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Universal Multiple-Octet Coded Character Set
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1. Introduction. The Chakma people were in origin Tibeto-Burman, related to the Burmese. The language which they now speak is Indo-European, part of the Southeastern Bengali branch of Eastern Indo-Aryan. Its better-known closest relatives are Bengali, Assamese, Chittagonian, Bishnupriya, and Sylheti. It is spoken by 312,000 people in southeast Bangladesh near Chittagong City, and another 176,000 in India in Mizoram, Assam, Tripura, and Arunachal Pradesh. Literacy in Chakma script is low. The script itself is also called 𑄇𑄚𑄴𑄟𑄳𑄦 *Ajhā pāṭh*, sometimes romanized *Ojhopath*.

There is a certain amount of glyph variation between the script as used in India and Bangladesh. Some fonts are rounder, similar to the style used in Myanmar; compare a similar variation in the Tai Tham script as used in Khün Tai. The glyphs used in this proposal are based on the Chadigang font, with some alterations toward more "generic" shapes for some characters.

The Chakma script is currently being adapted for use in Tanchangya, a language which is closely related to Chakma. An effort to develop the orthography is currently underway, and it appears that there may be additional letters, vowel signs, and tone marks added to cover this script. These extensions are a subject for future standardization, as the orthography for Tanchangya is still under development and testing.

2. Structure. Chakma is of the Brahmic type: the consonant letters contain an inherent vowel. Consonant clusters are written with conjunct characters, and a visible vowel killer shows the deletion of the inherent vowel when there is no conjunct.

3. Independent vowels. Four independent vowels exist: 𑄃 *a*, 𑄄 *i*, 𑄅 *u*, and 𑄆 *e*. Other vowels in initial position are formed by adding the vowel sign to 𑄃 *a*, as in 𑄃𑄴 *ī*, 𑄃𑄳 *ū*, 𑄃𑄧 *ai*, 𑄃𑄨 *oi*. Some modern writers are generalizing this spelling in 𑄄𑄴 *i*, 𑄅𑄳 *u*, and 𑄆𑄃 *e*.

4. Dependent vowels. Independent vowel signs have been encoded according to their phonetic value, as in Balinese or Telugu. However, because some of the independent vowels appear to be made out of smaller units, decomposition of the vowels has been taken into consideration. In order to avoid any ambiguous encoding, canonical equivalences have been given in order to resolve the issue of multiple representations. Two glyph fragments (CHAKMA O MARK and CHAKMA AU MARK) have been encoded in order to account for this, and to allow for any users who desire to create texts using the lower glyph fragments on their own. The Chakma vowel signs are given with the letter 𑄌 *ka* below.

𑄇 kā = 𑄇 kā

𑄈 ka = 𑄇 kā + ◌𑄴 -a (11127)

𑄉 ki = 𑄇 kā + ◌𑄰 i (11128)

𑄊 kī = 𑄇 kā + ◌𑄱 -ī (11129)

𑄋 ku = 𑄇 kā + ◌𑄲 -u (1112A)

𑄌 kū = 𑄇 kā + ◌𑄳 -ū (1112B)

𑄍𑄇 ke = 𑄇 kā + 𑄍◌ -e (1112C)

𑄎 kāi = 𑄇 kā + ◌𑄵 -āi (1112D)

𑄏 ko = 𑄇 kā + ◌𑄴𑄧 -o (1112E – *or* – 11131 + 11127)

𑄐 kau = 𑄇 kā + ◌𑄴𑄱 -au (1112F – *or* – 11132 + 11127)

𑄑 koi = 𑄇 kā + ◌𑄶 -oi (11130)

𑄀 kaṁ = 𑄇 kā + ◌𑄀 -ṁ (11100)

𑄁 kaṃ = 𑄇 kā + ◌𑄁 -ṃ (11101)

𑄂 kaḥ = 𑄇 kā + ◌𑄂 -ḥ (11102)

𑄃 k = 𑄇 kā + ◌𑄃 MAAYYAA

One of the interesting features of Chakma writing is that CANDRABINDU (*cānaphupudā*) can be used together with ANUSVARA (*ekaphudā*) and VISARGA (*dviphudā*):

