𒐼 (1/2, 1/4 and 1/8 of an iku) in the Sumerian GANA system was after a time augmented through the addition of the new sub-unit SAR: 𒊹, equal to 1/100 of an iku (𒂗). Similarly, the Sumerian weight unit "ma-na" which originally may have had only the sub-units 𒎌 ša-na (= 1/3 mana) and 𒎌𒌍 ša-na-bi (= 2/3 mana), and perhaps also gín: 𒄀 (= 1/60 mana), seems to have acquired, at some time or other, also the smaller sub-units

𒄀𒌍 (= 1/3 gín), and 𒄀 — še (= 1/3 × 1/60 gín).

Figure 6: Discussion of proposed fractions 𒌍, 𒌋, 𒐼, and 𒄀𒂗, as well as already-encoded 𒄀𒌍 and 𒄀𒌋 in [Fri78, p. 49].

stein publizierten Zeichenliste enthalten ist[3], bis vor kurzem unentdeckt bleiben konnte. Erst 1978 machte der schwedische Mathematiker J. Friberg, ERBM I, 9-11, darauf aufmerksam, daß die Zeichen für die Zahlen Eins (𒐼) und Zehn (●) in Verbindung mit dem Zeichen ŠE nicht im Verhältnis 1 zu 10 sondern im Verhältnis 1 zu 6 stehen. Bis dahin hatte man, obwohl die Andersartigkeit des in Verbindung mit dem Zeichen ŠE verwendeten Zahlzeichensystems bekannt war, für diese beiden häufigsten Zahlzeichen einheitlich ein Verhältnis 1 zu 10 unterstellt, obwohl es mehrere eindeutige Gegenbelege gab, von denen zumindest diejenigen der Archaischen Texte aus Ǧemdet Nasr bereits früh publiziert und jedermann zugänglich waren[4]. Als Folge

Figure 7: Discussion in [DE87, p. 117] of the discovery in [Fri78, pp. 9–11] (see Figure 4) of the different relations between 𒐼 and ● in systems *G* and *Š*.

there is in any case an important qualitative difference between IX for Latin novem and ⁘ for Sumerian niš. niš seems to be a primary numberword requiring, in a system depicting Sumerian numeration, a differentiated representation comparable

Figure 8: The sign ⁘ used in a parallel with IX in [Eng88, pp. 131–133 n. 9], discussing an argument from [Pow72, p. 172] on the question of the language of the Uruk III texts.

of decreasing fractions $^1/_n$ of this measure, whereby "n" was determined by the number of oblique impressions made by the rounded end of a thin stylus around a central point in a specific sign. Thus 𒐼 = $^1/_2$ N_{39}, 𒌍 = $^1/_3$ N_{39}, and so on. The first sign of the latter units, N_{34},

Figure 9: Description of the fractions 𒐼 and 𒌍 in [Eng98, p. 113][59].

For instance, the first line contains the notations $1N_{34}$ $1N_{39}$; $2N_{20}$, which can be translated "60 of the (grain rations containing) 𒌦 (of grain); (grain involved:) 2 ● (of ground barley)". This calculation contradicts the assumed numerical relationship $10N_1 = 1N_{14}$, since as was well known the measure represented by the sign N_{39} was $^1/_5$ of that represented by N_1, so that 60 × $^1/_5$ = 12 and not 20, as $2N_{14}$ would imply. Instead of relying on complicated

Figure 10: The sign 𒌦 used as a capacity measure within otherwise translated text in [Eng98, p. 116].

[59]The text erroneously has N_{34} instead of N_{24}.

Die halbkreisförmigen Griffeleindrücke gehen manchmal in mehr oder weniger eckige Formen über (▽)[685]. Es gibt aber auch Einer in Form von regelrechten – meist mehr oder weniger schräggestellten – Keilen (▽), die öfters neben halbrunden Einern vorkommen und mit diesen kontrastieren[686]. Selten treten mit ▽ gebildete Zahlen auf[687] (sie entsprechen den bariga-Zahlen im Hohlmaßsystem, s.u. 7.4).

Figure 11: Discussion of co-occurrences and contrasts between ▽, ▽, and ▽ in [Kre98, p. 303].

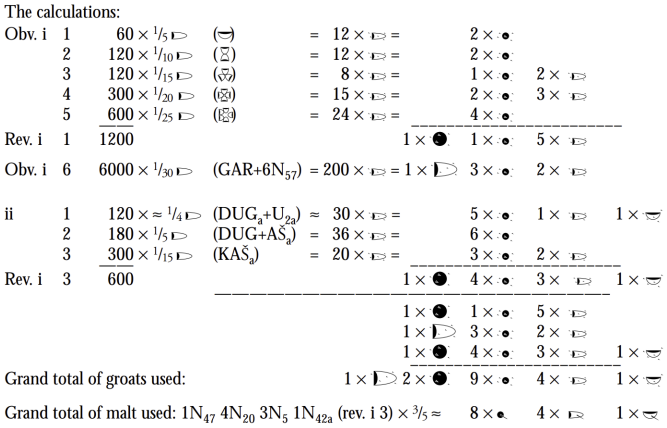


Figure 6. Transliteration and calculations of *MSVO* 4, 66.

Figure 12: Calculations from [P005468] transcribed in [Eng01, p. 132] using modern mathematical notation combined with some of the proposed characters.

strong similarities between "area" 1 and "area" 3 systems, the sign with two concentric discs (◎, notated N_{50}^{27}) remains problematic. It never appears in any numerical combination with the sign with a single disc (●,

Figure 13: Discussion of ◎ and ●[60] in [Cha03, p. 6].

[60]The statement that these do not co-occur refers to the texts from ED I–II Ur; these signs co-occur both earlier and later in areas, with different relations as previously discussed.

$^1/_{15}$, etc., of gur, we would expect the metrogram gur to appear in sub-column ii. In a certain way, it does for larger measures: the notation 𒐼𒐊𒐏 could be understood as 1 $^1/_5$ gur.[27] However, the metrogram gur does not appear for lower measures. It would not be consistent to attribute different functions to the same grapheme, according to the relative importance (be it great or small) of the quantity, so the signs 𒐏 and 𒐐 cannot be considered klasmatograms.

Metrological tablets from the end of the 4th millennium (Nissen, Damerow and Englund 1993, 55-59, to *MSVO* 1, nos. 2-3) contain a discrete set of numerical signs with specific surface area reference:

1(iku) represents a surface of 3600m²
1(eše$_3$) represents a surface of 21,600m²
etc.

The signs iku and eše$_3$ constitute by themselves measures of surface areas. These measures are usually followed by the sign GAN$_2$, which means either surface or field and

Figure 14: OB capacities[61] and fourth millennium areas in [Pro09, p. 9].

formed by only two signs 𒁹 and 𒌋, repeated as many times as necessary; this type of notation is highly standardized. Second, the order of magnitude of the numbers noted in this system is not indicated: 1, 60, 60^2, 60^3, 1/60, $1/60^2$, etc. are written in the same way, with the vertical wedge 𒁹. The third feature concerns the exact function of

Figure 15: Description of the SPVS in [Cha12, p. 58], using the already-encoded signs 𒁹 and 𒌋.

one step. The scribes of the Early Dynastic Period (*c.* 2600 BC), for instance, represented the number 648, 000 with: 𒐕𒐋𒐋𒐋 but never with the repetition 𒐕𒐕𒐕𒐋𒐋𒐋.

Figure 16: Discussion of large numbers illustrated by 𒐕𒐋[62] in [Cha12, p. 59].

repetition of the same sign refers to both the capacity unit signified—often but not necessarily written immediately afterwards—and its value. The units of measurement are written in descending order from left to right—just as we would write 3 km, 120 m, 50 cm. For example:

𒐈𒐈𒐈 še bar 𒁓 *ba-rí-zu*

'3 *gubar* (capacity units) and 1 *parīsu*'.

Figure 17: Partial transliteration of [P240597, *recto* 5 3] 𒐈𒐈𒐈 𒄩 𒁓 in [Cha12, p. 61].

