Brahmic TECkit mappings

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Abstract

This file defines a set of TECkit mappings based on ISO 15919 *Transliteration of Devanagari and related Indic scripts into Latin characters* for reverse transliteration of Latin-based characters into various Indic scripts in the Brahmic family.

Contents

1   Introduction

This grew out of my experiments with typesetting Sanskrit text using X Ǝ LᴬTEX, which in turn stemmed from my attempts to satisfy my curiosity about how the Devanagari script works. With these mappings and suitable macros, you can write[1]

```
A simple \textbf{liquid vowel} followed by any \emph{other} vowel or
by a diphthong is changed into its semivowel;-e.g.\ \N{dadhi atra} =
\NS{dadhy atra}; \N{kartṛ uta} = \NS{kartr uta}; \N{madhu iva} = \NS{madv
  iva}; \N{nadī artham} = \N{nadyartham}.
```

and get

> A simple **liquid vowel** followed by any *other* vowel or by a diphthong is changed into its semivowel;—e.g. दधि अत्र **dadhi atra** = दध्यत्र **dadhy atra**; कर्तृ उत **kartṛ uta** = कर्त्रुत **kartr uta**; मधु इव **madhu iva** = मद्विव **madv iva**; नदी अर्थम् **nadī artham** = नद्यर्थम् **nadyartham**.

Since the same input is used to generate both the Roman and the Devanagari text, this eliminates the possibility that a typo in one or the other will cause a mismatch—assuming the mapping is implemented correctly, of course!

1.1   Acknowledgements

The first draft map was based on version 1.2 of `velthuis-sanskrit.map`. I've mauled the code almost beyond recognition, but it's influence is still apparent throughout Phase 2.

---

[1]Quoted from section 20 of *A Sanskrit Grammar for Students*[3]

1.2 Caveats

I'm fairly confident that the Devanagari transliteration works,[2] but I'm much less sanguine about the other scripts, of which I lack even the modest knowledge I have about Devanagari. I'd be grateful for any feedback from more knowledgeable users.

1.3 Supported scripts

deva   Devanagari
beng   Bengali
gujr   Gujarati
guru   Gurmukhi
knda   Kannada
mlym   Malayalam
orya   Oriya
sinh   Sinhala
taml   Tamil
telu   Telugu

2 Transcription table

This table is adapted from [1]. The main (intentional) departures are in the rows for **e**, **ē**, **ê**, **o**, **ō**, **ô**, and **ṃ**. Strictly speaking, ISO 15919 only allows them in selected scripts, but for convenience, I've allowed them to be used in all scripts as synonyms for something similar.

For purposes of illustration, I tried to find fonts that contain all of the characters covered, but there are still some missing glyphs in Devanagari, Kannada, Malayalam, Oriya, Telugu. I'd be grateful for suggestions of fonts containing those characters.

Latin	Dev.	San.	Gur.	Guj.	Ben.	Ori.	Tam.	Mal.	Kan.	Tel.	Sin.
a	अ	अ	ਅ	અ	অ	ଅ	அ	അ	ಅ	అ	අ
ā	आ	आ	ਆ	આ	আ	ଆ	ஆ	ആ	ಆ	ఆ	ආ
æ											ඇ
ǣ											ඈ
i	इ	इ	ਇ	ઈ	ই	ଇ	இ	ഇ	ಇ	ఇ	ඉ
ī	ई	ई	ਈ	ઈ	ঈ	ଈ	ஈ	ഈ	ಈ	ఈ	ඊ
u	उ	उ	ਉ	ઉ	উ	ଉ	உ	ഉ	ಉ	ఉ	උ
ū	ऊ	ऊ	ਊ	ઊ	ঊ	ଊ	ஊ	ഊ	ಊ	ఊ	ඌ
ŭ								ഝ			
ṛ	ऋ	ऋ		ઋ	ঋ	ଋ		ഋ	ಋ	బు	ඍa
ṝ	ॠ	ॠ		ૠ	ৠ	ଌ		ൠ	ೠ	బూ	ඎaa
ḷ	ळ	ळ			৯	ଊ		ണ	ಌ	ఌ	ඏ
ḹ	ॡ	ॡ			ৡ	ଢ		ൡ	ೡ	ౡ	ඐ
e	ऎ	ए	ਏ	એ	এ	ଏ	எ	എ	ಎ	ఎ	එ
ē	ए	ए	ਏ	એ	এ	ଏ	ஏ	ഏ	ಏ	ఏ	ඒ

Latin	Dev.	San.	Gur.	Guj.	Ben.	Ori.	Tam.	Mal.	Kan.	Tel.	Sin.
ê	ऍ	ए	ੲ	ઍ	এ	ଏ	எ	ഋ	ಎ	ఎ	ඵ
ai	ऐ	ऐ	ਐ	ઐ	ঐ	ଐ	ஐ	എ	ಐ	ఐ	ඓ
o	ओ	ओ	ੳ	ઓ	ও	ଓ	ஒ	ഒ	ಒ	ఒ	ඔ
ō	ओ	ओ	ੳ	ઓ	ও	ଓ	ஓ	ഓ	ಓ	ఓ	ඕ
ô	ऑ	ओ	ੳ	ઑ	ও	ଓ	ஓ	ഓ	ಓ	ఓ	ඕ
au	औ	औ	ਔ	ઔ	ঔ	ଔ	ஔ	ഔ	ಔ	ఔ	ඖ
ṁ	ँ	ँ	ਂ	ઁ	ঁ	ଂ		ം	ಂ	ం	ඦ
ṃ	ं	ं	ਃ	ં	ঁ	ଂ		ം	ಂ	ం	ඦ
m̌	ँ	ँ	ਂ	ઁ	ঁ	ଁ				□	
ň										ఄ	
ḥ	ः	ః	ਃ	ઃ	ঃ	ଃ		ഃ	ಃ	ః	ඃ
ẖ	?	?							□		
ḫ	?	?							□		
ḵ							ஃ				
ka	क	क	ਕ	ક	ক	କ	க	ക	ಕ	క	ක
kha	ख	ख	ਖ	ખ	খ	ଖ		ഖ	ಖ	ఖ	ඛ
ga	ग	ग	ਗ	ગ	গ	ଗ		ഗ	ಗ	గ	ග
gha	घ	घ	ਘ	ઘ	ঘ	ଘ		ഘ	ಘ	ఘ	ඝ
ṅa	ङ	ङ	ਙ	ઙ	ঙ	ଙ	ங	ങ	ಙ	జ	ඞ
ňga											ඟ
ca	च	च	ਚ	ચ	চ	ଚ	ச	ച	ಚ	చ	ච
ĉa										□	
cha	छ	छ	ਛ	છ	ছ	ଛ		ഛ	ಛ	ఛ	ඡ
ja	ज	ज	ਜ	જ	জ	ଜ	ஜ	ജ	ಜ	జ	ජ
jha	झ	झ	ਝ	ઝ	ঝ	ଝ		ഝ	ಝ	ఝ	ඣ
ña	ञ	ञ	ਞ	ઞ	ঞ	ଞ	ஞ	ഞ	ಞ	ఞ	ඦ
ňja											ඦ
ṭa	ट	ट	ਟ	ટ	ট	ଟ	ட	ട	ಟ	ట	ට
ṭha	ठ	ठ	ਠ	ઠ	ঠ	ଠ		ഠ	ಠ	ఠ	ඨ
ḍa	ड	ड	ਡ	ડ	ড	ଡ		ഡ	ಡ	డ	ඩ
ṛa	ड़	ड	ੜ	ડ	ড়	ଡ଼					
ḍha	ढ	ढ	ਢ	ઢ	ঢ	ଢ		ഢ	ಢ	ఢ	ඪ
ṛha	ढ़				ঢ়অ	ଢ଼					
ṇa	ण	ण	ਣ	ણ	ণ	ଣ	ண	ണ	ಣ	ణ	ණ
ňḍa											ඬ
ta	त	त	ਤ	ત	ত	ତ	த	ത	ತ	త	ත
tha	थ	थ	ਥ	થ	থ	ଥ		ഥ	ಥ	థ	ථ
da	द	द	ਦ	દ	দ	ଦ		ദ	ದ	ద	ද
dha	ध	ध	ਧ	ધ	ধ	ଧ		ധ	ಧ	ధ	ධ
na	न	न	ਨ	ન	ন	ନ	ந	ന	ನ	న	න
ňda											ඳ

4

Latin	Dev.	San.	Gur.	Guj.	Ben.	Ori.	Tam.	Mal.	Kan.	Tel.	Sin.
pa	प	प	ਪ	**પ**	প	ଓ	ப	പ	ಪ	ప	ප
pha	फ	फ	ਫ	**ફ**	ফ	ଫ		ഫ	ಫ	ఫ	ඵ
ba	ब	ब	ਬ	બ	ব	ବ		ബ	ಬ	బ	බ
bha	भ	भ	ਭ	**ભ**	ভ	ଭ		ഭ	ಭ	భ	භ
ma	म	म	ਮ	મ	ম	ମ	ம	മ	ಮ	మ	ම
m̆ba											ඹ
ṟa	ऱ						ற	ഠ	ಱ	ఱ	ර.
ṯa								□			
ṉa	ऩ						ன	□			ඟ.
ḻa	ऴ						ழ	ഴ	ೞ	□	ළ.
ya	य	य	ਜ	**થ**	য	ଯ	ய	യ	ಯ	య	ය
ẏa	य़				য়অ	ୟ					
ra	र	र	ਰ	**ર**	র	ର	ர	ര	ರ	ర	ර
ř	॒	॒									
la	ल	ल	ਲ	**લ**	ল	ଲ	ல	ല	ಲ	ల	ල
ḷa	ळ	ळ	ਲ਼	**ળ**		ଳ	ள	ള	ಳ	ళ	ළ
va	व	व	ਵ	**વ**	র	□	வ	വ	ವ	వ	ව
śa	श	श	ਸ਼	**શ**	শ	ଶ	ஶ	ശ	ಶ	శ	ශ
ṣa	ष	ष		**ષ**	ষ	ଷ	ஷ	ഷ	ಷ	ష	ෂ
sa	स	स	ਸ	**સ**	স	ସ	ஸ	സ	ಸ	స	ස
ha	ह	ह	ਹ	**હ**	হ	ହ	ஹ	ഹ	ಹ	హ	හ
'	ऽ	ऽ		ઽ	২	ଽ		□	□	□	
qa	क़		ਕ਼	**ફ઼**	क़.						
k͟ha	ख़		ਖ਼	**ખ઼**	ख़.						
ġa	ग़		ਗ਼	ગ઼	ग़.						
za	ज़		ਜ਼	**ઝ઼**	ज़.					ಜ□	□
fa	फ़		ਫ਼	**ફ઼**	फ़.					ಫ□	ෆ
wa					व.	□					

2.1 Special conventions

· A colon (:) can be used to break a ligature or diphthong: ब्ह **b:ha** vs. भ **bha**, प्रउ **pra:u** vs. प्रौ **prau**.
· Use U+007C VERTICAL LINE for dandas: ।, ॥.