𑄅𑄀 aḥṁ = 𑄅 ā + ◌𑄂 ḥ + ◌𑄀 ṁ

𑄅𑄀 aṃṁ = 𑄅 ā + ◌𑄁 ṃ + ◌𑄀 ṁ

𑄆𑄀 uṃṁ = 𑄆 u + ◌𑄁 ṃ + ◌𑄀 ṁ

𑄌𑄀 muṁ = 𑄉 mā + ◌𑄲 u + ◌𑄀 ṁ

Glyph rendering of CANDRABINDU with other vowel signs (like ◌𑄴 *a* or ◌𑄰 *i*) is as yet unattested; nevertheless the encoding is clear.

5. Consonants with killed vowels and conjunct consonants. Like other Brahmic scripts, Chakma makes use of the MAAYYAA (*killer*) to invoke conjoined consonants. In the past, practice was much more common than it is today. Like the Myanmar script, Chakma is encoded with two vowel-killing characters in order to conform to modern user expectations. As shown above, most letters have their vowels killed with the use of the explicit MAAYYAA character:

𑄃 k = 𑄇 kā + ◌𑄃 MAAYYAA

In 2001 an orthographic reform was recommended in the book *Cāṅmā pattham pāt* which would limit the standard repertoire of conjuncts to those composed with the five letters 𑄝 *yā*, 𑄞 *rā*, 𑄟 *lā*, 𑄠 *wā*, and 𑄡 *nā*. The four here are the most widely-accepted repertoire of conjuncts.

ya: X + 𑄳 VIRAMA + 𑄪 *yā*:

ra: X + 𑄳 VIRAMA + 𑄨 *rā*:

la: X + 𑄳 VIRAMA + 𑄩 *lā*:

wa: X + 𑄳 VIRAMA + 𑄫 *wā*:

No separate conjunct forms of subjoined full-form *-yā* or *-rā* appear to exist. The fifth of these conjuncts, the *-na* conjunct, is exemplary of the orthographic shift which has taken place in Chakma.

na: X + 𑄳 VIRAMA + 𑄝 *nā*:

While some writers would indeed write *kakna* (in ligating style) as 𑄌𑄝 or (in subjoining style) as 𑄌𑄝𑄳, most now would probably expect it to be written as 𑄌𑄳𑄝. The ligating style of glyphs is now considered old-fashioned. Thus, taking the letter 𑄪 *mā* as the second element, while the glyph shapes 𑄌𑄪 *kmā*, 𑄓𑄪 *tmā*, 𑄝𑄪 *nmā*, 𑄚𑄪 *bbā*, 𑄟𑄪 *mmā*, 𑄢𑄪 *llā*, 𑄞𑄪 *smā*, and 𑄠𑄪 *hmā* are attested, most users now prefer the glyph shapes 𑄌𑄴 *kmā*, 𑄓𑄴 *tmā*, 𑄝𑄴 *nmā*, 𑄚𑄴 *bbā*, 𑄟𑄴 *mmā*, 𑄢𑄴 *llā*, 𑄞𑄴 *smā*, and 𑄠𑄴 *hmā*. Again, this distinction is stylistic and not orthographic.

As with Myanmar and Meetei Mayek, encoding a visible killer for modern users alongside an explicit conjoin-former permits the user to make specific choices about spelling more easily. Both the Myanmar encoding model and the Devanagari encoding model have been explained to the user community and feedback is that the Myanmar model fits the script better. (This is little surprise considering the close relationship between the Myanmar and Chakma scripts.)

In principle, nothing prevents the visible killer from appearing together with a stack. Thus while 𑄌 *kā* + 𑄳 VIRAMA + 𑄞 *sā* gives 𑄌𑄳 *ksā*, the sequence 𑄌 *kā* + 𑄳 VIRAMA + 𑄞 *sā* + 𑄧 MAAYYAA could give 𑄌𑄳 *ks*. Neither the string 𑄳 VIRAMA + 𑄧 MAAYYAA nor the string 𑄧 MAAYYAA + 𑄳 VIRAMA following a consonant would be meaningful, however, as both kill the inherent vowel, and “double-killing” a vowel makes no sense; either sequence should generate an error presentation.