This is particularly true of the signs 𒁔, 𒁕, 𒁖 and 𒁗, whose form explicitly denotes the fractions 1/6, 2/6, 3/6, and 4/6 of the barig capacity measure written 𒁓 in Mesopotamia—also transcribed by Assyriologists as 1 bán, 2 bán, 3 bán, and 4 bán with reference to the bán measure worth 1/6 of the barig. At Ebla, the sign 𒁓 is most often associated with the *parīsu* measure, while the signs 𒁔, 𒁕, 𒁖 and 𒁗 refer to 1, 2, 3,

Figure 18: Discussion in [Cha12, p. 64] of the relation between 𒁔–𒁗 and 𒁓 in Mesopotamia and in Ebla.

[61] The cuneiform text is Unicode-encoded.

[62] Compare 𒌋𒐕 in system $G_{\text{Ur III/OB}}$. Sign order can be variable in early texts, see [Fox16, p. 8]. See [P010773], also discussed in [Fri07, p. 148], for an example of 𒐕●, and [P274845; P241764] for examples of n●𒐕.

shape. The principle of notation is additive: each sign is noted as many times as necessary (e.g.,  transliterated as 2(šar$_2$) 1(geš'u) 3(u), means 2 × 3600 + 1 × 600 + 3 × 10). The system is based on an alternation of factors ten and

Figure 19: Explanation of the structure of the number  in [Pro20, p. 350].

might think of one fabric and a half,[11] but the presence of notations with "2 2", "3 3", and "6 6" (Fig. 1) elements excludes that one deals with fractions, as these notations are not consistent with those of Šuruppag's weight measurement system.[12] The notation "1 gada" in o. ii 1 and r. vi 1, along with the total of "39

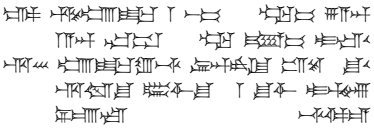
Fig. 1. Combinations of numerals attested in Š. 742.

Figure 20: Discussion of the contrast between and numerals in [Gor23, p. 162].

as, for example, in TM.75.G.3125 = *ARET* III 107 o. iv 1, "4 *'a$_3$-da-um*^{tu9}-2 4 aktum 4 ib$_2^{tu9}$×3 sa$_6$ gunu$_3$" (Fig. 2).

Figure 21: Transliteration in [Gor23, p. 163] of [P242293, *recto* 4 1] incorporating untransliterated numerals.

3.5 Non-numeric usage



The beginning of the scribal art is a single wedge. That one has six pronunciations; it also stands for 'sixty'[63]. Do you know its reading[64]?

Examenstext A[65]

Many of the cuneiform numerals are used with a logographic or phonetic value. For example, the sign has, *inter alia*, the values aš, rum, and dili. While the horizontal numerals are most frequently written in the Early Dynastic period[66],

[63]The reader will recall that ŋeš$_2$ is written , with a larger wedge than ; however, these signs have merged by the time Examenstext A is composed.

[64]Besides ŋeš$_2$, a look at [OSL] shows that the values diš, ge$_3$, makkaš, saŋtak$_4$, and tal$_4$ are attested both in [ePSD2] and in lexical lists. The sign is also used for the Akkadian word *ana* in the Neo-Assyrian period.

[65]Translation from and composite text after [BLMS].

[66]A [CDLI] search for "(asz@c)" finds 3296 ED texts, while a search for "(asz)" finds 81 ED texts, of which 46 also contain "(asz@c)".

such non-numeric usage is almost[67] always written 𒀸, for instance:

— in personal names in administrative texts, such as the following, which all contain ⊃ numerals:
  — 𒀸𒀴[68] in [P010424, rev. 1 5; P010458, obv. 1 5; P010459, obv. 2 5′] from ED IIIa أبو صلابيخ,
  — 𒀸𒁺 in [P010960, obv. 2 5] from ED IIIa Šuruppag,
  — 𒋛𒌓𒀸𒂍 in [P251641, obv. 4 3] from ED IIIb Adab,
  — 𒀴𒁁𒀸𒂍 in [P252866, obv. 2 3] from ED IIIb Adab,
  — 𒊺𒈨𒀸𒁺 in [P298637, rev. 2 4] from ED IIIb Umma;

— in the Sumerian word 𒌑𒀸 u$_2$-rum, "property" in ED IIIb Ŋirsu administrative texts which contain ⊃ numerals, such as [P020006, obv. 2 3; P020008, rev. 1 2; P020018, rev. 1 2; P020024, obv. 1 4; P020030, obv. 3 1];

— in lexical texts:
  — in the divine name 𒀭𒂗𒆤𒀸𒆷 in the lexical texts [P010570, rev. 2 4; P010572, obv. 3 6], where the entries are prefixed with ⊃.
  — in the word 𒀸 dili, "small fish" in [P010578, obv. 2 5], witness to Early Dynastic Fish,
  — in the same word with a determinative, 𒀸𒄩 dili$^{\text{ku}_6}$, in [P010586, obv. 4 4, 6], witness to Early Dynastic Food, which starts with ⊃ numerals.

This is a clear contrast between 𒀸 and ⊃ in this period, and genuine ambiguity can arise if it is lost; for instance, the personal name 𒀸𒀴 occurs on its own line in the aforementioned administrative texts; a line ⊃𒀴 would instead be read as "one slave".

3.6 The limited benefits of diachronic encoding for numerals

The argument in favour of diachronic encoding is that it facilitates interoperability in a variety of use cases, as we have outlined in §3.1. While these benefits are real and now visible for cuneiform signs, similar considerations are not generally applicable to curviform numerals.

Diachronic reference works such as sign lists and dictionaries tend to not include numbers, or when they do, they treat them separately, and include signs such as 𒀸 that have both numeric and non-numeric values in both the main list and the section on numbers. For instance, [Sch35, pp. 123 sqq.] lists all of 𒀸–𒐇 together with ⊃–⊃⊃⊃⊃⊃⊃⊃⊃⊃, while 𒀸, 𒐀, and 𒐁, and only those, appear at the beginning of the sign list, since they have non-numeric values[69]. [Cat13, p. 58] has the numeric signs ⊃, 𒀹, 𒁹, whereas non-numeric 𒀸 is at the beginning of the sign list, where its values *aš* and *rum* are listed. For signs with both non-numeric and numeric usage, [Dei22] writes *s. die Zahlz.* throughout the main list; LAK 1 𒀸 thus reappears at LAK 829 together with ⊃, 𒀹, and 𒁹. One should note [Bor10], which has numbers throughout the sign list; but that sign list does not show glyphs predating the Old Babylonian period, nor does it comprehensively cover the numerals used in the Ur III and Old Babylonian periods, as, for instance, it does not have 𒐲–𒐴 used in system $G_{\text{Ur III/OB}}$.

Composite texts rarely have witnesses both from the Early Dynastic period and later; the kinds of texts that do, chiefly lexical and literary texts, do not con-

[67] Exceptions are discussed in §3.7.1.

[68] Possibly a toponym, see [Pos, p. 195].

[69] Non-numeric values of 𒀸 were discussed in §3.5; 𒐀 has the values man$_3$ and min$_5$, and is used for the word didli, "several, various"; 𒐁 has the value eš$_6$.

tain numbers to the extent that administrative texts do. Further, there tend to be changes[70] to the text between Early Dynastic and later witnesses that prevent a diachronic encoding of such composites. For numerals, the switch from 𒐕 to 𒁹 numerals prevents diachronic encoding even if 𒐕 were unified with 𒀸. For instance, the lexical list Early Dynastic Food, already mentioned in §3.5, contains some numbers, and has a witness from the Old Akkadian period covering these numbers: [P215653, a 1′–6′]; however, they are written with 𒁹 numerals, whereas they are written with 𒐕 numerals in the Early Dynastic witnesses; since 𒁹 and 𒀸 are distinct[71] characters, the 𒐕-𒀸 unification does not help.

More generally, since numbers are so deeply tied to metrology, and since metrological systems change between the Early Dynastic and later periods[72], there is little opportunity for a diachronic representation of numeric quantities.