2.2 Special extensions for Sanskrit

· ṛ can be used instead of r̥ for vocalic r.
· ḷ can be used immediately following a **k** for the vocalic l, thus the root कॢप् can be typed "klp" rather than "kl̥p".
· A diaeresis can also be to break a diphthong: प्रउ **praü** vs. प्रौ **prau**.
· **n̄** is a synonym for **ṅ**.
· **ç** is a synonym for **ś**.
· **āi** and **āu** are synonyms for **ai** and **au**, respectively.

5

References

[1] Anthony P. Stone. "Transliteration of Indic Scripts: How to use ISO 15919." `http://homepage.ntlworld.com/stone-catend/trind.htm`

[2] Arthur A. Macdonell, *A Sanskrit-English Dictionary*. Longmans, Green, and Co., London, 1893.

[3] Arthur A. MacDonell, *A Sanskrit Grammar for Students*, third edition. Oxford University Press, 1927.

[4] The Unicode Consortium. *The Unicode Standard: Version 7.0—Core Specification.* `http://www.unicode.org/versions/Unicode7.0.0/UnicodeStandard-7.0.pdf` (modification date 09/26/2014 03:27:41 PM; md5sum aa6c89d24d7075f93259069fae273251).

[5] William Dwight Whitney, *Sanskrit Grammar: Including both the Classical Language, and the older Dialects, of Veda and Brahmana*. Harvard University Press, fourteenth printing, 1975.

3 TECkit header

```
 1 LHSName "Unicode/ISO 15919"
 2 ⟨deva&!san⟩RHSName "Unicode/Devanagari"
 3 ⟨deva & san⟩RHSName "Unicode/Sanskrit"
 4 ⟨beng⟩RHSName "Unicode/Bengali"
 5 ⟨gujr⟩RHSName "Unicode/Gujarati"
 6 ⟨guru⟩RHSName "Unicode/Gurmukhi"
 7 ⟨knda⟩RHSName "Unicode/Kannada"
 8 ⟨mlym⟩RHSName "Unicode/Malayalam"
 9 ⟨orya⟩RHSName "Unicode/Oriya"
10 ⟨sinh⟩RHSName "Unicode/Sinhala"
11 ⟨taml⟩RHSName "Unicode/Tamil"
12 ⟨telu⟩RHSName "Unicode/Telugu"
13 Version "0.00 beta"
```

4 Overview

Conceptually, the mapping process is divided into two main phases, the first of which translates user input into an internal normalized form and the second of which translates that normalized form into the desired output alphabet. So, we are actually dealing with three different sets of characters:

1. User input: The specific Latin-based Unicode characters supplied by the user. This can be a mix of upper and lower case and precomposed or fully decomposed characters.

2. Normalized input: During Phase 1, the user input is converted into a normalized form, based on, but not identical with, Unicode Normalization Form D. In broad terms, all characters are downcased, and combining marks representing long vowels or tone

marks are separated from their base characters, while combining marks designating distinct consonants are combined with their base characters. In addition, alternative representations are merged and in some cases context-sensitive disambiguation is performed.

3. Output: During Phase 2, the normalized input is converted into the desired output script.

5   Normalized input characters

5.1   Vowels and diphthongs

```
14 Define a        U+0061
15 Define ae       U+00E6
16 Define b        U+0062
17 Define c        U+0063
18 Define d        U+0064
19 Define e        U+0065
20 Define f        U+0066
21 Define g        U+0067
22 Define h        U+0068
23 Define i        U+0069
24 Define j        U+006A
25 Define k        U+006B
26 Define l        U+006C
27 Define m        U+006D
28 Define n        U+006E
29 Define o        U+006F
30 Define p        U+0070
31 Define q        U+0071
32 Define r        U+0072
33 Define s        U+0073
34 Define t        U+0074
35 Define u        U+0075
36 Define v        U+0076
37 Define w        U+0077
38 ; Define x        U+0078
39 Define y        U+0079
40 Define z        U+007A
```

It will be convenient to have single-character representations for vocalic r and vocalic l, but Unicode doesn't have precomposed characters for l or r with a ring below. So, for convenience, we will map them to the PUA in our internal representation.

```
41 Define ri       U+E000 ; PUA
42 Define lry      U+E001 ; PUA
```

Symbols

```
43 Define apos     U+0027
44 ; Define colon    U+003A ; predefined
```

```
45 Define degree    U+00B0
46 Define bar       U+007C
47
48 Define lbrack    U+005B
49 Define rbrack    U+005D
```

5.2 Combining accents

Define short names for the various combining accents we need.[3]

```
50 Define grave       U+0300
51 Define acute       U+0301
52 Define circumflex  U+0302
53 Define tildeabove  U+0303
54 Define macronabove U+0304
55 Define breveabove  U+0306
56 Define dotabove    U+0307
57 Define dieresis    U+0308
58 Define vert        U+030D
59 Define CANDRABINDU U+0310
60 Define dotbelow    U+0323
61 Define ringbelow   U+0325
62 Define ccedilla    U+0327
63 Define hookbelow   U+0328
64 Define brevebelow  U+032E
65 Define macronbelow U+0331
```

6 Output Characters

Now define the output space.

6.1 Script-independent characters

```
66 Define danda    U+0964
67 Define dbldanda U+0965
68
69 Define zwnj     U+200C ; ZERO WIDTH NON-JOINER
70 Define zwj      U+200D ; ZERO WIDTH JOINER
71 Define hiatus   U+0020 ; SPACE
72 Define nbsp     U+00A0 ; NO-BREAK SPACE
73
74 Define NOTDEF   U+FFFD
```

