

# Archaic cuneiform numbers

Robin Leroy and Anshuman Pandey

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The Unicode Standard includes some cuneiform numbers: 𐎶-𐎶𐎵 1-9(diš) and 𐎶-𐎶𐎵𐎶 1-9(aš), 𐎶-𐎶𐎵 1-5(u), 𐎶-𐎶𐎵𐎶 1-9(ḫeš<sub>2</sub>), 𐎶-𐎶𐎵 1-5(ḫeš<sup>3</sup>u), etc., used in the Sumero-Akkadian Cuneiform script (ISO 15924: Xsux, Script property value long name: Cuneiform).

In the investigation that led to their encoding in Unicode Version 5.0, it was thought appropriate to unify these with the earlier curviform numerals 𐎶-𐎶𐎵 1-9(aš<sup>c</sup> =  $N_1$ ), 𐎶-𐎶𐎵 1-5(u<sup>c</sup> =  $N_{14}$ ), 𐎶-𐎶𐎵𐎶 1-9(ḫeš<sub>2</sub><sup>c</sup> =  $N_{34}$ ), 𐎶-𐎶𐎵 1-5(ḫeš<sup>3</sup>u<sup>c</sup> =  $N_{48}$ ), etc., see [L2/04-099](#). While the curviform numerals sometimes co-occur with the cuneiform ones, this was analysed as a stylistic distinction which should not be encoded in plain text. It has now become apparent that a distinction needs to be made for the adequate representation of Early Dynastic (ED) texts and scholarship pertaining to them.

In addition, these numerals will be needed for the representation of proto-cuneiform texts from the earlier archaic period. The non-numeric signs of proto-cuneiform (ISO 15924: Pcun) 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 is semantic, requiring an understanding of the text to correctly encode it.

The use of the curviform numeric signs is however understood, as we will discuss in Section 1; further, the conventions used for archaic numerals are also used when discussing ED numerals, see Section 5. As a result, the same numerals can be used when encoding archaic and ED texts, and in order to avoid issues ambiguities in representation when converting from transliteration, these should be unified. The overall picture of unifications and disunifications would be as follows:

	Uruk III & earlier	ED – Ur III	OB & later
Non-numeric signs	Future Pcun	Existing Xsux	
Numbers	This proposal	This proposal + Existing Xsux	Existing Xsux

# 1 Metrologies

𒂗 𒍪𒍪𒍪𒍪𒍪 𒂗  
 𒂗 𒍪 𒍪𒍪𒍪 𒍪𒍪 𒍪𒍪𒍪  
 𒂗 𒍪𒍪𒍪 𒍪𒍪 𒍪𒍪 𒍪𒍪𒍪

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

Edubba'a D

In order to explain why TODO:n more numerals are needed, it is useful to first recall why we have so many kinds of cuneiform numerals already.

As is well known<sup>1</sup> a sexagesimal place value system (SPVS) was used in Mesopotamia from the late third millenium 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. The digits 1–59 of the SPVS have inner structure which is reflected in the encoding: the digits 1–9 are the individual characters 𒂗–𒍪, the multiples of ten (10–50) are 𒂗–𒍪, but the other digits 11–59 are sequences 𒂗–𒍪𒍪; 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*  $S_{Ur III/OB}$ , which had different signs for the units 𒂗–𒍪, tens 𒂗–𒍪, sixties 𒂗–𒍪 (with larger wedges than the units), six hundreds 𒂗–𒍪, three thousand six hundreds 𒂗–𒍪, and thirty-six thousands 𒂗–𒍪.

The relations between the values of the signs in the cuneiform discrete counting system may be summarized as follows, where the number over arrow indicates the multiple of the preceding sign (right of the arrow) corresponding to the following sign (left).

$$\diamond \xleftarrow{10} \diamond \xleftarrow{6} \text{𒂗} \xleftarrow{10} \text{𒂗} \xleftarrow{6} \text{𒂗} \xleftarrow{10} \text{𒂗} \quad (S_{Ur III/OB})$$

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

$$\diamond \xleftarrow{10} \diamond \xleftarrow{6} \text{𒂗} \xleftarrow{10} \text{𒂗} \xleftarrow{3} \text{𒂗} \xleftarrow{6} \text{𒂗} \xleftarrow{2} \text{𒂗} \xleftarrow{2} \text{𒂗} \quad (G_{Ur III/OB})$$