In the case of analyses such as [Rom23, *sub* "Adding Corpora"], it is interesting to note that numeric expressions are removed prior to the conversion of the corpus to Unicode cuneiform for further analysis.

3.7 Compatibility considerations

A disunification twenty years after the fact, affecting all numerals, would ordinarily be a serious compatibility issue. Fortunately, with the exception of one character discussed below, we are not aware of any font using curviform glyphs for the already-encoded numerals. In fact we are not aware of any font designed for a style earlier than Old Babylonian, except for fonts mimicking the representative glyphs from the code charts, which are primarily Ur III, but sometimes earlier or later, as described in [UTR56, §2.4]. The lack of dedicated Ur III fonts may be explainable by the chart-like fonts[73] being good enough for most purposes; the lack of Early Dynastic fonts, by the aforementioned issues with numeral unification making the representation of any text with numerals intractable.

3.7.1 The case of ŠAR$_2$

The character U+122B9 ● CUNEIFORM SIGN SHAR2 has a circular reference glyph.

In most texts from the Early Dynastic IIIb and Old Akkadian period[74], a contrast

[70]Compare, *e.g.*, in the *Instructions of Šuruppag*, 𒋢𒆳𒊒𒆠 𒋗𒀀𒐕 𒌉𒉌𒊏 / 𒈾 𒈾𒈬𒁲𒁲 in the ED IIIa witness [P222243, obv. 2 7], also discussed in §3.7.1, and 𒋢𒆳𒊒𒆠𒂊 𒌉𒉌𒊏 𒈾 𒈾𒈬𒌦𒁲𒁲 in the OB composite [Q000782, 6] (translated "Šuruppag gave instructions to his son" in [ETCSL, t.5.6.1, 1–13]). It does not matter for the construction of a composite text whether this is encoded 𒋗𒀀𒐕 or 𒋗𒀀𒀸, since that word is absent from other witnesses, and since the surrounding words differ.

[71]Besides the contrasts in numeric usage mentioned in §3.3.3, these (already-encoded) characters were clearly not unifiable because of the many contrasts in non-numeric usage between them; several values of 𒀸 which are not shared with 𒁹 have already been mentioned, but perhaps most striking is the fact that, in the Neo-Assyrian period, 𒀸 is used for the preposition *ina*, "in", and 𒁹 for the preposition *ana*, "to".

[72]See, *e.g.*, [Pow87, p. 493; Rob08, p. 55] on the unification of metrologies in the Old Akkadian period, resulting in the systems described in §3.3.

[73]Most prominently Noto Sans Cuneiform, a system font on both Windows—as part of Segoe UI Historic—and macOS.

[74]For example, in personal names:

- — 𒌨𒆤𒂗𒋛 in [P020019, rev. 1 2] from ED IIIb Ŋirsu;
- — 𒉿𒁇𒂗𒋛𒆠 in [P020182, obv. 2 9], also from ED IIIb Ŋirsu;
- — 𒅗𒀭𒂗 in [P222186, obv. 3 3] from ED IIIb Umma;
- — 𒌋𒀭𒈫𒂗 in [P235312, obv. 16] from Old Akkadian Umma.

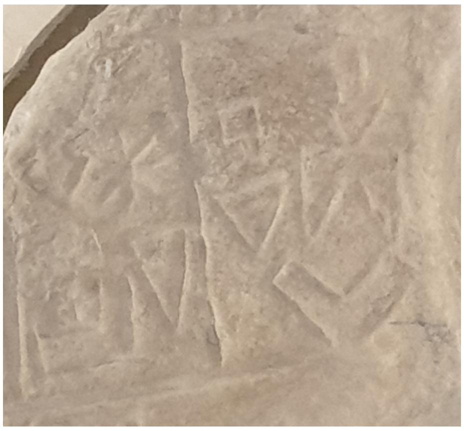


Figure 22: [P222399, obv. 6 16–17] 𒁯𒂄𒁯 / 𒀭𒂗 𒄭𒆰.

between non-numeric šar$_2$ written 𒄭 and numeric 1(šar$_2^c$) written 𒊹 can be observed, similar to the contrast between 𒁹 and ⊳ previously discussed in §3.5. However, in lexical lists from Šuruppag and Ebla[75], as well as in the *Stèle des vautours*, non-numeric šar$_2$ is curviform:

— 𒀭𒈾𒄭𒊹 and 𒀭𒈾𒊹𒌋𒁇 in [P010566, obv. 10 10, 11];
— 𒊹𒀭𒂗 and 𒀭𒊹𒀭𒂗 in [P010576, rev. 3 16, 17];
— 𒊹𒈦 in [P240986, *recto* 3 3][76];
— 𒊹𒆰𒄭 in [P222399, obv. 17 9, 18 11, 22 12][77].

It *would* be disruptive to the diachronic representation of text if non-numeric šar$_2$ were to have two different representations. The character U+122B9 CUNEIFORM SIGN SHAR2 should therefore be used in those cases, with its curviform glyph 𒊹, identical to the glyph of the proposed U+12579 ● CUNEIFORM NUMERIC SIGN ONE N45. Since the archaizing style of texts wherein non-numeric šar$_2$ is curviform solidly predates the transition from ● to 𒄭 in the relevant metrological systems, there is no need to represent a 𒄭-● contrast, so these characters can have the same glyph in specialist archaizing Early Dynastic fonts.

Since cuneiform U+122B9 CUNEIFORM SIGN SHAR2 effectively merges with U+1212D 𒄭 CUNEIFORM SIGN HI, the reference glyph should remain as it is, *i.e.*, curviform, so that the contrast between reference glyphs within the Cuneiform block remains clear; see [UTR56, §2.4]. Since system fonts follow the reference glyphs, and since extant specialist fonts target styles where U+122B9 is unambiguously cuneiform, there are no compatibility issues.

Note that in rare cases, such as [P222243, obv. 2 7] from ED IIIa Adab, non-numeric 𒁹 (here with the value rum) is written ⊳. It is out of scope for this proposal to decide whether such occurrences should be treated as anomalous spellings, encoded as U+12550 ⊳ cuneiform numeric sign one N01, or as stylistic

[75] These are archaizing in other ways, *e.g.*, they have a 𒉆–𒌆 (NAM$_2$–TUG$_2$) split.
[76] From copy in [Man81, ELLes 397].
[77] Note however 𒀭𒂗 𒄭𒆰 on [P222399, obv. 6 17], see Figure 22. Curviform non-numeric šar$_2$ is clearly archaizing in ED IIIb Ŋirsu; one might suppose that the scribe slipped into their modern ways here.

distinctions, encoded as U+12038 CUNEIFORM SIGN ASH with a curviform glyph. in practice this would often be determined by the transliteration from which the cuneiform text is generated; it is noteworthy that as of this writing, the [CDLI] transliteration (UR2-1(aš@c)) and the [ePSD2] one (uru_8^{rum}) of this word disagree on that aspect. Since 𒀸 has a cuneiform reference glyph, this does not pose any compatibility concerns.

3.7.2 Transliteration

An important feature of the encoding is that, in order to support input and bulk conversion of transliterated corpora to Unicode cuneiform, it should not represent distinctions that are finer than those recorded in typical transliterations; thus, while some older forms of BIL_2 can be described as 𒉈×𒆜 NE×KASKAL or 𒉈×𒉽 NE×PAP[78], they are typically all transliterated bil_2, and therefore are all represented by the character U+1224B 𒉋 CUNEIFORM SIGN NE SHESHIG, its name notwithstanding, as described in [UTR56, §2.5].

The situation is more complicated for numbers. Many transliterations do not represent the type of numeral used, instead interpreting the whole numeric expression and transcribing it with delimiters or units as needed to disambiguate. For instance, 𒁹𒌍𒐊𒄥 from [P305639, rev. 21] may be transliterated as 95 gur, as in [Feu04, vol. 2, p. 62]. The numerals may also be transliterated separately, but solely by their values in terms of the overt unit, as in [EbDA] transliterations: the aforementioned [cuneiform] from [P240533, *recto* 3 3] is transliterated “20-1-1/2 *gu_2-bar* 7 nig_2-sagšu 2-1/2 an-zam_x[79] *za*”, reading both [cuneiform] and [cuneiform] as 1/2, but not distinguishing them.