6.2 Devanagari

```
75 ⟨∗deva⟩
76 ; Define altcandrabindu U+0900
77 Define candrabindu U+0901
```

---

[3]The names tilde, macron, breve, dot_above, and diaeresis are predefined the compiler to refer to the spacing variants of those accents, so I've had to choose alternate names.

```
 78 Define anusvara    U+0902
 79 Define visarga     U+0903
 80
 81 ; Define ashort    U+0904
 82 Define asvara      U+0905
 83 Define Asvara      U+0906
 84
 85 Define isvara      U+0907
 86 Define Isvara      U+0908
 87
 88 Define usvara      U+0909
 89 Define Usvara      U+090A
 90
 91 Define rsvara      U+090B
 92 Define lsvara      U+090C
 93
 94 ⟨∗san⟩
 95 Define esvara      U+090F
 96 Define Esvara      U+090F
 97 Define ecandra     U+090F
 98 ⟨/san⟩
 99 ⟨∗!san⟩
100 Define esvara      U+090E
101 Define Esvara      U+090F
102 Define ecandra     U+090D
103 ⟨/!san⟩
104
105 Define aisvara     U+0910
106
107 ⟨∗san⟩
108 Define osvara      U+0913
109 Define Osvara      U+0913
110 Define ocandra     U+0913
111 ⟨/san⟩
112 ⟨∗!san⟩
113 Define osvara      U+0912
114 Define Osvara      U+0913
115 Define ocandra     U+0911
116 ⟨/!san⟩
117
118 Define ausvara     U+0914
119
120 Define ka          U+0915
121 Define kha         U+0916
122 Define ga          U+0917
123 Define gha         U+0918
124 Define nga         U+0919
125
126 Define ca          U+091A
127 Define cha         U+091B
```

```
128 Define ja          U+091C
129 Define jha         U+091D
130 Define nya         U+091E
131
132 Define tta         U+091F
133 Define ttha        U+0920
134 Define dda         U+0921
135 Define ddha        U+0922
136 Define nna         U+0923
137
138 Define ta          U+0924
139 Define tha         U+0925
140 Define da          U+0926
141 Define dha         U+0927
142 Define na          U+0928
143
144 Define nnna        U+0929
145
146 Define pa          U+092A
147 Define pha         U+092B
148 Define ba          U+092C
149 Define bha         U+092D
150 Define ma          U+092E
151
152 Define ya          U+092F
153 Define ra          U+0930
154 Define rra         U+0931
155 Define la          U+0932
156 Define lla         U+0933
157 Define llla        U+0934
158 Define va          U+0935
159
160 Define sha         U+0936
161 Define ssa         U+0937
162 Define sa          U+0938
163 Define ha          U+0939
164
165 ; Define oematra     U+093A
166 ; Define OEmatra     U+093B
167
168 Define nukta       U+093C
169 Define avagraha    U+093D
170
171 Define Amatra      U+093E
172
173 Define imatra      U+093F
174 Define Imatra      U+0940
175
176 Define umatra      U+0941
177 Define Umatra      U+0942
```

```
178
179 Define rmatra       U+0943
180 Define Rmatra       U+0944
181
182 ⟨∗san⟩
183 Define ematra        U+0947
184 Define Ematra        U+0947
185 Define ecandramatra U+0947
186 ⟨/san⟩
187 ⟨∗!san⟩
188 Define ematra        U+0946
189 Define Ematra        U+0947
190 Define ecandramatra U+0945
191 ⟨/!san⟩
192
193 Define aimatra      U+0948
194
195 ⟨∗san⟩
196 Define omatra        U+094B
197 Define Omatra        U+094B
198 Define ocandramatra U+094B
199 ⟨/san⟩
200 ⟨∗!san⟩
201 Define omatra        U+094A
202 Define Omatra        U+094B
203 Define ocandramatra U+0949
204 ⟨/!san⟩
205
206 Define aumatra      U+094C
207
208 Define virama       U+094D
209 ; Define prishthamatra U+094E
210 ; Define awmatra     U+094F
211 ; Define om          U+0950
212
213 Define udatta       U+0951
214 Define anudatta     U+0952
215
216 ; Define devgrave   U+0953
217 ; Define devacute   U+0954
218
219 ; Define Ecandra    U+0955
220
221 ; Define uematra    U+0956
222 ; Define UEmatra    U+0957
223
224 ⟨∗nukta⟩
225 Define qa           U+0958
226 Define khha         U+0959
227 Define ghha         U+095A
```

```
228 Define za          U+095B
229 Define dddha       U+095C
230 Define rha         U+095D
231 Define fa          U+095E
232 Define yya         U+095F
233 ⟨/nukta⟩
234
235 ⟨∗!nukta⟩
236 Define qa          NOTDEF
237 Define khha        NOTDEF
238 Define ghha        NOTDEF
239 Define za          NOTDEF
240 Define dddha       NOTDEF
241 Define rha         NOTDEF
242 Define fa          NOTDEF
243 Define yya         NOTDEF
244 ⟨/!nukta⟩
245
246 Define Rsvara      U+0960
247 Define Lsvara      U+0961
248 Define lmatra      U+0962
249 Define Lmatra      U+0963
250
251 Define zero        U+0966
252 Define one         U+0967
253 Define two         U+0968
254 Define three       U+0969
255 Define four        U+096A
256 Define five        U+096B
257 Define six         U+096C
258 Define seven       U+096D
259 Define eight       U+096E
260 Define nine        U+096F
261
262 Define abbrev      U+0970
263
264 ; Define devdot      U+0971
265 ; Define acandra     U+0972
266 ; Define oesvara     U+0973
267 ; Define OEsvara     U+0974
268 ; Define awsvara     U+0975
269 ; Define uesvara     U+0976
270 ; Define UEsvara     U+0977
271 ; Define ddamarwari  U+0978
272 ; Define zha         U+0979
273 ; Define jjya        U+097a
274 ; Define gga         U+097b
275 ; Define jja         U+097c
276 ; Define devglottal  U+097d
277 ; Define ddda        U+097e
```

```
278 ; Define bba          U+097f
279
280 ⟨san⟩Define svarita_k_i U+1CD7
281
282 Define jihvamuliya U+1CF5
283 Define upadhmaniya U+1CF6
284
285 Define extravyanjana dddha fa ghha khha lla llla qa rha yya za
286 ⟨/deva⟩
```

6.3   Bengali

```
287 ⟨∗beng⟩
288 ; Define anji       U+0980
289 Define candrabindu U+0981
290 Define anusvara     U+0982
291 Define visarga      U+0983
292
293 Define asvara       U+0985
294 Define Asvara       U+0986
295
296 Define isvara       U+0987
297 Define Isvara       U+0988
298
299 Define usvara       U+0989
300 Define Usvara       U+098A
301
302 Define rsvara       U+098B
303 Define lsvara       U+098C
304
305 Define esvara       U+098F
306 Define Esvara       U+098F
307 Define ecandra      U+098F
308 Define aisvara      U+0990
309
310 Define osvara       U+0993
311 Define Osvara       U+0993
312 Define ocandra      U+0993
313 Define ausvara      U+0994
314
315 Define ka           U+0995
316 Define kha          U+0996
317 Define ga           U+0997
318 Define gha          U+0998
319 Define nga          U+0999
320
321 Define ca           U+099A
322 Define cha          U+099B
323 Define ja           U+099C
324 Define jha          U+099D
```

13

```
325  Define nya         U+099E
326
327  Define tta         U+099F
328  Define ttha        U+09A0
329  Define dda         U+09A1
330  Define ddha        U+09A2
331  Define nna         U+09A3
332
333  Define ta          U+09A4
334  Define tha         U+09A5
335  Define da          U+09A6
336  Define dha         U+09A7
337  Define na          U+09A8
338
339  Define pa          U+09AA
340  Define pha         U+09AB
341  Define ba          U+09AC
342  Define bha         U+09AD
343  Define ma          U+09AE
344
345  Define ya          U+09AF
346  Define ra          U+09B0
347  Define la          U+09B2
348  Define lla         NOTDEF
349  Define va          U+09F1
350
351  Define sha         U+09B6
352  Define ssa         U+09B7
353  Define sa          U+09B8
354  Define ha          U+09B9
355
356  Define nukta       U+09BC
357  Define avagraha    U+09BD
358
359  Define Amatra      U+09BE
360
361  Define imatra      U+09BF
362  Define Imatra      U+09C0
363
364  Define umatra      U+09C1
365  Define Umatra      U+09C2
366
367  Define rmatra      U+09C3
368  Define Rmatra      U+09C4
369
370  Define ematra       U+09C7
371  Define Ematra       U+09C7
372  Define ecandramatra U+09C7
373  Define aimatra      U+09C8
374
```

14

```
375 Define omatra        U+09CB
376 Define Omatra        U+09CB
377 Define ocandramatra U+09CB
378 Define aumatra       U+09CC
379
380 Define virama        U+09CD
381
382 Define khandata      U+09CE
383
384 Define udatta        NOTDEF
385 Define anudatta      NOTDEF
386
387 Define aulength      U+09D7
388
389 Define dddha         U+09DC
390
391 Define qa            U+E002 ; PUA
392 Define khha          U+E005 ; PUA
393 Define ghha          U+E007 ; PUA
394 Define za            U+E008 ; PUA
395 Define rra           NOTDEF
396 Define rha           U+09DD
397 Define fa            U+E009 ; PUA
398 Define yya           U+09DF
399
400 Define Rsvara        U+09E0
401 Define Lsvara        U+09E1
402 Define lmatra        U+09E2
403 Define Lmatra        U+09E3
404
405 Define zero          U+09E6
406 Define one           U+09E7
407 Define two           U+09E8
408 Define three         U+09E9
409 Define four          U+09EA
410 Define five          U+09EB
411 Define six           U+09EC
412 Define seven         U+09ED
413 Define eight         U+09EE
414 Define nine          U+09EF
415
416 Define wa            U+E010 ; PUA
417
418 ; Define ramd U+09F0
419 ; Define rald U+09F1
420 ; Define rupeemark U+09F2
421 ; Define rupeesign U+09F3
422 ; Define curnumone U+09F4
423 ; Define curnumtwo U+09F5
424 ; Define curnumthree U+09F6
```

```
425 ; Define curnumfour U+09F7
426 ; Define curnumoneless U+09F8
427 ; Define curdenosixteen U+09F9
428 ; Define isshar U+09FA
429 ; Define ganda mark U+09FB
430
431 Define abbrev        U+0970
432
433 Define extravyanjana dddha fa ghha khha qa rra va wa za
434 ⟨/beng⟩
```

6.4 Gujarati

```
435 ⟨*gujr⟩
436 Define candrabindu U+0A81
437 Define anusvara    U+0A82
438 Define visarga     U+0A83
439
440 Define asvara      U+0A85
441 Define Asvara      U+0A86
442
443 Define isvara      U+0A87
444 Define Isvara      U+0A88
445
446 Define usvara      U+0A89
447 Define Usvara      U+0A8A
448
449 Define rsvara      U+0A8B
450 Define lsvara      U+0A8C
451
452 Define esvara      U+0A8F
453 Define Esvara      U+0A8F
454 Define ecandra     U+0A8D
455 Define aisvara     U+0A90
456
457 Define osvara      U+0A93
458 Define Osvara      U+0A93
459 Define ocandra     U+0A91
460 Define ausvara     U+0A94
461
462 Define ka          U+0A95
463 Define kha         U+0A96
464 Define ga          U+0A97
465 Define gha         U+0A98
466 Define nga         U+0A99
467
468 Define ca          U+0A9A
469 Define cha         U+0A9B
470 Define ja          U+0A9C
471 Define jha         U+0A9D
```

```
472 Define nya          U+0A9E
473
474 Define tta          U+0A9F
475 Define ttha         U+0AA0
476 Define dda          U+0AA1
477 Define ddha         U+0AA2
478 Define nna          U+0AA3
479
480 Define ta           U+0AA4
481 Define tha          U+0AA5
482 Define da           U+0AA6
483 Define dha          U+0AA7
484 Define na           U+0AA8
485
486 Define pa           U+0AAA
487 Define pha          U+0AAB
488 Define ba           U+0AAC
489 Define bha          U+0AAD
490 Define ma           U+0AAE
491
492 Define ya           U+0AAF
493 Define ra           U+0AB0
494 Define la           U+0AB2
495 Define lla          U+0AB3
496 Define va           U+0AB5
497
498 Define sha          U+0AB6
499 Define ssa          U+0AB7
500 Define sa           U+0AB8
501 Define ha           U+0AB9
502
503 Define nukta        U+0ABC
504 Define avagraha     U+0ABD
505
506 Define Amatra       U+0ABE
507
508 Define imatra       U+0ABF
509 Define Imatra       U+0AC0
510
511 Define umatra       U+0AC1
512 Define Umatra       U+0AC2
513
514 Define rmatra       U+0AC3
515 Define Rmatra       U+0AC4
516
517 Define ematra       U+0AC7
518 Define Ematra       U+0AC7
519 Define ecandramatra U+0AC5
520 Define aimatra      U+0AC8
521
```

```
522 Define omatra        U+0ACB
523 Define Omatra        U+0ACB
524 Define ocandramatra U+0AC9
525 Define aumatra       U+0ACC
526
527 Define virama        U+0ACD
528 ; Define om          U+0AD0
529
530 Define udatta        NOTDEF
531 Define anudatta      NOTDEF
532
533 Define qa            U+E003 ; PUA
534 Define khha          U+E006 ; PUA
535 Define ghha          U+E007 ; PUA
536 Define za            U+E008 ; PUA
537 Define rra           NOTDEF
538 Define rha           NOTDEF
539 Define fa            U+E009 ; PUA
540 Define yya           NOTDEF
541
542 Define Rsvara        U+0AE0
543 Define Lsvara        U+0AE1
544 Define lmatra        U+0AE2
545 Define Lmatra        U+0AE3
546
547 Define zero          U+0AE6
548 Define one           U+0AE7
549 Define two           U+0AE8
550 Define three         U+0AE9
551 Define four          U+0AEA
552 Define five          U+0AEB
553 Define six           U+0AEC
554 Define seven         U+0AED
555 Define eight         U+0AEE
556 Define nine          U+0AEF
557
558 Define abbrev        U+0AF0
559
560 ; Define rupeemark NOTDEF
561 ; Define rupeesign U+0AF1
562
563 Define extravyanjana fa ghha khha qa za
564 ⟨/gujr⟩
```