1 bur <sub>3</sub>	1 eše <sub>3</sub>	1 iku	1 ubûm
1 būrum	1 eblum	1 ikûm	1800 m <sup>2</sup>
6,48 ha	2,16 ha	3600 m <sup>2</sup>	

Note that for the range of areas given above<sup>2</sup>, this system does not use any symbols separate from the numerals for the individual units (*ubûm*, *ikûm*, *eblum*, and

<sup>1</sup>See, e.g., *The Unicode Standard*, Version 16.0, Section 22.3.3 *Non-Decimal Radix Systems*, sub “Cuneiform Numerals”.

<sup>2</sup>For areas smaller than a quarter *ikûm*, an overt unit is used, with 1 *mūšarum* (36 m<sup>2</sup>) written 𒂗𒍪, equal to one hundredth of an *ikûm*, then sexagesimally subdivided in 60 𒂗 (shekels). For areas greater

Another such systems of note is the one for volumes,

(C)

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

- $\mathbb{I}$ - $\mathbb{III}$  used in  $S_{U_r \text{ III/OB}}$  and the SPVS as well as with overt units;
- $\mathbb{I}$ - $\mathbb{III}$  used in  $G_{U_r \text{ III/OB}}$ , of which  $\mathbb{I}$ - $\mathbb{III}$  are also used in  $S_{U_r \text{ III/OB}}$  and the SPVS as well as with overt units;
- $\mathbb{I}$ - $\mathbb{III}$  used in  $S_{U_r \text{ III/OB}}$  and the SPVS;
- $\mathbb{I}$ - $\mathbb{III}$  used in  $C$  as well as in the weight system;
- $\mathbb{I}$ ,  $\mathbb{II}$ ,  $\mathbb{III}$ ,  $\mathbb{IV}$ ,  $\mathbb{V}$  used in TODO;
- $\mathbb{I}$ ,  $\mathbb{II}$ ,  $\mathbb{III}$ ,  $\mathbb{IV}$  used in  $C$ —note the overlap with  $\mathbb{I}$ - $\mathbb{III}$ ;
- $\mathbb{I}$  and  $\mathbb{II}$  used in  $G_{U_r \text{ III/OB}}$ .

than 3600 *būrū*, the  $\diamond$ - and  $\blacklozenge$ -numerals are reused with a suffix  $\text{𒂍}$  (gal, Sumerian: big), as follows:

<sup>3</sup>As in the surface of the field of  (Apisal) reported on P102305 r. 1.

<sup>4</sup>From P309594.