The 2004 book *Phadagaṅ* shows examples of the five conjuncts above together alongside conjuncts formed with 𑄚 *bā*, 𑄪 *mā*, and 𑄠 *hā*. These are all formed by simple subjoining.

ba: X + ◌್ VIRAMA + ಬ bā:

ಕ್ಬ ಖ್ಬ ಗ್ಬ ಘ್ಬ ಙ್ಬ - ಚ್ಬ ಛ್ಬ ಜ್ಬ ಝ್ಬ ಞ್ಬ - ಟ್ಬ ಠ್ಬ ಡ್ಬ ಢ್ಬ ಣ್ಬ
ತ್ಬ ಥ್ಬ ದ್ಬ ಧ್ಬ ನ್ಬ - ಪ್ಬ ಫ್ಬ ಬ್ಬ ಭ್ಬ ಮ್ಬ - ಯ್ಬ ರ್ಬ ಲ್ಬ ವ್ಬ ಳ್ಬ

ma: X + ◌್ VIRAMA + ಮ mā:

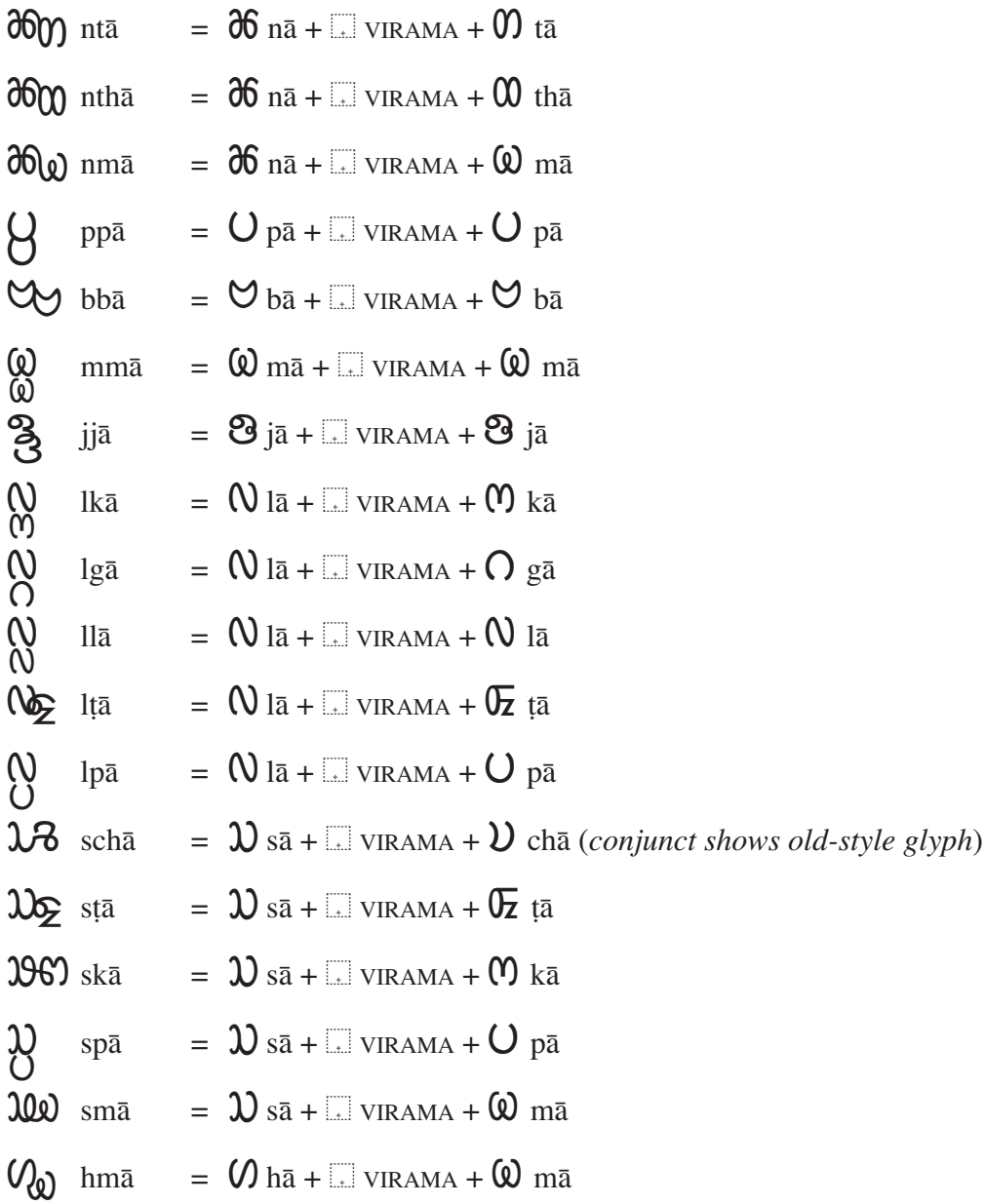
ಕ್ಮ ಖ್ಮ ಗ್ಮ ಘ್ಮ ಙ್ಮ - ಚ್ಮ ಛ್ಮ ಜ್ಮ ಝ್ಮ ಞ್ಮ - ಟ್ಮ ಠ್ಮ ಡ್ಮ ಢ್ಮ ಣ್ಮ
ತ್ಮ ಥ್ಮ ದ್ಮ ಧ್ಮ ನ್ಮ - ಪ್ಮ ಫ್ಮ ಬ್ಮ ಭ್ಮ ಮ್ಮ - ಯ್ಮ ರ್ಮ ಲ್ಮ ವ್ಮ ಳ್ಮ