6.5 Gurmukhi

```
565 ⟨*guru⟩
566 Define candrabindu U+0A01
567 Define anusvara    U+0A02
568 Define visarga     U+0A03
```

```
569
570 Define asvara      U+0A05
571 Define Asvara      U+0A06
572
573 Define isvara      U+0A07
574 Define Isvara      U+0A08
575
576 Define usvara      U+0A09
577 Define Usvara      U+0A0A
578
579 Define rsvara      NOTDEF
580 Define Rsvara      NOTDEF
581
582 Define lsvara      NOTDEF
583 Define Lsvara      NOTDEF
584
585 Define esvara      U+0A0F
586 Define Esvara      U+0A0F
587 Define ecandra     U+0A0F
588 Define aisvara     U+0A10
589
590 Define osvara      U+0A13
591 Define Osvara      U+0A13
592 Define ocandra     U+0A13
593 Define ausvara     U+0A14
594
595 Define ka          U+0A15
596 Define kha         U+0A16
597 Define ga          U+0A17
598 Define gha         U+0A18
599 Define nga         U+0A19
600
601 Define ca          U+0A1A
602 Define cha         U+0A1B
603 Define ja          U+0A1C
604 Define jha         U+0A1D
605 Define nya         U+0A1E
606
607 Define tta         U+0A1F
608 Define ttha        U+0A20
609 Define dda         U+0A21
610 Define ddha        U+0A22
611 Define nna         U+0A23
612
613 Define ta          U+0A24
614 Define tha         U+0A25
615 Define da          U+0A26
616 Define dha         U+0A27
617 Define na          U+0A28
618
```

```
619 Define pa              U+0A2A
620 Define pha             U+0A2B
621 Define ba              U+0A2C
622 Define bha             U+0A2D
623 Define ma              U+0A2E
624
625 Define ya              U+0A2F
626 Define ra              U+0A30
627 Define la              U+0A32
628 Define lla             U+0A33
629 Define va              U+0A35
630
631 Define sha             U+0A36
632 Define ssa             NOTDEF
633 Define sa              U+0A38
634 Define ha              U+0A39
635
636 Define nukta           U+0A3C
637 Define avagraha        NOTDEF
638
639 Define Amatra          U+0A3E
640
641 Define imatra          U+0A3F
642 Define Imatra          U+0A40
643
644 Define umatra          U+0A41
645 Define Umatra          U+0A42
646
647 Define rmatra          NOTDEF
648 Define Rmatra          NOTDEF
649
650 Define ematra          U+0A47
651 Define Ematra          U+0A47
652 Define ecandramatra    U+0A47
653 Define aimatra         U+0A48
654
655 Define omatra          U+0A4B
656 Define Omatra          U+0A4B
657 Define ocandramatra    U+0A4B
658 Define aumatra         U+0A4C
659
660 Define virama          U+0A4D
661
662 Define udatta          U+0A51
663 Define anudatta        NOTDEF
664
665 Define qa              U+E004 ; PUA
666 Define khha            U+0A59
667 Define ghha            U+0A5A
668 Define za              U+0A5B
```

```
669 Define rra          U+0A5C
670 Define rha          NOTDEF
671 Define fa           U+0A5E
672 Define yya          NOTDEF
673
674 Define lmatra       NOTDEF
675 Define Lmatra       NOTDEF
676
677 Define zero         U+0A66
678 Define one          U+0A67
679 Define two          U+0A68
680 Define three        U+0A69
681 Define four         U+0A6A
682 Define five         U+0A6B
683 Define six          U+0A6C
684 Define seven        U+0A6D
685 Define eight        U+0A6E
686 Define nine         U+0A6F
687
688 Define abbrev       NOTDEF
689
690 Define tippi        U+0A70
691
692 Define addak        U+0A71
693 Define iri          U+0A72
694 Define ura          U+0A73
695 Define ek_onkar     U+0A74
696 Define yakash       U+0A75
697
698 Define extravyanjana fa ghha khha qa rra za
699 ⟨/guru⟩
```

6.6 Kannada

```
700 ⟨∗knda⟩
701 Define candrabindu U+0C81
702 Define anusvara     U+0C82
703 Define visarga      U+0C83
704
705 Define asvara       U+0C85
706 Define Asvara       U+0C86
707
708 Define isvara       U+0C87
709 Define Isvara       U+0C88
710
711 Define usvara       U+0C89
712 Define Usvara       U+0C8A
713
714 Define rsvara       U+0C8B
715
```

```
716 Define lsvara      U+0C8C
717
718 Define esvara      U+0C8E
719 Define Esvara      U+0C8F
720 Define ecandra     U+0C8F
721 Define aisvara     U+0C90
722
723 Define osvara      U+0C92
724 Define Osvara      U+0C93
725 Define ocandra     U+0C93
726 Define ausvara     U+0C94
727
728 Define ka          U+0C95
729 Define kha         U+0C96
730 Define ga          U+0C97
731 Define gha         U+0C98
732 Define nga         U+0C99
733
734 Define ca          U+0C9A
735 Define cha         U+0C9B
736 Define ja          U+0C9C
737 Define jha         U+0C9D
738 Define nya         U+0C9E
739
740 Define tta         U+0C9F
741 Define ttha        U+0CA0
742 Define dda         U+0CA1
743 Define ddha        U+0CA2
744 Define nna         U+0CA3
745
746 Define ta          U+0CA4
747 Define tha         U+0CA5
748 Define da          U+0CA6
749 Define dha         U+0CA7
750 Define na          U+0CA8
751
752 Define pa          U+0CAA
753 Define pha         U+0CAB
754 Define ba          U+0CAC
755 Define bha         U+0CAD
756 Define ma          U+0CAE
757
758 Define ya          U+0CAF
759 Define ra          U+0CB0
760 Define rra         U+0CB1
761 Define la          U+0CB2
762 Define lla         U+0CB3
763 Define va          U+0CB5
764
765 Define llla        U+0CDE
```

```
766
767 Define sha          U+0CB6
768 Define ssa          U+0CB7
769 Define sa           U+0CB8
770 Define ha           U+0CB9
771
772 Define nukta        U+0CBC
773 Define avagraha     U+0CBD
774
775 Define Amatra       U+0CBE
776
777 Define imatra       U+0CBF
778 Define Imatra       U+0CC0
779
780 Define umatra       U+0CC1
781 Define Umatra       U+0CC2
782
783 Define rmatra       U+0CC3
784 Define Rmatra       U+0CC4
785
786 Define ematra       U+0CC6
787 Define Ematra       U+0CC7
788 Define ecandramatra U+0CC7
789 Define aimatra      U+0CC8
790
791 Define omatra       U+0CCA
792 Define Omatra       U+0CCB
793 Define ocandramatra U+0CCB
794 Define aumatra      U+0CCC
795
796 Define udatta       NOTDEF
797 Define anudatta     NOTDEF
798
799 Define virama         U+0CCD
800 ; Define length_mark    U+0CD5
801 ; Define ai_length_mark U+0CD6
802
803 Define za           U+E008 ; PUA
804 Define fa           U+E014 ; PUA
805
806 Define Rsvara       U+0CE0
807 Define Lsvara       U+0CE1
808 Define lmatra       U+0CE2
809 Define Lmatra       U+0CE3
810
811 Define zero         U+0CE6
812 Define one          U+0CE7
813 Define two          U+0CE8
814 Define three        U+0CE9
815 Define four         U+0CEA
```

23

```
816 Define five         U+0CEB
817 Define six          U+0CEC
818 Define seven        U+0CED
819 Define eight        U+0CEE
820 Define nine         U+0CEF
821
822 Define abbrev       NOTDEF
823
824 Define jihvamuliya U+0CF1
825 Define upadhmaniya U+0CF2
826
827 Define extravyanjana fa llla za
828 ⟨/knda⟩
```