In particular, these transliterations do not differentiate between 𒀸 and 𒁹 numerals, nor between [cuneiform] and [cuneiform] numerals. For instance, the aforementioned [P242293, *recto* 4 1] [cuneiform] is transliterated “4 *ʾa_3-da-um*^{tug_2}-II 4 aktum^{tug_2} 4 ib_2-III gun_3 sa_6 ^{tug_2}” in [EbDA], with no distinction between the [cuneiform] and [cuneiform]. Since 𒀸 and 𒁹 numerals are separately encoded, the numeric expressions in such transliterations cannot be transformed into Unicode cuneiform without additional context, regardless of curviform–cuneiform unification.

In metrological systems such as systems $G_{\text{Ur III/OB}}$ and $C_{\text{Ur III/OB}}$ where some units are indicated by the type of numeral rather than an overt unit sign, it is common practice to add the unit in parentheses in transliteration; for instance, [cuneiform] from [P386847, obv. 1] is transliterated “1($eše_3$) 5½ iku[80] 7 sar” in [Feu04, vol. 2, p. 176], and [cuneiform] from [P307255, obv. 12] is transliterated “1(n[81]) 2(b) 7 ½ $sila_3$” in [Feu04, vol. 2, p. 151].

This practice has been generalized to systematically indicate numeral shape; this is in particular the case in [CDLI], where the transliterations of some the above examples are “1(gesz2) 3(u) 5(asz) gur” for 𒁹𒌍𒐊𒄥, “1(esze3) 5(iku) 1/2(iku) GAN2 7(disz) sar” for [cuneiform], and “3(barig) 2(ban2) 7(disz) 1/2(disz) sila3” for [cuneiform]. [CDLI] and [ePSD2] both distinguish curviform from cuneiform numerals in transliteration: the length [cuneiform] from [P020129, rev. 2 1] is transliterated “6(gesz2@c) 3(u@c) {ninda}nindax(DU) 1/2(asz@c) 4(disz@t) gi” in [CDLI], and “6($geš_2^c$) 3(u^c) ^{ninda}$ninda_x$(DU) 1/2($aš^c$) 4($diš^t$) gi” in [ePSD2]. Another

[78] As on [P249253].
[79] As of this writing, [EbDA] actually has an-zam_χ, with U+1D6A GREEK SUBSCRIPT SMALL LETTER CHI.
[80] [cuneiform] interpreted as a unit, as discussed in §3.3.
[81] short for nigida, an older reading of bariga; see [Lan50, p. 376; Pow75, p. 181; Fox22, p. 9].

example is [Mol14, p. 39], which uses 1*a* for 𒀸, 1*d* for 𒁹, 1*ac* for ⊃, 1*dc* or ½*dc* for ▿ depending on reading, etc. The literature on the Uruk and Early Dynastic I–II periods uses a different set of transliteration conventions that also disambiguate numeral shapes, as will be discussed in §4.

While there exist transliterations that distinguish 𒀸 from 𒁹 but not ⊃⊃⊃ from 𒀸, such as the ones used in [DCCMT], the trend, especially in more recent works in third millennium studies, seems to be to represent numeral shape; for example, [MV24] gave an example of the input syntax used by the new "Urban Economy Begins" project as "10 + 5c(GUR) + 2(BARIGA) + 1(BAN2)" for ●⊃⊃⊃⊃⊃𒐖𒑘, with a c indicating that the GUR numerals are curviform, and the parenthetical GUR indicating that these are ⊃ rather than ▿ numerals. The "tradition of cavalierly dispensing with numerical notations in notations of administrative documents", as [Eng04, p. 30] describes it, seems to be fading.

3.8 Conclusions

Co-occurences of curviform and cuneiform numerals are not anecdotal in the Early Dynastic period, nor are they the result of scribal idosyncrasy. Instead, they represent systematic contrasts between metrological systems, between individual units within metrological system, and between numeric usage and phonetic or logographic usage. This contrastive usage is reflected in modern publications. The contrast frequently applies to individual numerals, rather than to the span of entire numeric expressions.

While it would be technically possible to handle this contrast as a stylistic distinction, this approach has no real benefit, and is highly inconvenient, as it would require any treatment of Early Dynastic administrative texts to use multiple cuneiform fonts, often within single numeric expressions. Further, if that contrast is lost in plain-text interchange, the text can be misinterpreted: 𒌍 is a length of three ropes, but ●●● is an area of three bur₃; ⊃𒁹 could be read as one 𒃷 𒁺 and one 𒉺𒁹𒀴, where ⊃▿ would be one and a half 𒃷 𒁺; 𒀸𒀴 is a personal name, but ⊃𒀴 would be "one slave".

In addition, there would be a risk of confusion about character identity should fontmakers attempt to treat the curviform and cuneiform numerals as unified. A designer concerned about the numeric-syllabic ⊃–𒀸 contrast, and wishing to support diachronic encoding between systems $S_{\text{Ur III/OB}}$ and S, might give the 𒁹 numeral series (which is typically only used numerically in the Early Dynastic period) the glyphs of the ⊃ numeral series, since the clear 𒁹–⊃ identification involves the same rotation; this would however make it impossible to represent capacity measures that use ▿. Similarly, in an effort to support diachronic encoding for 1/2(iku), one might be tempted to give 𒀹 the glyph of ▿, thereby rendering the font unusable for quantities measured using the 𒀹 numeral series; an ED I–II Ur font designer could decide to give 𒑏 the same glyph as ◇ (that of the proposed ◉), according to the older area system, making it impossible to represent the newer system.

At the same time, contrary to most disunifications, the separate encoding of curviform numerals poses no serious compatibility issues for existing fonts or encoded corpora, nor does it, in general, introduce new issues with transliterated third millennium corpora. The oddity of ● requires some explanation, but does not pose any architectural issues, and is not fundamentally different from the other mergers and splits encountered in the cuneiform script.

4 Rationale for ED–Uruk numeral unification

A complete rationale for disunification between the non-numeric signs used in the fourth millennium and the already-encoded cuneiform signs will be given in the forthcoming proto-cuneiform encoding proposal. The core issue with extending the cuneiform script further back in time is that, since 1987, fourth millennium studies have used a different model of character identity and associated transliteration conventions, with names being given to structurally different glyphs, and no attempt being made at assigning phonetic values to them.

This is not a mere classification of glyph variants, as contrastive meanings of these systematic variants can often be reconstructed, with, *e.g.*, signs KAŠ_a, KAŠ_b, and KAŠ_c, depicting filled jars with a spout (a), a handle (c), or neither (b), being understood as referring to containers of different substances, see [Eng01, pp. 34 sq.]. However, not all identified systematic variants are understood, and the general approach to character identity is closer to that used for undeciphered or partially deciphered scripts.

As part of the development of these conventions, a classification of fourth millennium numeric signs was developed; see [DE87]. This classification assigns to each unit numerals an identifier formed by the letter *N* with a numeric subscript (sometimes with an additional alphabetic subscript): N_1 is , N_{14} is  , N_{34} is , etc. Transliterations of numeric expression then use those to identify the type of number used, thus $5N_1$ is , and $5N_{14}$ is .

In contrast with the use of parenthetical unit names, this approach does not require interpreting the quantity being counted. This is valuable in contexts where numerals are being used atypically, as conventional transliterations can otherwise force a dubious interpretation. For instance, the [CDLI] transliteration of or in [P283802, rev. 1 6, 2 2] currently uses (barig@c) for the vertical numerals, since numerals are typically capacity measures; but [Gor23] interprets these instead as counting linen textiles. As a result, the fourth millennium conventions for numeral transliteration are used in Early Dynastic texts, especially those from the ED I–II period, even though the Sumerian text uses classical assyriological transliteration conventions; see [Cha03, p. 6 n. 27].