ha: X + ◌್ VIRAMA + ಹ hā:

ಕ್ಹ ಖ್ಹ ಗ್ಹ ಘ್ಹ ಙ್ಹ - ಚ್ಹ ಛ್ಹ ಜ್ಹ ಝ್ಹ ಞ್ಹ - ಟ್ಹ ಠ್ಹ ಡ್ಹ ಢ್ಹ ಣ್ಹ
ತ್ಹ ಥ್ಹ ದ್ಹ ಧ್ಹ ನ್ಹ - ಪ್ಹ ಫ್ಹ ಬ್ಹ ಭ್ಹ ಮ್ಹ - ಯ್ಹ ರ್ಹ ಲ್ಹ ವ್ಹ ಳ್ಹ

In the 1982 book *Cāṅmār āg pudhi* a much wider range of conjunct pairs is shown, some of them with fairly complicated glyphs.

ಕ್ಕ kkā = ಕ kā + ◌್ VIRAMA + ಕ kā
ಕ್ಟ kṭā = ಕ kā + ◌್ VIRAMA + ಟ ṭā
ಕ್ತ ktā = ಕ kā + ◌್ VIRAMA + ತ tā
ಕ್ಮ kmā = ಕ kā + ◌್ VIRAMA + ಮ mā
ಕ್ಚ kcā = ಕ kā + ◌್ VIRAMA + ಚ cā (*conjunct shows old-style glyph*)
ಙ್ಕ ṅkā = ಙ ṅā + ◌್ VIRAMA + ಕ kā
ಙ್ಗ ṅgā = ಙ ṅā + ◌್ VIRAMA + ಗ gā
ಚ್ಚ ccā = ಚ cā + ◌್ VIRAMA + ಚ cā (*conjunct shows old-style glyph*)
ಚ್ಛ cchā = ಚ cā + ◌್ VIRAMA + ಛ chā (*conjunct shows old-style glyph*)
ಞ್ಚ ñcā = ಞ ñā + ◌್ VIRAMA + ಚ cā (*conjunct shows old-style glyph*)
ಞ್ಜ ñjā = ಞ ñā + ◌್ VIRAMA + ಜ jā
ಞ್ಝ ñjhā = ಞ ñā + ◌್ VIRAMA + ಝ jhā
ಟ್ಟ ṭṭā = ಟ ṭā + ◌್ VIRAMA + ಟ ṭā
ತ್ತ ttā = ತ tā + ◌್ VIRAMA + ತ tā
ತ್ಮ tmā = ತ tā + ◌್ VIRAMA + ಮ mā
ತ್ಥ tthā = ತ tā + ◌್ VIRAMA + ಥ thā
ಡ್ಡ ddā = ಡ dā + ◌್ VIRAMA + ಡ dā
ಡ್ಢ ddhā = ಡ dā + ◌್ VIRAMA + ಢ dhā