6.7   Malayalam

```
829 ⟨*mlym⟩
830 Define candrabindu U+0D01
831 Define anusvara     U+0D02
832 Define visarga      U+0D03
833
834 Define asvara       U+0D05
835 Define Asvara       U+0D06
836
837 Define isvara       U+0D07
838 Define Isvara       U+0D08
839
840 Define usvara       U+0D09
841 Define Usvara       U+0D0A
842
843 Define rsvara       U+0D0B
844 Define lsvara       U+0D0C
845
846 Define esvara       U+0D0E
847 Define Esvara       U+0D0F
848 Define ecandra      U+0D0F
849 Define aisvara      U+0D10
850
851 Define osvara       U+0D12
852 Define Osvara       U+0D13
853 Define ocandra      U+0D13
854 Define ausvara      U+0D14
855
856 Define ka           U+0D15
857 Define kha          U+0D16
858 Define ga           U+0D17
859 Define gha          U+0D18
860 Define nga          U+0D19
861
862 Define ca           U+0D1A
```

```
863 Define cha        U+0D1B
864 Define ja         U+0D1C
865 Define jha        U+0D1D
866 Define nya        U+0D1E
867
868 Define tta        U+0D1F
869 Define ttha       U+0D20
870 Define dda        U+0D21
871 Define ddha       U+0D22
872 Define nna        U+0D23
873
874 Define ta         U+0D24
875 Define tha        U+0D25
876 Define da         U+0D26
877 Define dha        U+0D27
878 Define na         U+0D28
879
880 Define nnna       U+0D29
881
882 Define pa         U+0D2A
883 Define pha        U+0D2B
884 Define ba         U+0D2C
885 Define bha        U+0D2D
886 Define ma         U+0D2E
887
888 Define ya         U+0D2F
889 Define ra         U+0D30
890 Define rra        U+0D31
891 Define la         U+0D32
892 Define lla        U+0D33
893 Define llla       U+0D34
894 Define va         U+0D35
895
896 Define sha        U+0D36
897 Define ssa        U+0D37
898 Define sa         U+0D38
899 Define ha         U+0D39
900
901 Define ttta       U+0D3A
902
903 Define avagraha   U+0D3D
904
905 Define Amatra     U+0D3E
906
907 Define imatra     U+0D3F
908 Define Imatra     U+0D40
909
910 Define umatra     U+0D41
911 Define Umatra     U+0D42
912
```

```
913  Define rmatra        U+0D43
914  Define Rmatra        U+0D44
915
916  Define ematra        U+0D46
917  Define Ematra        U+0D47
918  Define ecandramatra U+0D47
919  Define aimatra       U+0D48
920
921  Define omatra        U+0D4A
922  Define Omatra        U+0D4B
923  Define ocandramatra U+0D4B
924  Define aumatra       U+0D4C
925
926  Define virama        U+0D4D
927
928  Define dot_reph      U+0D4E
929
930  Define udatta        U+0D51
931  Define anudatta      U+0D52
932
933 ; Define au_length_mark U+0D57
934
935  Define fa            NOTDEF
936
937  Define Rsvara        U+0D60
938  Define Lsvara        U+0D61
939  Define lmatra        U+0D62
940  Define Lmatra        U+0D63
941
942  Define zero          U+0D66
943  Define one           U+0D67
944  Define two           U+0D68
945  Define three         U+0D69
946  Define four          U+0D6A
947  Define five          U+0D6B
948  Define six           U+0D6C
949  Define seven         U+0D6D
950  Define eight         U+0D6E
951  Define nine          U+0D6F
952
953 ; Define ten           U+0D70
954 ; Define hundred       U+0D71
955 ; Define thousand      U+0D72
956
957 ; Define quarter       U+0D73
958 ; Define half          U+0D74
959 ; Define three_quarters U+0D75
960
961 ; Define date_mark     U+0D79
962
```

```
963 Define abbrev      NOTDEF
964
965 Define chillu_nn U+0D7A
966 Define chillu_n  U+0D7B
967 Define chillu_rr U+0D7C
968 Define chillu_l  U+0D7D
969 Define chillu_ll U+0D7E
970 Define chillu_k  U+0D7F
971
972 Define extravyanjana llla ttta
973 ⟨/mlym⟩
```

6.8   Oriya

```
974 ⟨*orya⟩
975 Define candrabindu U+0B01
976 Define anusvara    U+0B02
977 Define visarga     U+0B03
978
979 Define asvara      U+0B05
980 Define Asvara      U+0B06
981
982 Define isvara      U+0B07
983 Define Isvara      U+0B08
984
985 Define usvara      U+0B09
986 Define Usvara      U+0B0A
987
988 Define rsvara      U+0B0B
989 Define lsvara      U+0B0C
990
991 Define esvara      U+0B0F
992 Define Esvara      U+0B0F
993 Define ecandra     U+0B0F
994 Define aisvara     U+0B10
995
996 Define osvara      U+0B13
997 Define Osvara      U+0B13
998 Define ocandra     U+0B13
999 Define ausvara     U+0B14
1000
1001 Define ka          U+0B15
1002 Define kha         U+0B16
1003 Define ga          U+0B17
1004 Define gha         U+0B18
1005 Define nga         U+0B19
1006
1007 Define ca          U+0B1A
1008 Define cha         U+0B1B
1009 Define ja          U+0B1C
```

```
1010 Define jha          U+0B1D
1011 Define nya          U+0B1E
1012
1013 Define tta          U+0B1F
1014 Define ttha         U+0B20
1015 Define dda          U+0B21
1016 Define ddha         U+0B22
1017 Define nna          U+0B23
1018
1019 Define ta           U+0B24
1020 Define tha          U+0B25
1021 Define da           U+0B26
1022 Define dha          U+0B27
1023 Define na           U+0B28
1024
1025 Define pa           U+0B2A
1026 Define pha          U+0B2B
1027 Define ba           U+0B2C
1028 Define bha          U+0B2D
1029 Define ma           U+0B2E
1030
1031 Define ya           U+0B2F
1032 Define ra           U+0B30
1033 Define la           U+0B32
1034 Define lla          U+0B33
1035 Define va           U+0B35
1036
1037 Define sha          U+0B36
1038 Define ssa          U+0B37
1039 Define sa           U+0B38
1040 Define ha           U+0B39
1041
1042 Define nukta        U+0B3C
1043 Define avagraha     U+0B3D
1044
1045 Define Amatra       U+0B3E
1046
1047 Define imatra       U+0B3F
1048 Define Imatra       U+0B40
1049
1050 Define umatra       U+0B41
1051 Define Umatra       U+0B42
1052
1053 Define rmatra       U+0B43
1054 Define Rmatra       U+0B44
1055
1056 Define ematra       U+0B47
1057 Define Ematra       U+0B47
1058 Define ecandramatra U+0B47
1059 Define aimatra      U+0B48
```

```
1060
1061 Define omatra        U+0B4B
1062 Define Omatra        U+0B4B
1063 Define ocandramatra  U+0B4B
1064 Define aumatra       U+0B4C
1065
1066 Define virama        U+0B4D
1067
1068 Define udatta        NOTDEF
1069 Define anudatta      NOTDEF
1070
1071 ; Define ai_length_mark U+0B56
1072 ; Define au_length_mark U+0B57
1073
1074 Define rra           U+0B5C
1075 Define rha           U+0B5D
1076 Define yya           U+0B5F
1077
1078 Define fa            NOTDEF
1079
1080 Define Rsvara        U+0B60
1081 Define Lsvara        U+0B61
1082 Define lmatra        U+0B62
1083 Define Lmatra        U+0B63
1084
1085 Define zero          U+0B66
1086 Define one           U+0B67
1087 Define two           U+0B68
1088 Define three         U+0B69
1089 Define four          U+0B6A
1090 Define five          U+0B6B
1091 Define six           U+0B6C
1092 Define seven         U+0B6D
1093 Define eight         U+0B6E
1094 Define nine          U+0B6F
1095
1096 Define abbrev        NOTDEF
1097
1098 Define isshar            U+0B70
1099 Define wa                U+0B71
1100 Define quarter           U+0B72
1101 Define half              U+0B73
1102 Define three_quarters    U+0B74
1103 Define sixteenth         U+0B75
1104 Define eighth            U+0B76
1105 Define three_sixteenths U+0B77
1106
1107 Define extravyanjana rha rra wa yya
1108 ⟨/orya⟩
```