<sup>5</sup>A larger unit, the *guru*<sub>7</sub> (*karûm*, grain heap), is sometimes used instead, with 𐎠𐎡𐎢𐎣𐎤𐎥𐎦𐎧𐎨𐎩𐎪𐎫𐎬𐎭𐎮𐎯𐎰𐎱𐎲𐎳𐎴𐎵𐎶𐎷𐎸𐎹𐎺𐎻𐎼𐎽𐎾𐎿𐏀𐏁𐏂𐏃𐏄𐏅𐏆𐏇𐏈𐏉𐏊𐏋𐏌𐏍𐏎𐏏𐏐𐏑𐏒𐏓𐏔𐏕𐏖𐏗𐏘𐏙𐏚𐏛𐏜𐏝𐏞𐏟𐏠𐏡𐏢𐏣𐏤𐏥𐏦𐏧𐏨𐏩𐏪𐏫𐏬𐏭𐏮𐏯𐏰𐏱𐏲𐏳𐏴𐏵𐏶𐏷𐏸𐏹𐏺𐏻𐏼𐏽𐏾𐏿𐐀𐐁𐐂𐐃𐐄𐐅𐐆𐐇𐐈𐐉𐐊𐐋𐐌𐐍𐐎𐐏𐐐𐐑𐐒𐐓𐐔𐐕𐐖𐐗𐐘𐐙𐐚𐐛𐐜𐐝𐐞𐐟𐐠𐐡𐐢𐐣𐐤𐐥𐐦𐐧𐐨𐐩𐐪𐐫𐐬𐐭𐐮𐐯𐐰𐐱𐐲𐐳𐐴𐐵𐐶𐐷𐐸𐐹𐐺𐐻𐐼𐐽𐐾𐐿𐑀𐑁𐑂𐑃𐑄𐑅𐑆𐑇𐑈𐑉𐑊𐑋𐑌𐑍𐑎𐑏𐑐𐑑𐑒𐑓𐑔𐑕𐑖𐑗𐑘𐑙𐑚𐑛𐑜𐑝𐑞𐑟𐑠𐑡𐑢𐑣𐑤𐑥𐑦𐑧𐑨𐑩𐑪𐑫𐑬𐑭𐑮𐑯𐑰𐑱𐑲𐑳𐑴𐑵𐑶𐑷𐑸𐑹𐑺𐑻𐑼𐑽𐑾𐑿𐒀𐒁𐒂𐒃𐒄𐒅𐒆𐒇𐒈𐒉𐒊𐒋𐒌𐒍𐒎𐒏𐒐𐒑𐒒𐒓𐒔𐒕𐒖𐒗𐒘𐒙𐒚𐒛𐒜𐒝𐒞𐒟𐒠𐒡𐒢𐒣𐒤𐒥𐒦𐒧𐒨𐒩𐒪𐒫𐒬𐒭𐒮𐒯𐒰𐒱𐒲𐒳𐒴𐒵𐒶𐒷𐒸𐒹𐒺𐒻𐒼𐒽𐒾𐒿𐓀𐓁𐓂𐓃𐓄𐓅𐓆𐓇𐓈𐓉𐓊𐓋𐓌𐓍𐓎𐓏𐓐𐓑𐓒𐓓𐓔𐓕𐓖𐓗𐓘𐓙𐓚𐓛𐓜𐓝𐓞𐓟𐓠𐓡𐓢𐓣𐓤𐓥𐓦𐓧𐓨𐓩𐓪𐓫𐓬𐓭𐓮𐓯𐓰𐓱𐓲𐓳𐓴𐓵𐓶𐓷𐓸𐓹𐓺𐓻𐓼𐓽𐓾𐓿𐔀𐔁𐔂𐔃𐔄𐔅𐔆𐔇𐔈𐔉𐔊𐔋𐔌𐔍𐔎𐔏𐔐𐔑𐔒𐔓𐔔𐔕𐔖𐔗𐔘𐔙𐔚𐔛𐔜𐔝𐔞𐔟𐔠𐔡𐔢𐔣𐔤𐔥𐔦𐔧𐔨𐔩𐔪𐔫𐔬𐔭𐔮𐔯𐔰𐔱𐔲𐔳𐔴𐔵𐔶𐔷𐔸𐔹𐔺𐔻𐔼𐔽𐔾𐔿𐕀𐕁𐕂𐕃𐕄𐕅𐕆𐕇𐕈𐕉𐕊𐕋𐕌𐕍𐕎𐕏𐕐𐕑𐕒𐕓𐕔𐕕𐕖𐕗𐕘𐕙𐕚𐕛𐕜𐕝𐕞𐕟𐕠𐕡𐕢𐕣𐕤𐕥𐕦