5.1 Specific recommendation for Chakma fonts. In Chakma, the encoding model supports conjunct behaviour and Chakma fonts *by default* should display the subjoined form of letters when following virama, to ensure legibility. Whether a conjunct is required or not is part of the spelling of a word; it is not a stylistic issue. (We have seen no examples of conjuncts with more than one consonant, and while the encoding handles (in principle) any length of stacking examples of such would probably be spelling errors.)

6. Collating order. As an Indo-European language, the standard Brahmic sorting order applies to Chakma.

7. Character names. Consonant letter names use the typical Brahmic transliteration used in the UCS. Chakma letters have a descriptive name followed by a traditional Brahmic consonant. These latter are given in annotations to the character names.

8. Punctuation and digits. Alongside a । DANDA and ॥ DOUBLE DANDA punctuation, Chakma has a unique ؞ QUESTION MARK, and a ꠰ SECTION MARK. There is some variation in the glyphs for the SECTION MARK, some looking like flowers or leaves. A set of digits exists and is encoded, although Bengali digits are also used. The Tanchangya use Myanmar digits.

9. Linebreaking. Letters and digits behave as in Bengali. Both CHAKMA DANDA and CHAKMA DOUBLE DANDA behave as in Devanagari. The CHAKMA QUESTION MARK behaves like U+003F QUESTION MARK. The CHAKMA SECTION MARK behaves like U+2055 FLOWER PUNCTUATION MARK.