While the non-numeric signs are treated as undeciphered, the metrological systems used in the fourth millennium are well understood, as can be seen in [DE87, p. 165]. As a result, contrary to the non-numeric proto-cuneiform conventions, these numeric transliteration conventions are compatible with the classical ones described in §3.7.2; they are indeed used interchangeably, as in [P011104] which uses the notation u@f in [ePSD2], but N14@f in [CDLI]. Indeed, the numerals are used similarly in Early Dynastic metrological systems, and are visually identical.

A disunification of numerals between the third and fourth millennium would therefore induce confusion as to which numerals should be used in third millennium studies, and would needlessly duplicate the encoding of at least seventy characters; by splitting the attestations, these separate encoding proposals would run into additional difficulties to supply evidence for encoding.

Note that the structural variants designated by letters in fourth millennium notation have systematically been encoded, as they have occasionally be found to carry distinct numeric meaning. For instance, N_{30c} is listed as a variant of N_{30a} in [DE87, p. 166], where the numeric value of either in relation to N_{39a} is still unknown, but their values are found in [Eng04, p. 33] to be $= \frac{1}{10}$, whereas

$\frac{1}{6}$.

5 Considerations on individual numeral series

Usages of the characters U+12550–U+12597, under subheadings “Common Numerals”, “Numerals used for land areas”, and “Early Dynastic capacity measures”, have already been discussed in §3.4. The variant forms of fractions of the iku are not unifiable with the ordinary ones: U+12411 is never used as a capacity measure, nor as one half in any other metrological system, contrary to U+12413.

The character U+12410 represents both the usages $\frac{1}{2}$ and 1 ban_2, whereas U+12226 CUNEIFORM SIGN MASH and U+1244F CUNEIFORM NUMERIC SIGN ONE BAN2 are disunified. This disunification is motivated by the unrelated origins of maš (logographic, meaning “goat”), always resembling U+12226, and 1 ban_2, descended from U+12410. One could argue that based on their etymologies, U+1244F would make more sense as the sign used for $\frac{1}{2}$, but U+12226 is used as the transliteration MAŠ is frequent, see, *e.g.*, [Hue11, p. 165].

The signs U+12598 and U+12599 are used in the ED IIIb Ǧirsu weight system for fractions $\frac{1}{3}$ and $\frac{2}{3}$ of a shekel, with the already-encoded U+1245D and U+1245E used for fractions of a mina, see [Lec16]. Note that as usual, the description $\times (+ n)$ must be understood as allowing for free variation between , , and , the last one being the description in [Lec16]. Compare discussed in [UTR56, §2.5], *šeššig* = $\times$ = $\times$ (the last one in, *e.g.*, Ebla lexical texts).

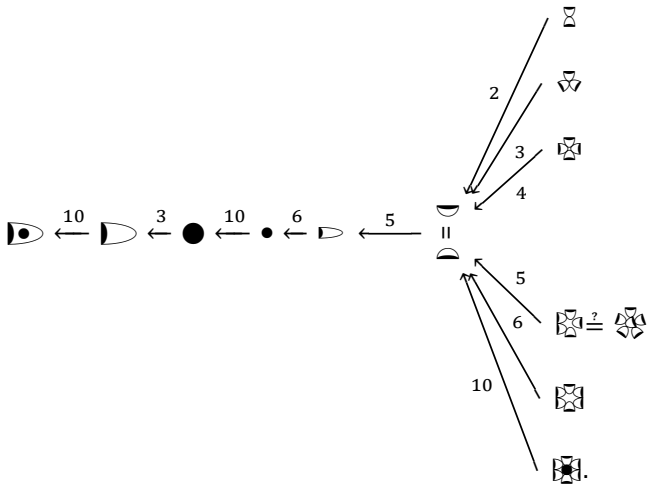
The characters U+12550–U+12597 are used in the bisexagesimal counting system, whose factor diagram is as follows [Fri78, p. 15; DE87, p. 165; NDE93, p. 28], with being the unit:

$$\leftarrow^{6} \leftarrow^{10} \leftarrow^{2} \leftarrow^{6} \leftarrow^{10} \leftarrow^{2} . \tag{B}$$

This system is used to count rations of discrete dry grain products, cheese, and fresh fish; see [DE87, pp. 132–134][28]NissenDamerowEnglund1993[34]Englund2004. It is well attested in the fourth millennium, but is also attested in Early Dynastic IIIa Šuruppag. The reference glyph for is based on the design in [DE87; NDE93], rather than the one in [Eng04; Eng23], as the latter requires the use of grey, whereas the earlier one is black and white. The highest attested number in this system is , in [P003595].

The characters U+12597–U+125B0, U+125B6–U+125BD are used in the grain capa-

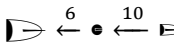
city system [DE87, pp. 136–139, 165; NDE93, p. 28; Eng01, p. 4; Eng04, pp. 33, 39]:



($\check{S}$)

The signs U+125B1–U+125B5 are listed together with them in [Eng01, p. 29] under "dry cereal products and rations: numerical signs in ideographic use". Since the numerals up to 5 are encoded based on their use in system S, there is no need to find the highest attested quantity measured in system $\check{S}$.

The characters U+125BE–U+125D0 are used in a variant of system S used to count dead animals, as well as and jars of certain types of beer; see [DE87, p. 131; NDE93, p. 28; Eng04, p. 40 n. 23]:



(S')

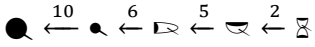
The highest attested number in this system is , 306 dead sheep, in [P006365]. The sign is also used in a liquid capacity system, see [DE87, p. 131; NDE93, p. 29; Eng04, p. 33].

The characters U+125D1–U+125E9 are used in a variant of the bisexagesimal system used to count a certain kind of rations, possibly a type of fish; see [DE87, pp. 135, 165; NDE93, p. 28]:

($B*$)

The highest well-preserved number in this system is in [P005153]; there is also a damaged in [P004804].

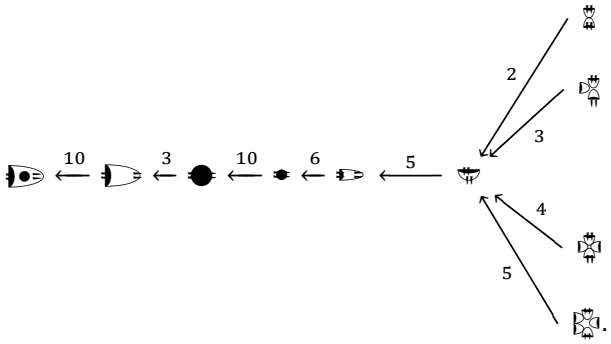
The characters U+125EA–U+125FD are used in a variant of system $\check{S}$ probably used to measure malted barley, see [DE87, p. 139; NDE93, p. 29; Eng01, p. 17 n. 30]:



($\check{S}'$)

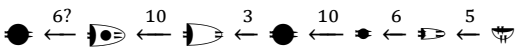
The highest attested quantity in this system is , in [P005363]. The numeral N_{45a} is not included in [DE87, pp. 165 sq.], and the numeral N_{24a} appears there only in brackets, without a name; both appear in [NDE93, p. 29; Eng04, p. 33] with the names $N_{45'}$ and $N_{24'}$, and are listed in [Eng23] with their ATF names `N45~a` and `N24~a`. They are attested in [CDLI] transliterations.

The characters U+125FE–U+12622 are used in a variant of system *Š* probably used to measure emmer, see [DE87, p. 140, p. 155 n. 67; NDE93, p. 29]:



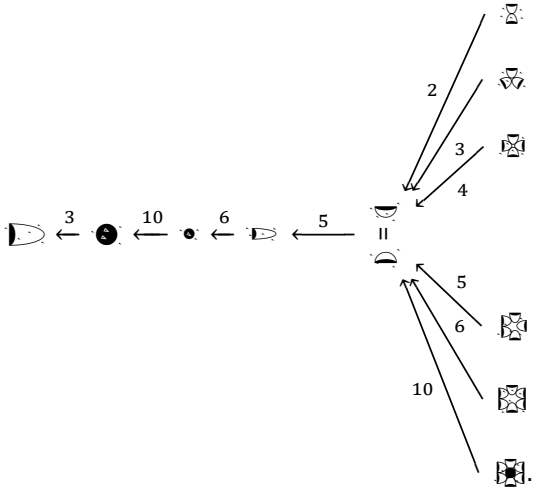
(*Š″*)

The fractions are not listed in any of [DE87; NDE93; Eng04], but those that are included are attested in [CDLI] and listed in [Eng23]. As noted in [DE87, p. 140] N_{46} appears to also represent a quantity larger than , with 3 2 5 2 1 attested in [P003330]. [DE87, p. 140] suggests = 6 based on proto-Elamite = 6, with the factor diagram



reused in later works. Given that this ratio is questionable, and that 5 is not attested, we have neither included 5 nor 3. The highest attested clearly understood quantity in this system is in [P002673].