6.9 Sinhala

```
1109 ⟨∗sinh⟩
1110 Define candrabindu NOTDEF
1111 Define anusvara     U+0D82
1112 Define visarga      U+0D83
1113
1114 Define asvara       U+0D85
1115 Define Asvara       U+0D86
1116
1117 Define aesvara      U+0D87
1118 Define AEsvara      U+0D88
1119
1120 Define isvara       U+0D89
1121 Define Isvara       U+0D8A
1122
1123 Define usvara       U+0D8B
1124 Define Usvara       U+0D8C
1125
1126 Define rsvara       U+0D8D
1127 Define Rsvara       U+0D8E
1128
1129 Define lsvara       U+0D8F
1130 Define Lsvara       U+0D90
1131
1132 Define esvara       U+0D91
1133 Define Esvara       U+0D92
1134 Define ecandra      U+0D92
1135 Define aisvara      U+0D93
1136
1137 Define osvara       U+0D94
1138 Define Osvara       U+0D95
1139 Define ocandra      U+0D95
1140 Define ausvara      U+0D96
1141
1142 Define ka           U+0D9A
1143 Define kha          U+0D9B
1144 Define ga           U+0D9C
1145 Define gha          U+0D9D
1146 Define nga          U+0D9E
1147 Define nnga         U+0D9F
1148
1149 Define nnna         U+E011 ; PUA
1150
1151 Define ca           U+0DA0
1152 Define cha          U+0DA1
1153 Define ja           U+0DA2
1154 Define jha          U+0DA3
1155 Define nya          U+0DA4
1156 Define jnya         U+0DA5
```

```
1157 Define nyja        U+0DA6
1158
1159 Define tta         U+0DA7
1160 Define ttha        U+0DA8
1161 Define dda         U+0DA9
1162 Define ddha        U+0DAA
1163 Define nna         U+0DAB
1164 Define nndda       U+0DAC
1165
1166 Define ta          U+0DAD
1167 Define tha         U+0DAE
1168 Define da          U+0DAF
1169 Define dha         U+0DB0
1170 Define na          U+0DB1
1171
1172 Define nda         U+0DB3
1173
1174 Define pa          U+0DB4
1175 Define pha         U+0DB5
1176 Define ba          U+0DB6
1177 Define bha         U+0DB7
1178 Define ma          U+0DB8
1179 Define mba         U+0DB9
1180
1181 Define ya          U+0DBA
1182 Define ra          U+0DBB
1183 Define rra         U+E012 ; PUA
1184 Define la          U+0DBD
1185 Define va          U+0DC0
1186
1187 Define sha         U+0DC1
1188 Define ssa         U+0DC2
1189 Define sa          U+0DC3
1190 Define ha          U+0DC4
1191 Define lla         U+0DC5
1192 Define fa          U+0DC6
1193
1194 Define llla        U+E013 ; PUA
1195
1196 Define avagraha    NOTDEF
1197
1198 Define virama      U+0DCA
1199
1200 Define Amatra      U+0DCF
1201
1202 Define aematra     U+0DD0
1203 Define AEmatra     U+0DD1
1204
1205 Define imatra      U+0DD2
1206 Define Imatra      U+0DD3
```

```
1207
1208 Define umatra       U+0DD4
1209 Define Umatra       U+0DD6
1210
1211 Define rmatra       U+0DD8
1212
1213 Define ematra       U+0DD9
1214 Define Ematra       U+0DDA
1215 Define ecandramatra U+0DDA
1216 Define aimatra      U+0DDB
1217
1218 Define omatra       U+0DDC
1219 Define Omatra       U+0DDD
1220 Define ocandramatra U+0DDD
1221 Define aumatra      U+0DDE
1222
1223 Define lmatra       U+0DDF
1224
1225 Define udatta       NOTDEF
1226 Define anudatta     NOTDEF
1227
1228 Define zero         U+0DE6
1229 Define one          U+0DE7
1230 Define two          U+0DE8
1231 Define three        U+0DE9
1232 Define four         U+0DEA
1233 Define five         U+0DEB
1234 Define six          U+0DEC
1235 Define seven        U+0DED
1236 Define eight        U+0DEE
1237 Define nine         U+0DEF
1238
1239 Define Rmatra       U+0DF2
1240 Define Lmatra       U+0DF3
1241
1242 Define kunddaliya   U+0DF4
1243
1244 Define abbrev       NOTDEF
1245
1246 Define extravyanjana fa lla llla mba nda nndda nnga nnna nyja rra
1247 ⟨/sinh⟩
```

6.10 Tamil

```
1248 ⟨*taml⟩
1249 Define candrabindu NOTDEF
1250 Define anusvara    U+0B82
1251 Define visarga     U+0B83
1252
1253 Define asvara      U+0B85
```

```
1254 Define Asvara      U+0B86
1255
1256 Define isvara      U+0B87
1257 Define Isvara      U+0B88
1258
1259 Define usvara      U+0B89
1260 Define Usvara      U+0B8A
1261
1262 Define rsvara      NOTDEF
1263 Define lsvara      NOTDEF
1264
1265 Define esvara      U+0B8E
1266 Define Esvara      U+0B8F
1267 Define ecandra     U+0B8F
1268 Define aisvara     U+0B90
1269
1270 Define osvara      U+0B92
1271 Define Osvara      U+0B93
1272 Define ocandra     U+0B93
1273 Define ausvara     U+0B94
1274
1275 Define ka          U+0B95
1276 Define kha         NOTDEF
1277 Define ga          NOTDEF
1278 Define gha         NOTDEF
1279 Define nga         U+0B99
1280
1281 Define ca          U+0B9A
1282 Define cha         NOTDEF
1283 Define ja          U+0B9C
1284 Define jha         NOTDEF
1285 Define nya         U+0B9E
1286
1287 Define tta         U+0B9F
1288 Define ttha        NOTDEF
1289 Define dda         NOTDEF
1290 Define ddha        NOTDEF
1291 Define nna         U+0BA3
1292
1293 Define ta          U+0BA4
1294 Define tha         NOTDEF
1295 Define da          NOTDEF
1296 Define dha         NOTDEF
1297 Define na          U+0BA8
1298
1299 Define nnna        U+0BA9
1300
1301 Define pa          U+0BAA
1302 Define pha         NOTDEF
1303 Define ba          NOTDEF
```

```
1304 Define bha          NOTDEF
1305 Define ma           U+0BAE
1306
1307 Define ya           U+0BAF
1308 Define ra           U+0BB0
1309 Define rra          U+0BB1
1310 Define la           U+0BB2
1311 Define lla          U+0BB3
1312 Define llla         U+0BB4
1313 Define va           U+0BB5
1314
1315 Define sha          U+0BB6
1316 Define ssa          U+0BB7
1317 Define sa           U+0BB8
1318 Define ha           U+0BB9
1319
1320 Define avagraha     NOTDEF
1321
1322 Define Amatra       U+0BBE
1323
1324 Define imatra       U+0BBF
1325 Define Imatra       U+0BC0
1326
1327 Define umatra       U+0BC1
1328 Define Umatra       U+0BC2
1329
1330 Define rmatra       NOTDEF
1331 Define Rmatra       NOTDEF
1332
1333 Define ematra        U+0BC6
1334 Define Ematra        U+0BC7
1335 Define ecandramatra U+0BC7
1336 Define aimatra       U+0BC8
1337
1338 Define omatra        U+0BCA
1339 Define Omatra        U+0BCB
1340 Define ocandramatra U+0BCB
1341 Define aumatra       U+0BCC
1342
1343 Define virama       U+0BCD
1344
1345 Define om           U+0BD0
1346
1347 Define udatta       NOTDEF
1348 Define anudatta     NOTDEF
1349
1350 ; Define au_length_mark U+0BD7
1351
1352 Define fa           NOTDEF
1353
```

```
1354 Define  Rsvara       NOTDEF
1355 Define  Lsvara       NOTDEF
1356 Define  lmatra       NOTDEF
1357 Define  Lmatra       NOTDEF
1358
1359 Define  zero         U+0BE6
1360 Define  one          U+0BE7
1361 Define  two          U+0BE8
1362 Define  three        U+0BE9
1363 Define  four         U+0BEA
1364 Define  five         U+0BEB
1365 Define  six          U+0BEC
1366 Define  seven        U+0BED
1367 Define  eight        U+0BEE
1368 Define  nine         U+0BEF
1369
1370 Define  abbrev       NOTDEF
1371
1372 ; Define ten         U+0BF0
1373 ; Define hundred     U+0BF1
1374 ; Define thousand    U+0BF2
1375
1376 ; Define daysign     U+0BF3
1377 ; Define monthsign   U+0BF4
1378 ; Define yearsign    U+0BF5
1379 ; Define debitsign   U+0BF6
1380 ; Define creditsign  U+0BF7
1381 ; Define asabovesign U+0BF8
1382 ; Define rupeesign   U+0BF9
1383 ; Define numbersign  U+0BFA
1384
1385 Define extravyanjana llla
1386 ⟨/taml⟩
```

6.11   Telugu

```
1387 ⟨∗telu⟩
1388 Define candrabindu    U+0C00
1389 Define altcandrabindu U+0C01
1390 Define anusvara       U+0C02
1391 Define visarga        U+0C03
1392
1393 Define asvara         U+0C05
1394 Define Asvara         U+0C06
1395
1396 Define isvara         U+0C07
1397 Define Isvara         U+0C08
1398
1399 Define usvara         U+0C09
1400 Define Usvara         U+0C0A
```

```
1401
1402 Define rsvara       U+0C0B
1403 Define lsvara       U+0C0C
1404
1405 Define esvara       U+0C0E
1406 Define Esvara       U+0C0F
1407 Define ecandra      U+0C0F
1408 Define aisvara      U+0C10
1409
1410 Define osvara       U+0C12
1411 Define Osvara       U+0C13
1412 Define ocandra      U+0C13
1413 Define ausvara      U+0C14
1414
1415 Define ka           U+0C15
1416 Define kha          U+0C16
1417 Define ga           U+0C17
1418 Define gha          U+0C18
1419 Define nga          U+0C19
1420
1421 Define ca           U+0C1A
1422 Define cha          U+0C1B
1423 Define ja           U+0C1C
1424 Define jha          U+0C1D
1425 Define nya          U+0C1E
1426
1427 Define tta          U+0C1F
1428 Define ttha         U+0C20
1429 Define dda          U+0C21
1430 Define ddha         U+0C22
1431 Define nna          U+0C23
1432
1433 Define ta           U+0C24
1434 Define tha          U+0C25
1435 Define da           U+0C26
1436 Define dha          U+0C27
1437 Define na           U+0C28
1438
1439 Define pa           U+0C2A
1440 Define pha          U+0C2B
1441 Define ba           U+0C2C
1442 Define bha          U+0C2D
1443 Define ma           U+0C2E
1444
1445 Define ya           U+0C2F
1446 Define ra           U+0C30
1447 Define rra          U+0C31
1448 Define la           U+0C32
1449 Define lla          U+0C33
1450 Define llla         U+0C34
```

36

```
1451 Define va             U+0C35
1452
1453 Define sha            U+0C36
1454 Define ssa            U+0C37
1455 Define sa             U+0C38
1456 Define ha             U+0C39
1457
1458 Define avagraha       U+0C3D
1459
1460 Define Amatra         U+0C3E
1461
1462 Define imatra         U+0C3F
1463 Define Imatra         U+0C40
1464
1465 Define umatra         U+0C41
1466 Define Umatra         U+0C42
1467
1468 Define rmatra         U+0C43
1469 Define Rmatra         U+0C44
1470
1471 Define ematra         U+0C46
1472 Define Ematra         U+0C47
1473 Define ecandramatra   U+0C47
1474 Define aimatra        U+0C48
1475
1476 Define omatra         U+0C4A
1477 Define Omatra         U+0C4B
1478 Define ocandramatra   U+0C4B
1479 Define aumatra        U+0C4C
1480
1481 Define virama         U+0C4D
1482
1483 Define udatta         NOTDEF
1484 Define anudatta       NOTDEF
1485
1486 ; Define length_mark     U+0C55
1487 ; Define ai_length_mark  U+0C56
1488
1489 Define tsa            U+0C58
1490 Define dza            U+0C59
1491
1492 Define fa             NOTDEF
1493
1494 Define Rsvara         U+0C60
1495 Define Lsvara         U+0C61
1496 Define lmatra         U+0C62
1497 Define Lmatra         U+0C63
1498
1499 Define zero           U+0C66
1500 Define one            U+0C67
```

```
1501 Define two          U+0C68
1502 Define three        U+0C69
1503 Define four         U+0C6A
1504 Define five         U+0C6B
1505 Define six          U+0C6C
1506 Define seven        U+0C6D
1507 Define eight        U+0C6E
1508 Define nine         U+0C6F
1509
1510 Define abbrev       NOTDEF
1511
1512 Define zero1        U+0C78
1513 Define one1         U+0C79
1514 Define two1         U+0C7A
1515 Define three1       U+0C7B
1516
1517 Define one2         U+0C7C
1518 Define two2         U+0C7D
1519 Define three2       U+0C7E
1520
1521 Define tuumu        U+0C7F
1522
1523 Define extravyanjana dza llla tsa
1524 ⟨/telu⟩
```

7   Phase 1: Normalization

By first normalizing the input, we can simplify the transliteration rules without sacrificing flexibility on the input side.

7.1   Normalization Pass 1: Decompose compound characters.

Separate diacritics from their base letters and sort them into a standard order. This ensures that, for example, all long vowels are encoded as base letter + macron and not by a precomposed character.

```
1525 pass(NFD)
```

7.2   Normalization Pass 2: Downcase base characters.

Convert all uppercase letters to lowercase.

```
1526 pass(Unicode)
1527
1528 UniClass[upper] = (U+0041 .. U+005A) ; A..Z
1529 UniClass[lower] = (U+0061 .. U+007A) ; a..z
1530
1531 [upper] > [lower]
```

This is also a good time to delete optional characters.

```
1532 lbrack .* rbrack >
```

7.3   Normalization Pass 3: Special cases and alternate transcriptions.

ḷ and r̥ always represent vocalic l and vocalic r.

```
1533 pass(Unicode)
1534
1535 l ringbelow > lry
1536 r ringbelow > ri
```

For compatibility with IAST and common practice, allow r̥ as a synonym for vocalic r in Sanskrit.

```
1537 ⟨san⟩r dotbelow  > ri
```

Similarly, accept ḷ as a synonym for vocalic l in an appropriate context. Specifically, as per section 26 of Whitney's grammar, vocalic l is only found in derivatives of the rare root **kḷp** and (as far as I can tell) it will always immediately following a **k.** The following rule allows ḷ to be used in those contexts. (See "Transliteration pass 1.5" below for another way to disambiguate dual uses of ḷ.)

```
1538 ⟨san⟩l dotbelow / k _ > lry
```

Allow **āi** and **āu** as synonyms for **ai** and **au.**

```
1539 ⟨san⟩a macronabove / _ (i | u) > a
```

Recognize some older transcription conventions used in, for example, works by Macdonell or Whitney.

```
1540 ⟨∗san⟩
1541 n macronabove <> n dotabove
1542 c ccedilla <> s acute
1543 circumflex <> macronabove
1544 ⟨/san⟩

1545 ⟨∗san⟩
1546 a macronbelow u macronbelow > a u macronbelow
1547 a macronbelow i macronbelow > a i macronbelow
1548 ⟨/san⟩
```

Diereses are used to keep "i" or "u" from forming diphthongs with a preceding "a".

```
1549 i dieresis > zwnj i
1550 u dieresis > zwnj u
```

In NFD, marks under the base character are encoded before marks above the character, but we need the long vowel mark and the candribindu to come first.

```
1551 macronbelow macronabove > macronabove macronbelow
1552 macronbelow CANDRABINDU > CANDRABINDU macronbelow
```

8   Sanskrit External Vowel Sandhi

This section was inspired by Macdonell's practice of writing, for example,

अध्यूढ **adhi_ūḍha,** *pp.* (√ūh) placed upon (*lc.*).

39

in his Sanskrit-English Dictionary to illustrate the action of vowel sandhi in compound words. With these rules, you can use U+203F UNDERTIE to request vowel coalescence in the Devanagari text:

```
\N{adhi _ ūḍha}, ...
```

I've attempted to implement all of sections 19–22 of *A Sanskrit Grammar for Students* [3]. The rules below are quoted from there, with minor adaptations and elisions. The order and division into passes is chosen to ensure that, for example, the digraphs **ai** and **au** are processed before any of the patterns beginning with **i** or **u**.

```
1553 ⟨∗san⟩
1554 pass(Unicode)
1555
1556 Define coalesce U+203F ; UNDERTIE
```

For simplicity (and because Macdonell doesn't display them in the Devanagari in his dictionary), drop all accents.

```
1557 UniClass[vaccent] = (acute grave macronbelow vert)
1558
1559 [vaccent] / _ coalesce                   >
1560 [vaccent] /   coalesce _                 >
1561 [vaccent] /   coalesce . macronabove? _ >
```

SGS §21a: The Guṇa vowels **e** and **o** remain unchanged before **a**, which is elided:

```
1562 coalesce a / (e | o) _ > apos
```

NB: **e** or **o** followed ā is handled by the next rule because more specific (i.e., longer) rules take precedence.

SGS §21b: The Guṇa vowels **e** and **o** become **a** (through **ay** and **av**, which drop the semivowel) before every other vowel or diphthong:

```
1563 UniClass[othervowel] = (i u ri lry e o)
1564
1565 ( e | o ) coalesce / _ a macronabove > a hiatus
1566 ( e | o ) coalesce / _ [othervowel]  > a hiatus
```

SGS §22: The Vṛddhi vowels ai and au respectively become ā and āv before every vowel (or diphthong):

```
1567 a i coalesce / _ (a | [othervowel]) > a macronabove hiatus
1568 a u coalesce / _ (a | [othervowel]) > a macronabove v
```

SGS §22a: The (secondary) hiatus occasioned by the dropping of y and v in the above three cases (21b and 22) remains.

```
1569 pass(Unicode)
```

SGS §19a: a and ā coalesce with a following simple liquid vowel to Guṇa:

```
1570 a macronabove? coalesce i   macronabove? > e
1571 a macronabove? coalesce u   macronabove? > o
1572 a macronabove? coalesce ri  macronabove? > a r
1573 a macronabove? coalesce lry macronabove? > a l
```

SGS §19b: a and ā coalesce with Guṇa vowels to Vṛddhi

SGS §19c: a and ā are absorbed by Vṛddhi vowels

```
1574 a macronabove? coalesce (e | a i) > a i
1575 a macronabove? coalesce (o | a u) > a u
```

Other cases of §19b,c are digraphs handled by §18 below.

SGS §20: A simple liquid vowel followed by any other vowel or by a diphthong is changed to its semivowel:

```
1576 UniClass[anyvowel] = (a i u ri lry e o)
1577 UniClass[liquid]   = (  i u ri lry)
1578 UniClass[sv]       = (  y v r  l)
1579
1580 [liquid] macronabove? coalesce / _ [anyvowel] > [sv]
```

SGS §18: If the same simple vowel (short or long) occurs at the end and beginning of words, the result is a long vowel:

```
1581 a   macronabove? coalesce a   macronabove? > a   macronabove
1582 i   macronabove? coalesce i   macronabove? > i   macronabove
1583 u   macronabove? coalesce u   macronabove? > u   macronabove
1584 ri  macronabove? coalesce ri  macronabove? > ri  macronabove
1585 lry macronabove? coalesce lry macronabove? > lry macronabove
```

8.1   Irregular sandhi

U+2054 INVERTED UNDERTIE can be used to invoke an alternate set of rules, for example,

उपोषण **upa‿oṣaṇa**, *n.* fasting.

where अ **a** and ओ **o** have coalesced to form ओ **o** rather than the regular औ **au.**

```
1586 Define altcoalesce U+2054 ; INVERTED UNDERTIE
1587
1588 a altcoalesce o > o
1589 ⟨/san⟩
```

(This is the only exception I've come across so far; if there are others, I'll add them.)

9   Phase 2: Transliteration

9.1   Transliteration Pass 1: Transliterate blindly.

After this step, all characters will be replaced by their approximate Devanagari equivalents, but the result will not be well-formed.

```
1590 pass(Unicode)
```

Numerals

```
1591 U+0030 > zero
1592 U+0031 > one
1593 U+0032 > two
1594 U+0033 > three
```

```
1595 U+0034 > four
1596 U+0035 > five
1597 U+0036 > six
1598 U+0037 > seven
1599 U+0038 > eight
1600 U+0039 > nine
```

Vowels

```
1601 UniClass[short_in]  = (a       i       u       ri      lry)
1602 UniClass[short_out] = (asvara isvara usvara rsvara lsvara)
1603 UniClass[long_out]  = (Asvara Isvara Usvara Rsvara Lsvara)
1604
1605 [short_in] macronabove > [long_out]
1606
1607 [short_in] > [short_out]
1608
1609 ⟨mlym⟩u breveabove > virama ; ???
1610 ⟨!mlym⟩u breveabove > usvara
1611
1612 e              > esvara
1613 e macronabove > Esvara
1614 a i           > aisvara
1615
1616 e circumflex > ecandra
1617 o circumflex > ocandra
1618
1619 o              > osvara
1620 o macronabove > Osvara
1621 a u           > ausvara
1622
1623 ⟨sinh⟩ae > aesvara
1624 ⟨sinh⟩ae macronabove > AEsvara
1625
1626 ⟨telu⟩n breveabove > altcandrabindu ; ???
1627
1628 ⟨deva | knda⟩h macronbelow > jihvamuliya
1629 ⟨deva | knda⟩h brevebelow  > upadhmaniya
1630
1631 ⟨taml⟩k macronbelow > visarga
1632
1633 apos > avagraha
```

Tone marks

```
1634 vert        > udatta
1635 macronbelow > anudatta
1636 ⟨san⟩hookbelow   > svarita_k_i
```

Delete non-Vedic accents.

```
1637 grave >
1638 acute >
```

42

```
1639 tildeabove >
```

Bindus and visargas

```
1640 m dotabove > anusvara
1641 h dotbelow > visarga
```

The International Alphabet of Sanskrit Transliteration uses ṃ instead of ṁ for the anusvara. Since ṃ is only otherwise used for the tippi in Gurmukhi, allow it as a synonym for the anusvara everywhere else.

```
1642 ⟨guru⟩m dotbelow > tippi
1643 ⟨!guru⟩m dotbelow > anusvara
```

```
1644 m CANDRABINDU > candrabindu
1645 n CANDRABINDU > candrabindu
```

Consonants (no conjuncts)

Nuktas

```
1646 ⟨*nukta⟩
1647 q           <> qa
1648 k macronbelow h macronbelow > khha
1649 g dotabove > ghha
1650 ⟨!telu⟩z > za
1651 f > fa
1652 ⟨/nukta⟩
1653 ⟨knda⟩z > za
1654 ⟨knda | sinh⟩f > fa
1655 ⟨telu⟩z > dza
1656 ⟨beng | orya⟩w > wa
```

Velar

```
1657 k           <> ka
1658 k h         <> kha
1659 g           <> ga
1660 g h         <> gha
1661 n dotabove <> nga
1662 ⟨sinh⟩n breveabove g > nnga
```

Palatal

```
1663 c             <> ca
1664 ⟨telu⟩c circumflex <> tsa
1665 c h           <> cha
1666 j             <> ja
1667 j h           <> jha
1668 n tildeabove <> nya
1669 ⟨sinh⟩n breveabove j <> nyja
```

Retroflex

```
1670 t dotbelow   <> tta
1671 t dotbelow h <> ttha
1672 d dotbelow   <> dda
```

43

```
1673 d dotbelow h <> ddha
1674 n dotbelow    <> nna
1675
1676 ⟨sinh⟩n breveabove d <> nda
1677 ⟨sinh⟩n breveabove d dotbelow <> nndda
1678
1679 ⟨deva&!san⟩r dotbelow > dddha
1680 ⟨beng⟩r dotbelow > dddha
1681 ⟨guru | orya⟩r dotbelow > rra
1682
1683 ⟨deva | beng | orya⟩r dotbelow h > rha
```

Dental

```
1684 t      <> ta
1685 t h    <> tha
1686 d      <> da
1687 d h    <> dha
1688 n      <> na
```

Labial

```
1689 p      <> pa
1690 p h    <> pha
1691 b      <> ba
1692 b h    <> bha
1693 m      <> ma
1694 ⟨sinh⟩m breveabove b <> mba
```

Semi-vowels

???

```
1695 r macronbelow <> rra
1696 ⟨mlym⟩t macronbelow <> ttta
1697 ⟨deva | taml | mlym⟩n macronbelow <> nnna
1698 ⟨sinh⟩n macronbelow <> nnna
1699 ⟨deva | taml | mlym | knda | telu | sinh⟩l macronbelow <> llla
```

Semi-vowels

```
1700 y           <> ya
1701 ⟨deva | beng | orya⟩y dotabove > yya
1702 r breveabove > rra zwj
1703 r           <> ra
1704 l           <> la
1705 v           <> va
```

Sibilants

```
1706 s acute    <> sha
1707 s dotbelow <> ssa
1708 s          <> sa
1709 h          <> ha
```

Vedic lingual l

```
1710 l dotbelow   <> lla
1711 ⟨*san⟩
1712 l dotbelow h <> lla ha
1713 ⟨/san⟩
```

Punctuation and symbols

```
1714 degree  <> abbrev
1715 bar     <> danda
1716 bar bar <> dbldanda
```

Ligature breaking

Per note 12 of Stone's *vade mecum*, allow a colon to break ligatures.

```
1717 UniClass[vyanjana] = (ka .. ha extravyanjana)
1718
1719 ; colon / [vyanjana] _ [vyanjana]  <> virama zwj
1720
1721 colon <> zwj
```

9.2   Transliteration Pass 1.5

Adding an additional pass here would enable automatic disambiguation between ḷ representing lingual l and ḷ representing vocalic l to be made based on the phonetic environment (see section 54 of Whitney's grammar), but only at the cost of making it more complicated to type an isolated lingual l. It hardly seems worth it.

```
1722 ; pass(Unicode)
1723 ;
1724 ; UniClass[vyanjana] = (ka .. ha)
1725 ;
1726 ; lla / [vyanjana] _ > lsvara
1727 ; lla / # _ > lsvara
1728 ; lla / _ # > lsvara
1729 pass(unicode)
```

Per rule R10 in section 12.1) of Unicode 7.0 [4], vedic accents ("svaras") should be encoded following bindus. This is necessary to get correct rendering in, e.g., XeTeX (luaTeX is more forgiving).

```
1730 UniClass[svaras] = (udatta anudatta)
1731 UniClass[bindus] = (anusvara candrabindu)
1732
1733 [svaras]=v1 [bindus]=b1 > @b1 @v1
```

9.3   Transliteration Pass 2: Attach vowels to consonants.

At this stage all vowels are still represented as independent vowels. This step will convert vowels following consonants into dependent vowel signs.

```
1734 pass(Unicode)
```

```
1735
1736 UniClass[vyanjana] = (ka .. ha extravyanjana)
1737
1738 UniClass[svara] = (         Asvara \
1739                  isvara   Isvara \
1740                  usvara   Usvara \
1741                  rsvara   Rsvara \
1742                  lsvara   Lsvara \
1743                  ecandra esvara Esvara \
1744                  aisvara \
1745                  ocandra osvara Osvara \
1746                  ausvara)
1747
1748 UniClass[matra] = (        Amatra \
1749                  imatra Imatra \
1750                  umatra Umatra \
1751                  rmatra Rmatra \
1752                  lmatra Lmatra \
1753                  ecandramatra ematra Ematra \
1754                  aimatra \
1755                  ocandramatra omatra Omatra \
1756                  aumatra)
1757
1758 [svara] / [vyanjana] _ > [matra]
```

Attach isolated vowel signs and other combining marks to a non-breaking space (cf. The Unicode Standard 7.0, page 60, "Exhibiting Nonspacing Marks in Isolation". HarfBuzz currently requires this for proper rendering.

NB: visarga is a *spacing* combiner.

```
1759 UniClass[combiners] = ([matra] \
1760                      candrabindu anusvara visarga \
1761                      udatta anudatta \
1762 ⟨san⟩              svarita_k_i \
1763 )
1764
1765 [combiners]=c1 / # _ > nbsp @c1
```

9.4   Transliteration Pass 3: Form consonant conjuncts.

```
1766 pass(Unicode)
1767
1768 UniClass[vyanjana] = (ka .. ha extravyanjana)
1769
1770 [vyanjana] / _ [vyanjana] > [vyanjana] virama
```

9.5   Transliteration Pass 4: Add viramas.

```
1771 pass(Unicode)
1772
1773 UniClass[vyanjana] = (ka .. ha extravyanjana)
```

```
1774
1775 UniClass[novirama] = (asvara Amatra \
1776                       imatra Imatra \
1777                       umatra Umatra \
1778                       rmatra Rmatra \
1779                       lmatra Lmatra \
1780                       ematra Ematra ecandramatra aimatra \
1781                       omatra Omatra ocandramatra aumatra \
1782                       virama)
1783
1784 [vyanjana] / _ ^[novirama] <> [vyanjana] virama
```

9.6   Transliteration Pass 5: Remove inherent a.

Finally, remove the inherent short **a**.

```
1785 pass(Unicode)
1786
1787 UniClass[vyanjana] = (ka .. ha extravyanjana)
1788
1789 [vyanjana] asvara <> [vyanjana]
```

9.7   Transliteration Pass 6: Resolve PUA characters.

```
1790 ⟨beng | gujr | guru | knda | sinh⟩pass(Unicode)
1791
1792 ⟨guru | gujr | beng⟩qa > ka nukta
1793 ⟨beng | gujr⟩khha > kha nukta
1794 ⟨beng | gujr⟩ghha > ga nukta
1795 ⟨beng | gujr⟩fa > pha nukta
1796 ⟨beng | gujr | knda⟩za > ja nukta
1797 ⟨beng⟩wa > ba nukta
1798 ⟨knda⟩fa > pha nukta
1799 ⟨sinh⟩nnna > na U+002E
1800 ⟨sinh⟩rra > ra U+002E
1801 ⟨sinh⟩llla > lla U+002E
```