10. Unicode Character Properties.

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11100;CHAKMA SIGN CANDRABINDU;Mn;230;NSM;;;;;N;;;;;
11101;CHAKMA SIGN ANUSVARA;Mn;230;NSM;;;;;N;;;;;
11102;CHAKMA SIGN VISARGA;Mc;230;L;;;;;N;;;;;
11103;CHAKMA LETTER AA;Lo;0;L;;;;;N;;;;;
11104;CHAKMA LETTER I;Lo;0;L;;;;;N;;;;;
11105;CHAKMA LETTER U;Lo;0;L;;;;;N;;;;;
11106;CHAKMA LETTER E;Lo;0;L;;;;;N;;;;;
11107;CHAKMA LETTER KAA;Lo;0;L;;;;;N;;;;;
11108;CHAKMA LETTER KHAA;Lo;0;L;;;;;N;;;;;
11109;CHAKMA LETTER GAA;Lo;0;L;;;;;N;;;;;
1110A;CHAKMA LETTER GHAA;Lo;0;L;;;;;N;;;;;
1110B;CHAKMA LETTER NGAA;Lo;0;L;;;;;N;;;;;
1110C;CHAKMA LETTER CAA;Lo;0;L;;;;;N;;;;;
1110D;CHAKMA LETTER CHAA;Lo;0;L;;;;;N;;;;;
1110E;CHAKMA LETTER JAA;Lo;0;L;;;;;N;;;;;
1110F;CHAKMA LETTER JHAA;Lo;0;L;;;;;N;;;;;
11110;CHAKMA LETTER NYAA;Lo;0;L;;;;;N;;;;;
11111;CHAKMA LETTER TTAA;Lo;0;L;;;;;N;;;;;
11112;CHAKMA LETTER TTHAA;Lo;0;L;;;;;N;;;;;
11113;CHAKMA LETTER DDAA;Lo;0;L;;;;;N;;;;;
11114;CHAKMA LETTER DDHAA;Lo;0;L;;;;;N;;;;;
11115;CHAKMA LETTER NNAA;Lo;0;L;;;;;N;;;;;
11116;CHAKMA LETTER TAA;Lo;0;L;;;;;N;;;;;
11117;CHAKMA LETTER THAA;Lo;0;L;;;;;N;;;;;
11118;CHAKMA LETTER DAA;Lo;0;L;;;;;N;;;;;
11119;CHAKMA LETTER DHAA;Lo;0;L;;;;;N;;;;;
1111A;CHAKMA LETTER NAA;Lo;0;L;;;;;N;;;;;
1111B;CHAKMA LETTER PAA;Lo;0;L;;;;;N;;;;;
1111C;CHAKMA LETTER PHAA;Lo;0;L;;;;;N;;;;;
1111D;CHAKMA LETTER BAA;Lo;0;L;;;;;N;;;;;
1111E;CHAKMA LETTER BHAA;Lo;0;L;;;;;N;;;;;
1111F;CHAKMA LETTER MAA;Lo;0;L;;;;;N;;;;;
11120;CHAKMA LETTER YYAA;Lo;0;L;;;;;N;;;;;
11121;CHAKMA LETTER YAA;Lo;0;L;;;;;N;;;;;
11122;CHAKMA LETTER RAA;Lo;0;L;;;;;N;;;;;
11123;CHAKMA LETTER LAA;Lo;0;L;;;;;N;;;;;
11124;CHAKMA LETTER WAA;Lo;0;L;;;;;N;;;;;
11125;CHAKMA LETTER SAA;Lo;0;L;;;;;N;;;;;
11126;CHAKMA LETTER HAA;Lo;0;L;;;;;N;;;;;
11127;CHAKMA VOWEL SIGN A;Mn;230;NSM;;;;;N;;;;;
11128;CHAKMA VOWEL SIGN I;Mn;230;NSM;;;;;N;;;;;
11129;CHAKMA VOWEL SIGN II;Mn;230;NSM;;;;;N;;;;;
1112A;CHAKMA VOWEL SIGN U;Mn;220;NSM;;;;;N;;;;;
1112B;CHAKMA VOWEL SIGN UU;Mn;220;NSM;;;;;N;;;;;
1112C;CHAKMA VOWEL SIGN E;Mc;224;L;;;;;N;;;;;
1112D;CHAKMA VOWEL SIGN AI;Mn;230;NSM;;;;;N;;;;;
1112E;CHAKMA VOWEL SIGN O;Mn;0;NSM;11131 11127;;;;N;;;;;
1112F;CHAKMA VOWEL SIGN AU;Mn;0;NSM;11132 11127;;;;N;;;;;
11130;CHAKMA VOWEL SIGN OI;Mn;230;NSM;;;;;N;;;;;
11131;CHAKMA O MARK;Mn;220;NSM;;;;;N;;;;;
11132;CHAKMA AU MARK;Mn;220;NSM;;;;;N;;;;;
11133;CHAKMA VIRAMA;Mn;9;NSM;;;;;N;;;;;
11134;CHAKMA MAAYYAA;Mn;9;NSM;;;;;N;;;;;
11136;CHAKMA DIGIT ZERO;Nd;0;L;;0;0;0;N;;;;;
11137;CHAKMA DIGIT ONE;Nd;0;L;;1;1;1;N;;;;;
11138;CHAKMA DIGIT TWO;Nd;0;L;;2;2;2;N;;;;;
11139;CHAKMA DIGIT THREE;Nd;0;L;;3;3;3;N;;;;;
1113A;CHAKMA DIGIT FOUR;Nd;0;L;;4;4;4;N;;;;;
1113B;CHAKMA DIGIT FIVE;Nd;0;L;;5;5;5;N;;;;;
1113C;CHAKMA DIGIT SIX;Nd;0;L;;6;6;6;N;;;;;
1113D;CHAKMA DIGIT SEVEN;Nd;0;L;;7;7;7;N;;;;;
1113E;CHAKMA DIGIT EIGHT;Nd;0;L;;8;8;8;N;;;;;
1113F;CHAKMA DIGIT NINE;Nd;0;L;;9;9;9;N;;;;;
11140;CHAKMA SECTION MARK;Po;0;L;;;;;N;;;;;
11141;CHAKMA DANDA;Po;0;L;;;;;N;;;;;
11142;CHAKMA DOUBLE DANDA;Po;0;L;;;;;N;;;;;
11143;CHAKMA QUESTION MARK;Po;0;L;;;;;N;;;;;
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11. Bibliography.

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