The characters U+12623–U+12642 are used in a variant of system *Š* probably used to measure barley groats, see [DE87, p. 141; NDE93, p. 29; Eng01, p. 3 n. 7, p. 17 n. 30].



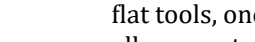
(*Š**)

The fractions , , and are listed in [DE87], the last one in brackets without a name. is called N_{28*} in [NDE93, p. 29; Eng04, p. 33]. All fractions included here are attested in [CDLI] transliterations and listed in [Eng23]. The highest attested quantity is in [P005461].

The characters U+12643–U+1264B are used in a system whose function is unknown, attested only in the Uruk IV period, see [DE87, pp. 143 sq.; NDE93, pp. 27 sq.]:

(*E*)

Again as the higher numerals are common, there is no need from a character encoding perspective to search for the highest attested quantity.

The "flat" characters U+1264C–U+12686 are used in various metrological systems in ED I–II Ur, see the factor diagrams in [Cha03, pp. 4 sq.]. These factor diagrams determine most of the upper bounds for the encoded numerals. The highest attested quantity in the "Cereal 2 system" with rectangular signs (similar to system *Š″*) is  in [P005773]. The glyphs in [Eng23; L2/23-190] suggest the use of two flat tools, one large and one small, as for the curviform signs. However, the signs all appear to have the same width in photographs; the glyphs in [Cha03] are also consistent with a single flat tool. The glyphs have been adjusted accordingly.

6 Characters not included in this proposal

Some numerals previously proposed in [L2/23-190], as well as some other numerals known to exist in the third millennium, are not included in this proposal. Some should be proposed at a later date; others are likely not encodable.

6.1 Fourth millennium numerals

The following eight numeral series from [DE87, p. 166] are not included; they are all listed as under *Nichteinordenbare Zahlzeichen* in [DE87, p. 147]. On these (and two others, possibly N_{57} and N_{58}), [NDE93, p. 27] write "Ten of the sixty numerical signs contained in the list in figure 27, moreover, do not belong to any of the identified systems. Three of them were apparently scribbled by an awkward pupil. As to four of those remaining, we are not sure whether they constitute derivations of other, as yet unknown numerical signs or whether they are in fact numerical signs at all. For at least two of the ten signs, [N_{23}] and [N_{43}], we can affirm that each formed part of two additional systems, about which we know nothing due to the fact that no informative texts have been unearthed with notations in these systems."

— N_{13} . [DE87, p. 147] mentions [P002551] as the only attestation. [CDLI] now transliterates this `2(N04)`, not in [Eng23]. Presumably representable as a rotated , as here.

— N_{16} and N_{17}. Described as "*vermutlich mit ideographischer Funktion*" in [DE87, p. 147]. N_{17} is only attested in [P000524], a witness to [Q000028]. N_{16} is attested in similar context in the same [P000524], but also in other artefacts, including [P283918] and [P283919] where notes by Englund in the [CDLI] transliteration suggest it is numeric, equal to $\frac{1}{20}$. N_{16} should probably be encoded in the Archaic Cuneiform Numerals block.

— N_{23}. In the current transliterated [CDLI] corpus, attested in one Uruk V artefact, and four Uruk IV artefacts. Similar in shape to proto-Elamite N_{23}, which is well-attested (53 artefacts) and well-understood (part of a decimal system, where it means 100). Best encoded as part of a proto-Elamite proposal, where we would clearly have 1–9, and given appropriate Script_Extensions.

— N_{43}; according to [DE87, p. 147], probably part of a variant of system $\check{S}$.

— N_{44}, N_{53}, and N_{55}: Only attested in [P003855], which contains no other text. Presumably these are the "awkward pupil" signs.

In addition, the following are not included:

— N_{10}. Only attested in [P001319] according to [DE87, p. 143], but that text now has N_{11} in its [CDLI] transliteration. Not in [Eng23].

— N_{57} and N_{58}. Dependent on the main proto-cuneiform proposal, whose rationale will justify the disunification from 𒀸 and 𒁹. These should be encoded in a different block to avoid confusion with 𒀸 and 𒁹, since the Archaic Numerals block contains numerals unifiable between Pcun and Xsux.

— N_{59}. Possibly a variant of [illegible] according to [DE87, p. 147].

— N_{30b}. Not attested in [CDLI] transliterations, not included in Englund's more recent works such as [Eng01, p. 29], nor in [Eng23].

The well-understood U_4 numerals, documented in [Eng88, pp. 136 sqq.] and listed in [Eng23; L2/23-190], have not been included as they are likewise dependent on the disunification of proto-cuneiform, and should be encoded in a different block to avoid confusion with [illegible]. Some additional numeral series from [Eng23; L2/23-190] are not included due to lack of documentation on their usage. In general, only numerals that are part of a well-understood metrological system have been included. In particular, numerals such as 12● (attested in [P200010]) have not been encoded, since the metrological systems involving ● numerals should not allow for a numeral beyond [illegible] (9●).

In addition, numerals that are not attested have not been included, unless they are part of a series where higher numerals in the metrological system are attested; thus the unattested [illegible] and [illegible], which are not in [Eng23], are included, because [illegible] is attested in [P006365], in a context where it is clearly used as part of system S'. However, `1(N30C~b)`, which is in [Eng23], and is the obvious counterpart of [illegible] in system $\check{S}''$, therefore presumably equal to $\frac{1}{10}$ [illegible], is not included, as it is not attested in [CDLI] transliterations at this time.

6.2 Third millennium numerals

The sign N^{f}_{48} listed in [Eng23; L2/23-190] only has questionable attestations in [CDLI] transliterations, and is not mentioned in [Cha03]. It has not been included.

The metrological systems from Early Dynastic IIIb Ŋirsu discussed in §3.4 require the numerals 7[illegible], 8[illegible], and 9[illegible], whereas only [illegible]–[illegible] are encoded. [illegible] numerals are also used in dates. The higher numerals are less frequent, as subtractive notation is often used instead, *e.g.*, [illegible] rather than 9[illegible], or [illegible] rather than [illegible] 8[illegible] [illegible], which is presumably why they are not yet encoded. However, they are clearly attested and understood enough to be encodable. They should be encoded in the Cuneiform Numbers and Punctuation block.

Early Dynastic IIIb Ŋirsu regnal years use [illegible] numerals (1–9). these are extremely well attested: a [CDLI] search for `"(|ASZxDISZ@t|)"` finds 1482 artefacts, all ED IIIb, of which 1447 are from Ŋirsu. These could be encoded in the Cuneiform Numbers and Punctuation block; together with 7–9[illegible], this would fill the block.

There are three attestations of [illegible] numerals for regnal years of 𒈗𒍠𒄀𒋛, one of which is damaged, and none of which have photographs. Absent further evidence, these seem unifiable with [illegible].

Some Old Akkadian artefacts have 𒐮×𒐯 (LAK 824) or 𒐞×𒐯, which has recently been found to mean 6000. The [CDLI] transliterations do not appear to distinguist the curviform and cuneiform versions of these signs. These signs appear to be associated with 6𒐮 or 6𒐞. Further collation[82] is needed to understand exactly what needs to be encoded.