𐕧𐕨𐕩𐕪𐕫𐕬𐕭𐕮𐕯𐕰𐕱𐕲𐕳𐕴𐕵𐕶𐕷𐕸𐕹𐕺𐕻𐕼𐕽𐕾𐕿𐖀𐖁𐖂𐖃𐖄𐖅𐖆𐖇𐖈𐖉𐖊𐖋𐖌𐖍𐖎𐖏𐖐𐖑𐖒𐖓𐖔𐖕𐖖𐖗𐖘𐖙𐖚𐖛𐖜𐖝𐖞𐖟𐖠𐖡𐖢𐖣𐖤𐖥𐖦𐖧𐖨𐖩𐖪𐖫𐖬𐖭𐖮𐖯𐖰𐖱𐖲𐖳𐖴𐖵𐖶𐖷𐖸𐖹𐖺𐖻𐖼𐖽𐖾𐖿𐗀𐗁𐗂𐗃𐗄𐗅𐗆𐗇𐗈𐗉𐗊𐗋𐗌𐗍𐗎𐗏𐗐𐗑𐗒𐗓𐗔𐗕𐗖𐗗𐗘𐗙𐗚𐗛𐗜𐗝𐗞𐗟𐗠𐗡𐗢𐗣𐗤𐗥𐗦𐗧𐗨𐗩𐗪𐗫𐗬𐗭𐗮𐗯𐗰𐗱𐗲𐗳𐗴𐗵𐗶𐗷𐗸𐗹𐗺𐗻𐗼𐗽𐗾𐗿𐘀𐘁𐘂𐘃𐘄𐘅𐘆𐘇𐘈𐘉𐘊𐘋𐘌𐘍𐘎𐘏𐘐𐘑𐘒𐘓𐘔𐘕𐘖𐘗𐘘𐘙𐘚𐘛𐘜𐘝𐘞𐘟𐘠𐘡𐘢𐘣𐘤𐘥𐘦𐘧𐘨𐘩𐘪𐘫𐘬𐘭𐘮𐘯𐘰𐘱𐘲𐘳𐘴𐘵𐘶𐘷𐘸𐘹𐘺𐘻𐘼𐘽𐘾𐘿𐙀𐙁𐙂𐙃𐙄𐙅𐙆𐙇𐙈𐙉𐙊𐙋𐙌𐙍𐙎𐙏𐙐𐙑𐙒𐙓𐙔𐙕𐙖𐙗𐙘𐙙𐙚𐙛𐙜𐙝𐙞𐙟𐙠𐙡𐙢𐙣𐙤𐙥𐙦𐙧𐙨𐙩𐙪𐙫𐙬𐙭𐙮𐙯𐙰𐙱𐙲𐙳𐙴𐙵𐙶𐙷𐙸𐙹𐙺𐙻𐙼𐙽𐙾𐙿𐚀𐚁𐚂𐚃𐚄𐚅𐚆𐚇𐚈𐚉𐚊𐚋𐚌𐚍𐚎𐚏𐚐𐚑𐚒𐚓𐚔𐚕𐚖𐚗𐚘𐚙𐚚𐚛𐚜𐚝𐚞𐚟𐚠𐚡𐚢𐚣𐚤𐚥𐚦𐚧𐚨𐚩𐚪𐚫𐚬𐚭𐚮𐚯𐚰𐚱𐚲𐚳𐚴𐚵𐚶𐚷𐚸𐚹𐚺𐚻𐚼𐚽𐚾𐚿𐛀𐛁𐛂𐛃𐛄𐛅𐛆𐛇𐛈𐛉𐛊𐛋𐛌𐛍𐛎𐛏𐛐𐛑𐛒𐛓𐛔𐛕𐛖𐛗𐛘𐛙𐛚𐛛𐛜𐛝𐛞𐛟𐛠𐛡𐛢𐛣𐛤𐛥𐛦𐛧𐛨𐛩𐛪𐛫𐛬𐛭𐛮𐛯𐛰𐛱𐛲𐛳𐛴𐛵𐛶𐛷𐛸𐛹𐛺𐛻𐛼𐛽𐛾𐛿𐜀𐜁𐜂𐜃𐜄𐜅𐜆𐜇𐜈𐜉𐜊𐜋𐜌𐜍𐜎𐜏𐜐𐜑𐜒𐜓𐜔𐜕𐜖𐜗𐜘𐜙𐜚𐜛𐜜𐜝𐜞𐜟𐜠𐜡𐜢𐜣𐜤𐜥𐜦𐜧𐜨𐜩𐜪𐜫𐜬𐜭𐜮𐜯𐜰𐜱𐜲𐜳𐜴𐜵𐜶𐜷𐜸𐜹𐜺𐜻𐜼𐜽𐜾𐜿𐝀𐝁𐝂𐝃𐝄𐝅𐝆𐝇𐝈𐝉𐝊𐝋𐝌𐝍𐝎𐝏𐝐𐝑𐝒𐝓𐝔𐝕𐝖𐝗𐝘𐝙𐝚𐝛𐝜𐝝𐝞𐝟𐝠𐝡𐝢𐝣𐝤𐝥𐝦𐝧𐝨𐝩𐝪𐝫𐝬𐝭𐝮𐝯𐝰𐝱𐝲𐝳𐝴𐝵𐝶𐝷𐝸𐝹𐝺𐝻𐝼𐝽𐝾𐝿𐞀𐞁𐞂𐞃𐞄𐞅𐞆𐞇𐞈𐞉𐞊𐞋𐞌𐞍𐞎𐞏𐞐𐞑𐞒𐞓