[Cha03, p. 5; Cha12, p. 61] mention a sign resembling a mirrored and rotated 𒑛, thus [illegible]. It is transliterated $N_{1'}$ in [Cha03, p. 5], which documents a metrological system that uses it. However, we have not been able to locate this sign in the ED I–II Ur corpus, as it is unclear how it is transliterated in [CDLI]. The use of this sign in Ebla is elaborated on in [Gor24, p. 142 n. 583]: it is used for a quarter 𒁉𒌒𒆷, (or equivalently, a half 𒁉𒁀𒉌), transliterated 1/4 in [EbDA], whereas 𒑛 is used for a sixth of a 𒁉𒌒𒆷. It may be proposed for encoding in the Archaic Cuneiform Numerals block in a future proposal.

6.3 Stacking patterns

The already-encoded numerals in the Cuneiform Numbers and Punctuation block distinguish some *stacking patterns*; for instance 9𒁹 is encoded both as U+12446 𒑆 and as U+1240E 𒐎. This is in part due to contrastive usage of stacking patterns. For instance, besides 𒑏 and 𒑐 which are characteristic of bariga measures, four bariga is written 𒑑 even where 4𒁹 is written 𒐉, as in [P255010, obv. 2 3, rev. 1 17; P292843, obv. 4, rev. 5]. Another contrast is that between the stacking patterns used in scratch calculations in the SPVS, often 𒁹 𒈫 𒐈 𒐉 𒐊 𒐋 𒐌 𒐍 𒐎 𒌋 𒎙 𒌍 𒐏 𒐐, and results in metrological systems, typically 𒁹 𒈫 𒐈 𒐼 𒐊 𒐋 𒐌 𒐍 𒐎 𒌋 𒎙 𒌍 𒐭 𒐪, occasionally co-occurring as in [P142827; P142357]. This separate encoding is also for compatibility with distinctions made in reference works and in some non-numeric transliterations; for instance, 𒐉 is [Bor10, MZL 860] and has the value limmu, whereas 𒐼 is [Bor10, MZL 852] and has the value limmu₅. Numeric[83] transliterations occasionally distinguish the stacking patterns 𒐉 𒐋 𒐌 𒐍 𒐏 𒐐, as in the [CDLI] transliterations of the aforementioned tablets, although this is rare; often 4(diš) is 𒐼 in Ur III, but 𒐉 in the Neo-Assyrian period.

However, the stacking patterns from earlier periods are not separately encoded; for instance, in ED IIIb Ŋirsu, 𒎙 2(u) often has one 𒌋 atop another. These older stacking patterns do not appear to be contrastive, are not marked in transliteration, and are not listed separately in sign lists nor assigned any different values. There is therefore no evidence of a need to encode them; instead, they should be considered style variants, and an ED IIIb Ŋirsu font should have an appropriate glyph for U+12399 𒎙 CUNEIFORM SIGN U U.

Likewise, many stacking patterns are attested for the curviform numerals proposed in this document, and it is not proposed to separately encode them. These distinctions would be incompatible with the state of the art in numeric transliterations, including those by Englund, who insisted on “a system of transliteration

[82] In the assyriological sense, not the Unicode sense.

[83] The Sumerian word limmu means “four”, so limmu and limmu₅ are still numbers. The distinction here is between usage in transliterations of phrases such as 𒈗 𒀭𒌒𒁕 𒐼𒁀𒆤 lugal an-ub-da limmu₅-ba-ke₄ (king of the four quarters) or of names, and of numeric expressions such as 𒐼𒋡 4(diš) sila₃.

Figure 23: The layout of case [P011099, rev. 2 3]; the numeral 8 is rotated to fit the rounded corner of the tablet.

Figure 24: The layout of case [P020066, obv. 1 1]; the numeral 8 is spread across two lines. The text is read in the order 8 20 2 1, "twenty-two oxen, one year old".

that reflects in a strict fashion the physical realities of the cuneiform inscriptions" [Eng04, p. 30], and they are not needed to represent reference works. Idiosyncratic stacking patterns are in fact particularly common in Early Dynastic and earlier tablets, as they are structured in rectangular cases rather than lines, so that numerals may be laid out across the case in whichever way fits the available space; this is illustrated in Figure 23. Note also that the numerals need to be considerably enlarged in order to reproduce the layout of the tablets, so that 8 often spans two lines of cuneiform signs, as shown in Figure 24. This is impractical when these numerals are set in text that contrasts them with the larger 10, and inconsistent with actual practice when typesetting these numerals, as illustrated in Figure 8: reproducing the layout of tablets is not within the scope of plain text.

The reference glyphs use stacking patterns that are common in the Early Dynastic period, but that are also attested in the fourth millennium in the Uruk III period; the fourth millennium, especially the Uruk IV period, also frequently features numerals that use a more vertical layout, as illustrated in Figure 25. The later, more horizontal styles were chosen for two reasons: for the numerals used in the third and fourth millennium, usage in third millennium scholarship will be more frequent; and the horizontal layout poses fewer layout difficulties when set in lines of non-cuneiform text, as most modern scholarship is. Indeed, the absolute size of the indents 1, 10, •, and ● must remain consistent across the numeral series, lest a 10 numeral be confused with an 1 numeral. Since the single indents are frequently used in running text, as illustrated in §3.4.5, they need to be large enough

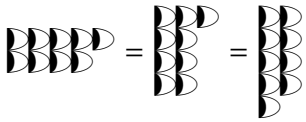


Figure 25: Three stacking patterns for U+12573 CUNEIFORM NUMERIC SIGN NINE N34. The one on the left is the reference glyph, used in Uruk III [P003499, obv. 1 1b; P004430, rev. 1 2], and widely afterwards, *e.g.*, ED IIIa Šuruppag [P010678, obv. 2], ED IIIb Ŋirsu [P020057, obv. 1 3], Old Akkadian Umma [P212464, obv. 11]. The ones in the middle and right are used in two Uruk IV tablets [P001243, rev. P004500, rev. 2]. All three Uruk examples are transliterated 9(N34) in [CDLI].

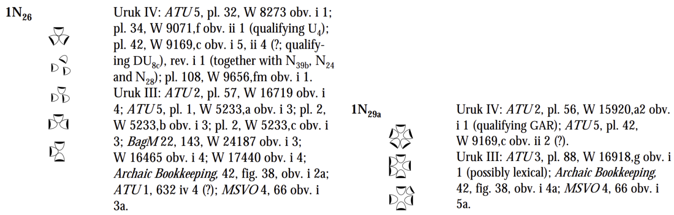


Figure 26: Variants of and from [Eng01, p. 31].

that the vertical stacking patterns are impractical.

Variant stacking patterns, if needed, may be handled at a higher level as stylistic distinctions; Figure 25 uses OpenType stylistic alternates, and Figure 23 rotates the character , in both cases preserving the plain text backing.

6.4 Other glyph variants not reflected in transliteration

In addition to stacking patterns proper, [L2/23-190, pp. 128 sq.] proposes separately encoding variant glyphs that are not distinguished in transliteration, but are listed (under the same name) in [Eng23], thus proposing two characters for and two characters for . These are merely illustrative of a wide continuum of attested glyphs; there are additional variants, as shown in Figure 26, and a cursory search on [CDLI] will find many attestations with further variation in the same vein. They should not be encoded. Only the systematic structural variants, which have been distinguished in transliteration based on a suspicion of distinct semantics, should be encoded.

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Peter Constable and Karljürgen Feuerherm provided useful feedback on the wording. Robin Leroy authored the bulk of the text. Rick McGowan suggested including a note in the character names list to clarify the identity of shrunk numerals in the code charts. Erica Scarpa brought the need for encoding the curviform numerals to our attention on multiple occasions and suggested several crucial references, most importantly [Gor23] which clearly demonstrates contrastive textual usage of curviform and cuneiform numerals in modern publications. Steve Tinney provided essential assistance on the interpretation of the Sumerian texts and suggested useful references. Ken Whistler gave important advice on matters of encodability, roadmapping, code point choice, and names list editing.

The reference glyphs for most of the proposed characters whose Script_Extensions value contains Pcun are based on a font made by Anshuman Pandey for [L2/23-190], itself based on designs by Bob Englund in [Eng23]. The reference glyphs for , –, and – are based on designs by Steve Tinney. The glyphs were adjusted by Robin Leroy as described in §5 and §6.3.

The Old Babylonian and Neo-Assyrian fonts used in §3.1 and in the epigraphs in §3.3 and §3.5 are *Santakku* and *Assurbanipal*, fonts created by Sylvie Vanséveren, available on the Hethitologie Portal Mainz [Van21]. The *CuneiformComposite* font by Steve Tinney is used when referring to the reference glyphs for already-encoded

cuneiform. *Noto Sans Cuneiform*, by Monotype Imaging, is used to for most of the cuneiform text in this document, with modifications (cuneiform glyph for 𒌑 ŠAR_2, corrected glyps for 𒌋 UN and 𒆳 KALAM per [Uni16], alternate glyph 𒀸 for 𒁹). Arabic text is set in *Scheherazade New* by SIL International; Traditional Chinese text is set in *Noto Serif TC* by Ken Lunde et al.; monospace text is set in *Consolas* by Luc(as) de Groot; the remainder of the text is set in *Cambria* and *Cambria Math* by Monotype Imaging and Tiro Typeworks.

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EbDA: 1415.

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CDLI: P240532.
EbDA: 1324.

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CDLI: P240533.
EbDA: 1379.

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CDLI: P240675.
EbDA: 1371.

[P240697] Excavation number TM.75.G.00579.
CDLI: P240697.
EbDA: 1381.

[P240964] Excavation number TM.75.G.01392.
CDLI: P240964.
ORACC: dccmt/P240964.
EbDA: 3184.

[P240986] Excavation number TM.75.G.01415.
CDLI: P240986.
ORACC: dcclt/P240986.

[P241708] Excavation number TM.75.G.02143.
CDLI: P241708.
EbDA: 3173.

[P241764] Excavation number TM.75.G.02200.
CDLI: P241764.

[P241904] Excavation number TM.75.G.02346.
CDLI: P241904.
EbDA: 3183.
ORACC: dccmt/P241904.

[P242293] Excavation number TM.75.G.03125.
CDLI: P242293.
EbDA: 217.

[P249253] *Code de Hammurabi*. Sb 00008. Paris, France: Musée du Louvre.
CDLI: P249253.

[P251641] MS 2464. Oslo, Norway: Schøyen Collection.
CDLI: P251641.
ORACC: epsd2/P251641.

[P252866] MS 3830. Oslo, Norway: Schøyen Collection.
CDLI: P252866.
ORACC: epsd2/P252866.

[P255010] YBC 04698. New Haven, Connecticut, United States: Yale Babylonian Collection.
CDLI: P255010.

[P271238] Anonymous.
CDLI: P271238.
ORACC: epsd2/P271238.

[P274845] CUNES 50-08-001. Ithaca, New York, United States: Department of Near Eastern Studies, Cornell University.
CDLI: P274845.

[P283802] Ist Š 0742. Arkeoloji Müzeleri.
CDLI: P283802.
ORACC: epsd2/P283802.

[P283918] CUNES 50-06-203. Ithaca, New York, United States: Department of Near Eastern Studies, Cornell University.
CDLI: P283918.

[P283919] CUNES 50-06-217. Ithaca, New York, United States: Department of Near Eastern Studies, Cornell University.
CDLI: P283919.

[P292843] NBC 05385. New Haven, Connecticut, United States: Nies Babylonian Collection, Yale Babylonian Collection.
CDLI: P292843.

[P298637] NBC 06978. New Haven, Connecticut, United States: Nies Babylonian Collection, Yale Babylonian Collection.
CDLI: P298637.
ORACC: epsd2/P298637.

[P305639] YBC 04398. New Haven, Connecticut, United States: Yale Babylonian Collection.
CDLI: P305639.

[P307255] YBC 06219. New Haven, Connecticut, United States: Yale Babylonian Collection.
CDLI: P307255.

[P309594] YBC 08761. New Haven, Connecticut, United States: Yale Babylonian Collection.
CDLI: P309594.
ORACC: epsd2/P309594.

[P386847] AO 06377. Paris, France: Musée du Louvre.
CDLI: P386847.

[Q000028] *Archaic Food*. Composite text.
CDLI: Q000028.
ORACC: dcclt/Q000028.

[Q000782] *The instructions of Šuruppag*. Composite text.
CDLI: Q000782.
ORACC: epsd2/Q000782.
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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://std.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://std.dkuug.dk/JTC1/SC2/WG2/docs/summaryform.html **.**
See also http://std.dkuug.dk/JTC1/SC2/WG2/docs/roadmaps.html **for latest *Roadmaps*.**

A. Administrative

1. **Title:** *Archaic Cuneiform Numerals*
2. Requester's name: *Robin Leroy*
3. Requester type (Member body/Liaison/Individual contribution): *Individual contribution*
4. Submission date: *2024-09-14*
5. Requester's reference (if applicable):
6. Choose one of the following:
   This is a complete proposal: *YES*
   (or) More information will be provided later:

B. Technical – General

1. Choose one of the following:
   a. This proposal is for a new script (set of characters): *YES*
      Proposed name of script: *Archaic Cuneiform Numerals*
   b. The proposal is for addition of character(s) to an existing block:
      Name of the existing block:
2. Number of characters in proposal:
3. Proposed category (select one from below - see section 2.2 of P&P document):

A-Contemporary		B.1-Specialized (small collection)		B.2-Specialized (large collection)	
C-Major extinct		D-Attested extinct		E-Minor extinct	
F-Archaic Hieroglyphic or Ideographic	X			G-Obscure or questionable usage symbols	

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. Fonts related:
   a. Who will provide the appropriate computerized font to the Project Editor of 10646 for publishing the standard?
   Robin Leroy
   b. Identify the party granting a license for use of the font by the editors (include address, e-mail, ftp-site, etc.):
   Robin Leroy (eggrobin@unicode.org)
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:
   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*

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 Unicode Character Database (http://www.unicode.org/reports/tr44/) and associated Unicode Technical Reports for information needed for consideration by the Unicode Technical Committee for inclusion in the Unicode Standard.

[1] Form number: N4502-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, 2008-05, 2009-11, 2011-03, 2012-01)

C. Technical - Justification

1. Has this proposal for addition of character(s) been submitted before? *NO*
   If YES explain
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*
   If YES, with whom? *Karljürgen Feuerherm, Erica Scarpa, and Steve Tinney.*
   If YES, available relevant documents: *This document.*
3. Information on the user community for the proposed characters (for example: size, demographics, information technology use, or publishing use) is included? *YES*
   Reference: *This document.*
4. The context of use for the proposed characters (type of use; common or rare) *rare*
   Reference:
5. Are the proposed characters in current use by the user community? YES
   If YES, where? Reference: *Scholarly publications. This document, §3.4.5.*
6. After giving due considerations to the principles in the P&P document must the proposed characters be entirely in the BMP? *NO*
   If YES, is a rationale provided?
   If YES, reference:
7. Should the proposed characters be kept together in a contiguous range (rather than being scattered)?
8. Can any of the proposed characters be considered a presentation form of an existing character or character sequence? *NO*
   If YES, is a rationale for its inclusion provided?
   If YES, reference:
9. Can any of the proposed characters be encoded using a composed character sequence of either existing characters or other proposed characters? *NO*
   If YES, is a rationale for its inclusion provided?
   If YES, reference:
10. Can any of the proposed character(s) be considered to be similar (in appearance or function) to, or could be confused with, an existing character? *NO*
    If YES, is a rationale for its inclusion provided?
    If YES, reference:
11. Does the proposal include use of combining characters and/or use of composite sequences? *NO*
    If YES, is a rationale for such use provided?
    If YES, reference:
    Is a list of composite sequences and their corresponding glyph images (graphic symbols) provided?
    If YES, reference:
12. Does the proposal contain characters with any special properties such as control function or similar semantics? *NO*
    If YES, describe in detail (include attachment if necessary)
13. Does the proposal contain any Ideographic compatibility characters? *NO*
    If YES, are the equivalent corresponding unified ideographic characters identified?
    If YES, reference: