Title: Additional Hangul character decompositions for the proper support of Hangul

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1 Introduction

The Hangul script as such is very elegantly designed. There is just a small number of letters (28, plus a small number of variant letters introduced later, but the latter have fallen out of use) and even a design philosophy for the shapes of the letters. However, the incarnation of Hangul as characters in ISO/IEC 10646 and Unicode is far from elegant. In particular, there are many characters that are not required, for "letter clusters", as well as precomposed syllables. The precomposed syllables have (partial) canonical decompositions into Hangul jamos, so the precomposed Hangul syllables are not dealt with here. Their (algorithmic) canonical decomposition is good as it is. But unfortunately the "letter cluster" Hangul jamos do not have canonical decompositions to their constituent letters, which they should have had. This leads to multiple representation for exactly the same sequence of letters. There is not even any compatibility like distinction, no font difference, no width difference, no ligaturing difference of any kind. They have even lost the compatibility decompositions that they once had. Also there are some problems with the Hangul compatibility letters, and their proper conversion to Hangul jamo characters. Just following their compatibility decompositions does not give the correct result.

In this paper these problems are addressed. Note that no changes to the Unicode normal forms (NFD, NFC, NFKD, and NFKC) are proposed, since these normal forms are frozen for already allocated characters. Instead the mappings presented here can be used in conjunction with the normal forms, as additions not part of the normalisation itself. No new normal forms are suggested either, four is more than there should be already, and some of the mappings here are "external context" dependent (for the compatibility letters) so would give rise to a plethora of normal forms.

1.1 Letter Hangul jamo characters

“In the winter of our year 1443-4, our King [Seycong] originated and designed the twenty eight letters of the Correct Sounds. The letters are simple and fine and very easy to learn; their shifts and changes in function are endless; and there are no [Korean] sounds that cannot be written.”

[Ceng Inci, in Hwunmin Cengum Haylyey, 1446; as translated in ‘The Korean Language’ by Ho-Min Sohn, Cambridge University Press,1999; the additions in brackets are mine.]

A letter Hangul jamo character represents a basic Hangul letter, or a variant of such a letter. There are 17 basic consonant letters (here given in the order as first presented: ㄱ, ㅋ, ㆁ, ㄷ, ㅌ, ㄴ, ㅂ, ㅍ, ㅁ, ㅈ, ㅊ, ㅅ, ㆆ, ㅎ, ㅇ, ㄹ, ㅿ), and 11 basic vowel letters (ㆍ, ㅡ, ㅣ, ㅗ, ㅏ, ㅜ, ㅓ, ㅛ, ㅑ, ㅠ, ㅕ). Some of the consonant letters have variants (ᄼ, ᄾ, ᅎ, ᅐ, ᅔ, ᅕ), that were invented after the invention of Hangul, as well as special letter combinations, for denoting sounds in Chinese. The variants, as well as a few of the original basic letters, have fallen out of use. E.g., ㆁ (YESIENG, a small circle with a ‘shoot’ on top, “ng”) in the trailing position has been replaced by ㅇ (IEUNG, a small circle, originally probably silent, as it still is as leading letter). There may also be a small number of missing, as encoded characters, historic variant letters.

The letters for a syllable are grouped into a “syllable block”, typographically the size of a Hàn ideograph. In practice, there are at most (in total, however represented, see below) three consonant letters in a consonants cluster, and at most (in total, however represented) three vowel letters in a vowel cluster. Note that some vowel combinations look very much the same (like e.g. A-I and I-EO, EU-YO and YU-EU), but for each such same-looking pair of vowels apparently only one is allowed in Korean.

The encoding as characters for Hangul jamo employ a little coding trick to determine syllable boundaries: the consonants are encoded twice, leading and trailing. Other ways that could have been used includes

(a) using an initiator/terminator/separator character before/between/after syllables (a similar approach is sometimes used for the Hangul compatibility letters, see below, using an initiator), or

(b) using combining characters for the Hangul letters following the first one in a syllable (this was the original Unicode design for Hangul, it is somewhat similar to the approach chosen; compare also the combining Latin letters above that have been encoded).

A possible problem here is that the variant consonant letters are only allocated as choseong (leading), with no jongseong (trailing) counterpart, despite the basic original approach that '[all] letters representing syllable-initial consonants are also used as letters representing syllable-final consonants'.

1.2 Basic composition of Hangul syllables

A Hangul syllable has the following syntax (disregarding precomposed Hangul syllable characters, but see below):

Hangul-syllable ::= L+ V+ T* M*

where L stands for a leading consonant jamo character, V stands for a vowel jamo character, T stands for a trailing consonant jamo character, and M stands for a combining mark, in particular a (historic) Hangul tone mark [U+302E, U+302F], or a COMBINING ENCLOSING CIRCLE. The tone mark (if any, or more generally, the sequence of combining characters) applies to the entire preceding syllable, not just the last part of it, since the Hangul syllable components, including the precomposed Hangul syllable characters, are conjoining characters, not base characters. The tone mark glyphically appears at the left of a syllable, so for a L V T M syllable, where M stands for a Hangul tone mark, the glyph for M is to be rendered to the left of the (possibly composed) glyph for L V T, not to the left of the (sub)glyph for T.

Typographically, the leading consonants are put in the top left part of a syllable block, normally left to right, the vowels are put under and to the right of the leading consonants, left to right/top-down, and trailing consonants are put at the bottom of the syllable block, normally left to right. An exception is when IEUNG is after some (one or two) non-IEUNG consonants: IEUNG is then placed under the consonants before it.

An addition to the encoded repertoire are the filler jamos: CHOSEONG FILLER (Lf) and JUNGSEONG FILLER (Vf). They do not stand for any letter, them having general category Lo is misleading, but are used as a "placeholder" for a missing letter where at least one is required (note that there has to be at least one lead consonant and at least one vowel in a syllable according to the syntax above). Virtual, i.e. no change to the backing store, filler characters may be introduced automatically, in case the given Hangul string would otherwise not be parseable into Hangul syllables (see page 53 of The Unicode Standard version 3.0). Note that there is no jongseong (trail) filler, so the fillers are not intended as placeholders *inside* a consonants cluster or vowel cluster. The two Hangul filler characters should normally not be explicitly used, but inserted automatically (without change to the backing store) to fullfill (L+|Lf) (V+|Vf) T* M* for each syllable. The fillers are not part of the orthography, they are used only to fullfill the representation requirements also for 'incomplete' syllables.

What has been presented so far is fully sufficient for representing any text in Hangul, historical (except for as yet missing historic variants, if any), modern, and future (unless new letters are invented and gain use). What follows next is several sections on additions that are unnecessary for the representation of Hangul, but have been added for various other reasons, such as compatibility with older standards. They generally introduce a number of difficulties for all processes handling Hangul.

1.3 Letter cluster Hangul jamo characters

Cluster Hangul jamo characters represent either clusters of two or three consonants, or clusters of two or three vowels. Cluster jamo characters for most (not all) consonant and vowel clusters *occurring* in Hangul texts are allocated. They work as L, V, or T in the syllable syntax above. One can preferably represent the sequence of consonants or sequence of vowels using single-letter Hangul jamo characters. The cluster Hangul jamos are thus not needed, and no more cluster jamos should be allocated. Ideally, the use of cluster jamo characters should be completely avoided.

At one point the cluster jamos had compatibility decompositions into single-letter jamos. But now there is, unfortunately, no longer any *canonical or compatibility* decomposition of the cluster jamos into single-letter jamos. Unfortunately, this leads to multiple representations of the same piece of Hangul text, multiple representations that are not normalised to the same representation via any of the Unicode normalisation forms. Ideally, whenever possible the cluster Hangul jamos should be treated as if they had canonical decompositions into the corresponding sequence of single-letter Hangul jamos. See the <jamo> decompositions in the table below.

Note that Hangul is a rather elegantly designed alphabetic script, and typographic features, such as cluster ligatures, variant (sub)glyph selection, and syllable layout should be handled by font mechanisms.

Ordering of Hangul syllables should be based on a weighting scheme that orders cluster characters as sequences of single letters. The clustering as such used for collation should be done by other mechanisms than using letter cluster characters (even though this may have been the original reason for having these cluster characters, and why they did not get canonical decompositions as they should have had).

1.4 Hangul compatibility letters

The Hangul compatibility letters and half-width letters encode the consonants and some of the consonants clusters only once each, no separation into lead and trail. The Hangul compatibility letters are normally rendered as spacing characters without any conjoinment. They may be used when talking about Hangul characters, or when writing Hangul texts in 'linear form' (obsolescent). In addition the compatibility Hangul letters have also FILLER characters, 3164 (HANGUL FILLER) and FFA0 (HALFWIDHT HANGUL FILLER), that work differently from the jamo fillers.

When converting from Hangul compatibility letter sequences to proper conjoining Hangul letters, the Hangul compatibility syllables have the (generalised) syntax:

Hangul-compatibility-syllable ::= Hf (C+|Hf) (W+|Hf) (C+|Hf) M*

where C is a (possibly half-width) Hangul compatibility consonant letter or consonant letter cluster, W is a (possibly half-width) Hangul compatibility vowel letter or vowel letter cluster, and Hf is a (possibly half-width) FILLER character (a minimal amount of FILLERs can partially be automatically inserted to fullfill that grammar). It may be reasonable to

convert input in compatibility Hangul charactersto a string of conjoining jamos (Hf (C+|Hf) (W+|Hf) (C+|Hf) M* → L+ V+ T* M*). Note that the first Hf is to be removed (note again the FILLERs are *not* letters, despite their general category as Lo), so is a trailing Hf, while a lead Hf should be converted to a Lf, and a vowel Hf should be converted to a Vf. Compatibility Hangul letters are not normally expected to display as conjoined Hangul syllables, but display as a sequence of free-standing letters. Note that the normal forms NFKD and NFKC do *not* do this conversion but return incorrect results for these characters.

Another possibility is to consider each (full- or half-width) Hangul compatibility letter as an isolated form (C → L+ Vf or even Lf Vf T+; and W → Lf V+), even though that leaves HANGUL FILLER useless. Note that the normal forms NFKD and NFKC do *not* do this conversion either but return incorrect results for these characters.

1.5 Hangul syllable characters

A lot of (not all) Hangul syllables have a character of their own in the range AC00-D7A3. They each have an algorithmic canonical decomposition into two (choseong, jungseong) or three (choseong, jungseong, jongseong) Hangul jamo characters in the ranges 1100-1112, 1161-1175, and 11A8-11C2. Some of the jamo characters thus decomposed into are letter cluster jamos.

The Hangul syllable characters alone can represent most modern Hangul words. They cannot represent all historic Hangul words (Middle Korean), nor all modern/future Hangul words. However, all Hangul words can elegantly be represented by sequences of single-letter Hangul jamo characters plus optional tone mark.

1.6 Full rule for composition of Hangul syllables

A Hangul syllable, allowing for precomposed syllable characters, has the following syntax (see page 53 of The Unicode Standard version 3.0, with adjustment for tone marks):

Hangul-ext-syllable ::= L+ V+ T* M* | L* LVsyllablechar V* T* M* | L* LVTsyllablechar T* M*

where LVsyllablechar is a precomposed consonants-vowels syllable character, LVTsyllablechar is a precomposed consonants-vowels-consonants syllable character.

1.7 Circled and parenthesised Hangul letters and syllables

All of the parenthesised or circled Hangul characters should be treated as compatibility characters with a compatibility mappings to a Hangul syllable sequence (including filler jamos plus parentheses where applicable). I.e., they should not have mappings to individual Hangul letters even for the single-letter characters of this kind; include a filler jamo to make a syllable instead.

2 Hangul letter cluster jamo strong decompositions

Spell checking, rendering, collation, identifier comparisons and all other processes *((e.g. W3C normalisation, IDN nameprepping, file name normalisation, identifier normalisation, normalisation for dictionary entries, collation key generation, ...))* that use (or should use) some normalisation form that add onto a Unicode canonical normalisation, except the Unicode normalisation forms themselves since they are frozen for already allocated characters, should regard Hangul letter cluster jamos as having the decompositions in the following table. These decompositions should also be used in inverted form (compare NFC and NFKC canonical combination step) when a maximally precomposed form is desired.

pos.	jamo decomposition	name
1101	<jamo> 1100 1100	% HANGUL CHOSEONG SSANGKIYEOK
1104	<jamo> 1103 1103	% HANGUL CHOSEONG SSANGTIKEUT
1108	<jamo> 1107 1107	% HANGUL CHOSEONG SSANGPIEUP
110A	<jamo> 1109 1109	% HANGUL CHOSEONG SSANGSIOS
110D	<jamo> 110C 110C	% HANGUL CHOSEONG SSANGCIEUC
1113	<jamo> 1102 1100	% HANGUL CHOSEONG NIEUN-KIYEOK
1114	<jamo> 1102 1102	% HANGUL CHOSEONG SSANGNIEUN
1115	<jamo> 1102 1103	% HANGUL CHOSEONG NIEUN-TIKEUT
1116	<jamo> 1102 1107	% HANGUL CHOSEONG NIEUN-PIEUP
1117	<jamo> 1103 1100	% HANGUL CHOSEONG TIKEUT-KIYEOK
1118	<jamo> 1105 1102	% HANGUL CHOSEONG RIEUL-NIEUN
1119	<jamo> 1105 1105	% HANGUL CHOSEONG SSANGRIEUL
111A	<jamo> 1105 1112	% HANGUL CHOSEONG RIEUL-HIEUH
111B	<jamo> 1105 110B	% HANGUL CHOSEONG KAPYEOUNRIEUL (RIEUL-IEUNG)
111C	<jamo> 1106 1107	% HANGUL CHOSEONG MIEUM-PIEUP
111D	<jamo> 1106 110B	% HANGUL CHOSEONG KAPYEOUNMIEUM (MIEUM-IEUNG)
111E	<jamo> 1107 1100	% HANGUL CHOSEONG PIEUP-KIYEOK
111F	<jamo> 1107 1102	% HANGUL CHOSEONG PIEUP-NIEUN
1120	<jamo> 1107 1103	% HANGUL CHOSEONG PIEUP-TIKEUT
1121	<jamo> 1107 1109	% HANGUL CHOSEONG PIEUP-SIOS
1122	<jamo> 1107 1109 1100	% HANGUL CHOSEONG PIEUP-SIOS-KIYEOK
1123	<jamo> 1107 1109 1103	% HANGUL CHOSEONG PIEUP-SIOS-TIKEUT
1124	<jamo> 1107 1109 1107	% HANGUL CHOSEONG PIEUP-SIOS-PIEUP
1125	<jamo> 1107 1109 1109	% HANGUL CHOSEONG PIEUP-SSANGSIOS
1126	<jamo> 1107 1109 110C	% HANGUL CHOSEONG PIEUP-SIOS-CIEUC
1127	<jamo> 1107 110C	% HANGUL CHOSEONG PIEUP-CIEUC
1128	<jamo> 1107 110E	% HANGUL CHOSEONG PIEUP-CHIEUCH
1129	<jamo> 1107 1110	% HANGUL CHOSEONG PIEUP-THIEUTH
112A	<jamo> 1107 1111	% HANGUL CHOSEONG PIEUP-PHIEUPH
112B	<jamo> 1107 110B	% HANGUL CHOSEONG KAPYEOUNPIEUP (PIEUP-IEUNG)
112C	<jamo> 1107 1107 110B	% HANGUL CHOSEONG KAPYEOUNSSANGPIEUP (SSANGPIEUP-IEUNG)

112D	<jamo> 1109 1100	% HANGUL CHOSEONG SIOS-KIYEOK
112E	<jamo> 1109 1102	% HANGUL CHOSEONG SIOS-NIEUN
112F	<jamo> 1109 1103	% HANGUL CHOSEONG SIOS-TIKEUT
1130	<jamo> 1109 1105	% HANGUL CHOSEONG SIOS-RIEUL
1131	<jamo> 1109 1106	% HANGUL CHOSEONG SIOS-MIEUM
1132	<jamo> 1109 1107	% HANGUL CHOSEONG SIOS-PIEUP
1133	<jamo> 1109 1107 1100	% HANGUL CHOSEONG SIOS-PIEUP-KIYEOK
1134	<jamo> 1109 1109 1109	% HANGUL CHOSEONG SIOS-SSANGSIOS
1135	<jamo> 1109 110B	% HANGUL CHOSEONG SIOS-IEUNG
1136	<jamo> 1109 110C	% HANGUL CHOSEONG SIOS-CIEUC
1137	<jamo> 1109 110E	% HANGUL CHOSEONG SIOS-CHIEUCH
1138	<jamo> 1109 110F	% HANGUL CHOSEONG SIOS-KHIEUKH
1139	<jamo> 1109 1110	% HANGUL CHOSEONG SIOS-THIEUTH
113A	<jamo> 1109 1111	% HANGUL CHOSEONG SIOS-PHIEUPH
113B	<jamo> 1109 1112	% HANGUL CHOSEONG SIOS-HIEUH
113D	<jamo> 113C 113C	% HANGUL CHOSEONG CHITUEUMSSANGSIOS
113F	<jamo> 113E 113E	% HANGUL CHOSEONG CEONGCHIEUMSSANGSIOS
1141	<jamo> 110B 1100	% HANGUL CHOSEONG IEUNG-KIYEOK
1142	<jamo> 110B 1103	% HANGUL CHOSEONG IEUNG-TIKEUT
1143	<jamo> 110B 1106	% HANGUL CHOSEONG IEUNG-MIEUM
1144	<jamo> 110B 1107	% HANGUL CHOSEONG IEUNG-PIEUP
1145	<jamo> 110B 1109	% HANGUL CHOSEONG IEUNG-SIOS
1146	<jamo> 110B 1140	% HANGUL CHOSEONG IEUNG-PANSIOS
1147	<jamo> 110B 110B	% HANGUL CHOSEONG SSANGIEUNG
1148	<jamo> 110B 110C	% HANGUL CHOSEONG IEUNG-CIEUC
1149	<jamo> 110B 110E	% HANGUL CHOSEONG IEUNG-CHIEUCH
114A	<jamo> 110B 1110	% HANGUL CHOSEONG IEUNG-THIEUTH
114B	<jamo> 110B 1111	% HANGUL CHOSEONG IEUNG-PHIEUPH
114D	<jamo> 110C 110B	% HANGUL CHOSEONG CIEUC-IEUNG
114F	<jamo> 114E 114E	% HANGUL CHOSEONG CHITUEUMSSANGCIEUC
1151	<jamo> 1150 1150	% HANGUL CHOSEONG CEONGCHIEUMSSANGCIEUC
1152	<jamo> 110E 110F	% HANGUL CHOSEONG CHIEUCH-KHIEUKH
1153	<jamo> 110E 1112	% HANGUL CHOSEONG CHIEUCH-HIEUH
1156	<jamo> 1111 1107	% HANGUL CHOSEONG PHIEUPH-PIEUP
1157	<jamo> 1111 110B	% HANGUL CHOSEONG KAPYEOUNPHIEUPH (PHIEUPH-IEUNG)
1158	<jamo> 1112 1112	% HANGUL CHOSEONG SSANGHIEUH
1162	<jamo> 1161 1175	% HANGUL JUNGSEONG AE (A-I)
1164	<jamo> 1163 1175	% HANGUL JUNGSEONG YAE (YA-I)
1166	<jamo> 1165 1175	% HANGUL JUNGSEONG E (EO-I)
1168	<jamo> 1167 1175	% HANGUL JUNGSEONG YE (YEO-I)
116A	<jamo> 1169 1161	% HANGUL JUNGSEONG WA (O-A)
116B	<jamo> 1169 1161 1175	% HANGUL JUNGSEONG WAE (O-A-I)
116C	<jamo> 1169 1175	% HANGUL JUNGSEONG OE (O-I)

116F	<jamo> 116E 1165	% HANGUL JUNGSEONG WEO (U-EO)
1170	<jamo> 116E 1165 1175	% HANGUL JUNGSEONG WE (U-EO-I)
1171	<jamo> 116E 1175	% HANGUL JUNGSEONG WI (U-I)
1174	<jamo> 1173 1175	% HANGUL JUNGSEONG YI (EU-I)
1176	<jamo> 1161 1169	% HANGUL JUNGSEONG A-O
1177	<jamo> 1161 116E	% HANGUL JUNGSEONG A-U
1178	<jamo> 1163 1169	% HANGUL JUNGSEONG YA-O
1179	<jamo> 1163 116D	% HANGUL JUNGSEONG YA-YO
117A	<jamo> 1165 1169	% HANGUL JUNGSEONG EO-O
117B	<jamo> 1165 116E	% HANGUL JUNGSEONG EO-U
117C	<jamo> 1165 1173	% HANGUL JUNGSEONG EO-EU
117D	<jamo> 1167 1169	% HANGUL JUNGSEONG YEO-O
117E	<jamo> 1167 116E	% HANGUL JUNGSEONG YEO-U
117F	<jamo> 1169 1165	% HANGUL JUNGSEONG O-EO
1180	<jamo> 1169 1165 1175	% HANGUL JUNGSEONG O-E (O-EO-I)
1181	<jamo> 1169 1167 1175	% HANGUL JUNGSEONG O-YE (O-YEO-I)
1182	<jamo> 1169 1169	% HANGUL JUNGSEONG O-O
1183	<jamo> 1169 116E	% HANGUL JUNGSEONG O-U
1184	<jamo> 116D 1163	% HANGUL JUNGSEONG YO-YA
1185	<jamo> 116D 1163 1175	% HANGUL JUNGSEONG YO-YAE (YO-YA-I)
1186	<jamo> 116D 1167	% HANGUL JUNGSEONG YO-YEO
1187	<jamo> 116D 1169	% HANGUL JUNGSEONG YO-O
1188	<jamo> 116D 1175	% HANGUL JUNGSEONG YO-I
1189	<jamo> 116E 1161	% HANGUL JUNGSEONG U-A
118A	<jamo> 116E 1161 1175	% HANGUL JUNGSEONG U-AE (U-A-I)
118B	<jamo> 116E 1165 1173	% HANGUL JUNGSEONG U-EO-EU
118C	<jamo> 116E 1167 1175	% HANGUL JUNGSEONG U-YE
118D	<jamo> 116E 116E	% HANGUL JUNGSEONG U-U
118E	<jamo> 1172 1161	% HANGUL JUNGSEONG YU-A
118F	<jamo> 1172 1165	% HANGUL JUNGSEONG YU-EO
1190	<jamo> 1172 1165 1175	% HANGUL JUNGSEONG YU-E (YU-EO-I)
1191	<jamo> 1172 1167	% HANGUL JUNGSEONG YU-YEO
1192	<jamo> 1172 1167 1175	% HANGUL JUNGSEONG YU-YE (YU-YEO-I)
1193	<jamo> 1172 116E	% HANGUL JUNGSEONG YU-U
1194	<jamo> 1172 1175	% HANGUL JUNGSEONG YU-I
1195	<jamo> 1173 116E	% HANGUL JUNGSEONG EU-U
1196	<jamo> 1173 1173	% HANGUL JUNGSEONG EU-EU
1197	<jamo> 1173 1175 116E	% HANGUL JUNGSEONG YI-U (EU-I-U)
1198	<jamo> 1175 1161	% HANGUL JUNGSEONG I-A
1199	<jamo> 1175 1163	% HANGUL JUNGSEONG I-YA
119A	<jamo> 1175 1169	% HANGUL JUNGSEONG I-O
119B	<jamo> 1175 116E	% HANGUL JUNGSEONG I-U
119C	<jamo> 1175 1173	% HANGUL JUNGSEONG I-EU

119D	<jamo> 1175 119E	% HANGUL JUNGSEONG I-ARAEA
119F	<jamo> 119E 1165	% HANGUL JUNGSEONG ARAEA-EO
11A0	<jamo> 119E 116E	% HANGUL JUNGSEONG ARAEA-U
11A1	<jamo> 119E 1175	% HANGUL JUNGSEONG ARAEA-I
11A2	<jamo> 119E 119E	% HANGUL JUNGSEONG SSANGARAEA
11A9	<jamo> 11A8 11A8	% HANGUL JONGSEONG SSANGKIYEOK
11AA	<jamo> 11A8 11BA	% HANGUL JONGSEONG KIYEOK-SIOS
11AC	<jamo> 11AB 11BD	% HANGUL JONGSEONG NIEUN-CIEUC
11AD	<jamo> 11AB 11C2	% HANGUL JONGSEONG NIEUN-HIEUH
11B0	<jamo> 11AF 11A8	% HANGUL JONGSEONG RIEUL-KIYEOK
11B1	<jamo> 11AF 11B7	% HANGUL JONGSEONG RIEUL-MIEUM
11B2	<jamo> 11AF 11B8	% HANGUL JONGSEONG RIEUL-PIEUP
11B3	<jamo> 11AF 11BA	% HANGUL JONGSEONG RIEUL-SIOS
11B4	<jamo> 11AF 11C0	% HANGUL JONGSEONG RIEUL-THIEUTH
11B5	<jamo> 11AF 11C1	% HANGUL JONGSEONG RIEUL-PHIEUPH
11B6	<jamo> 11AF 11C2	% HANGUL JONGSEONG RIEUL-HIEUH
11B9	<jamo> 11B8 11BA	% HANGUL JONGSEONG PIEUP-SIOS
11BB	<jamo> 11BA 11BA	% HANGUL JONGSEONG SSANGSIOS
11C3	<jamo> 11A8 11AF	% HANGUL JONGSEONG KIYEOK-RIEUL
11C4	<jamo> 11A8 11BA 11A8	% HANGUL JONGSEONG KIYEOK-SIOS-KIYEOK
11C5	<jamo> 11AB 11A8	% HANGUL JONGSEONG NIEUN-KIYEOK
11C6	<jamo> 11AB 11AE	% HANGUL JONGSEONG NIEUN-TIKEUT
11C7	<jamo> 11AB 11BA	% HANGUL JONGSEONG NIEUN-SIOS
11C8	<jamo> 11AB 11EB	% HANGUL JONGSEONG NIEUN-PANSIOS
11C9	<jamo> 11AB 11C0	% HANGUL JONGSEONG NIEUN-THIEUTH
11CA	<jamo> 11AE 11A8	% HANGUL JONGSEONG TIKEUT-KIYEOK
11CB	<jamo> 11AE 11AF	% HANGUL JONGSEONG TIKEUT-RIEUL
11CC	<jamo> 11AF 11A8 11BA	% HANGUL JONGSEONG RIEUL-KIYEOK-SIOS
11CD	<jamo> 11AF 11AB	% HANGUL JONGSEONG RIEUL-NIEUN
11CE	<jamo> 11AF 11AE	% HANGUL JONGSEONG RIEUL-TIKEUT
11CF	<jamo> 11AF 11AE 11C2	% HANGUL JONGSEONG RIEUL-TIKEUT-HIEUH
11D0	<jamo> 11AF 11AF	% HANGUL JONGSEONG SSANGRIEUL
11D1	<jamo> 11AF 11B7 11A8	% HANGUL JONGSEONG RIEUL-MIEUM-KIYEOK
11D2	<jamo> 11AF 11B7 11BA	% HANGUL JONGSEONG RIEUL-MIEUM-SIOS
11D3	<jamo> 11AF 11B8 11BA	% HANGUL JONGSEONG RIEUL-PIEUP-SIOS
11D4	<jamo> 11AF 11B8 11C2	% HANGUL JONGSEONG RIEUL-PIEUP-HIEUH
11D5	<jamo> 11AF 11B8 11BC	% HANGUL JONGSEONG RIEUL-KAPYEOUNPIEUP (RIEUL-PIEUP-IEUNG)
11D6	<jamo> 11AF 11BA 11BA	% HANGUL JONGSEONG RIEUL-SSANGSIOS
11D7	<jamo> 11AF 11EB	% HANGUL JONGSEONG RIEUL-PANSIOS
11D8	<jamo> 11AF 11BF	% HANGUL JONGSEONG RIEUL-KHIEUKH
11D9	<jamo> 11AF 11F9	% HANGUL JONGSEONG RIEUL-YEORINHIEUH
11DA	<jamo> 11B7 11A8	% HANGUL JONGSEONG MIEUM-KIYEOK
11DB	<jamo> 11B7 11AF	% HANGUL JONGSEONG MIEUM-RIEUL

11DC	<jamo> 11B7 11B8	% HANGUL JONGSEONG MIEUM-PIEUP
11DD	<jamo> 11B7 11BA	% HANGUL JONGSEONG MIEUM-SIOS
11DE	<jamo> 11B7 11BA 11BA	% HANGUL JONGSEONG MIEUM-SSANGSIOS
11DF	<jamo> 11B7 11EB	% HANGUL JONGSEONG MIEUM-PANSIOS
11E0	<jamo> 11B7 11BE	% HANGUL JONGSEONG MIEUM-CHIEUCH
11E1	<jamo> 11B7 11C2	% HANGUL JONGSEONG MIEUM-HIEUH
11E2	<jamo> 11B7 11BC	% HANGUL JONGSEONG KAPYEOUNMIEUM (MIEUM-IEUNG)
11E3	<jamo> 11B8 11AF	% HANGUL JONGSEONG PIEUP-RIEUL
11E4	<jamo> 11B8 11C1	% HANGUL JONGSEONG PIEUP-PHIEUPH
11E5	<jamo> 11B8 11C2	% HANGUL JONGSEONG PIEUP-HIEUH
11E6	<jamo> 11B8 11BC	% HANGUL JONGSEONG KAPYEOUNPIEUP (PIEUP-IEUNG)
11E7	<jamo> 11BA 11A8	% HANGUL JONGSEONG SIOS-KIYEOK
11E8	<jamo> 11BA 11AE	% HANGUL JONGSEONG SIOS-TIKEUT
11E9	<jamo> 11BA 11AF	% HANGUL JONGSEONG SIOS-RIEUL
11EA	<jamo> 11BA 11B8	% HANGUL JONGSEONG SIOS-PIEUP
11EC	<jamo> 11BC 11A8	% HANGUL JONGSEONG IEUNG-KIYEOK
11ED	<jamo> 11BC 11A8 11A8	% HANGUL JONGSEONG IEUNG-SSANGKIYEOK
11EE	<jamo> 11BC 11BC	% HANGUL JONGSEONG SSANGIEUNG
11EF	<jamo> 11BC 11BF	% HANGUL JONGSEONG IEUNG-KHIEUKH
11F1	<jamo> 11F0 11BA	% HANGUL JONGSEONG YESIEUNG-SIOS
11F2	<jamo> 11F0 11EB	% HANGUL JONGSEONG YESIEUNG-PANSIOS
11F3	<jamo> 11C1 11B8	% HANGUL JONGSEONG PHIEUPH-PIEUP
11F4	<jamo> 11C1 11BC	% HANGUL JONGSEONG KAPYEOUNPHIEUPH (PHIEUPH-IEUNG)
11F5	<jamo> 11C2 11AB	% HANGUL JONGSEONG HIEUH-NIEUN
11F6	<jamo> 11C2 11AF	% HANGUL JONGSEONG HIEUH-RIEUL
11F7	<jamo> 11C2 11B7	% HANGUL JONGSEONG HIEUH-MIEUM
11F8	<jamo> 11C2 11B8	% HANGUL JONGSEONG HIEUH-PIEUP

3 Hangul compatibility letter and letter cluster jamo weak decompositions

Spell checking, collation, case *insensitive* identifier comparisons and all other processes *((e.g. IDN nameprepping, case insensitive identifier normalisation, normalisation for dictionary entries, collation key generation, ...))* that use (or should use) a normalisation form that adds onto a Unicode compatibility normalisation form, except the Unicode compatibility normalisation forms themselves since they are frozen for already allocated characters, should regard Hangul letter cluster jamos as having the compatibility decompositions in the following table. These decompositions shall not be used inverted. Note that one needs to choose a context for these decompositions. Most may choose the free-standing context, which is usually the easiest to deal with. Some processes, like collation, may choose to (partially) interpret the Hangul compatibility syllable syntax, and then use the lead decompositions or the trail decompositions (depending on position in the syllable) for the compatibility consonants, and the ordinary <compat> decomposition for the compatibility vowel letters.

The compatibility mappings of the half-width compatibility letters are ok as such, but when decomposed to the full-width form, the same context analysis is needed before further decomposition to Hangul jamos.

The HANGUL FILLER has five possible different contexts. Most processes should use the free-standing one. Only processes that need to consider Hangul syllables consisting of Hangul compatibility letters, likely only for compatibility with old data, need consider the other four contexts: first, lead, vowel, and trail. Note that the vowel context is the one assumed in the main Unicode data-file. Recall that the compatibility Hangul syllable syntax, sans combining marks, is Hf (C+|Hf) (W+|Hf) (C+|Hf).

pos.	free-standing	first	lead	vowel	trail	name
3164	<free> 115F 1160	<delete>	<lead> 115F	<compat> 1160	<trail>	% HANGUL FILLER

For the Hangul compatibility consonant letters there are three different contexts. Most processes should again choose the free-standing context (including identifier-like uses; since fillers are unsuitable for use in identifiers, so are all of the Hangul compatibility letters). Only processes that need to consider Hangul syllables consisting of Hangul compatibility letters, likely only for compatibility with old data, need consider the other two contexts: lead and trail. Note that the context assumed in the main Unicode data-file varies between lead and trail.

pos.	free-standing	lead	trail	name
3131	<free> 1100 1160	<compat> 1100	<trail> 11A8	% HANGUL LETTER KIYEOK
3132	<free> 1101 1160	<compat> 1101	<trail> 11A9	% HANGUL LETTER SSANGKIYEOK
3133	<free> 1100 1109 1160	<lead> 1100 1109	<compat> 11AA	% HANGUL LETTER KIYEOK-SIOS
3134	<free> 1102 1160	<compat> 1102	<trail> 11AB	% HANGUL LETTER NIEUN
3135	<free> 1102 110C 1160	<lead> 1102 110C	<compat> 11AC	% HANGUL LETTER NIEUN-CIEUC
3136	<free> 1102 1112 1160	<lead> 1102 1112	<compat> 11AD	% HANGUL LETTER NIEUN-HIEUH
3137	<free> 1103 1160	<compat> 1103	<trail> 11AE	% HANGUL LETTER TIKEUT
3138	<free> 1104 1160	<compat> 1104	<trail> 11AE 11AE	% HANGUL LETTER SSANGTIKEUT
3139	<free> 1105 1160	<compat> 1105	<trail> 11AF	% HANGUL LETTER RIEUL
313A	<free> 1105 1100 1160	<lead> 1105 1100	<compat> 11B0	% HANGUL LETTER RIEUL-KIYEOK
313B	<free> 1105 1106 1160	<lead> 1105 1106	<compat> 11B1	% HANGUL LETTER RIEUL-MIEUM
313C	<free> 1105 1107 1160	<lead> 1105 1107	<compat> 11B2	% HANGUL LETTER RIEUL-PIEUP
313D	<free> 1105 1109 1160	<lead> 1105 1109	<compat> 11B3	% HANGUL LETTER RIEUL-SIOS
313E	<free> 1105 1110 1160	<lead> 1105 1110	<compat> 11B4	% HANGUL LETTER RIEUL-THIEUTH
313F	<free> 1105 1111 1160	<lead> 1105 1111	<compat> 11B5	% HANGUL LETTER RIEUL-PHIEUPH
3140	<free> 111A 1160	<compat> 111A	<trail> 11B6	% HANGUL LETTER RIEUL-HIEUH
3141	<free> 1106 1160	<compat> 1106	<trail> 11B7	% HANGUL LETTER MIEUM
3142	<free> 1107 1160	<compat> 1107	<trail> 11B8	% HANGUL LETTER PIEUP
3143	<free> 1108 1160	<compat> 1108	<trail> 11B8 11B8	% HANGUL LETTER SSANGPIEUP
3144	<free> 1121 1160	<compat> 1121	<trail> 11B9	% HANGUL LETTER PIEUP-SIOS
3145	<free> 1109 1160	<compat> 1109	<trail> 11BA	% HANGUL LETTER SIOS

3146	<free> 110A 1160	<compat> 110A	<trail> 11BB	% HANGUL LETTER SSANGSIOS
3147	<free> 110B 1160	<compat> 110B	<trail> 11BC	% HANGUL LETTER IEUNG
3148	<free> 110C 1160	<compat> 110C	<trail> 11BD	% HANGUL LETTER CIEUC
3149	<free> 110D 1160	<compat> 110D	<trail> 11BD 11BD	% HANGUL LETTER SSANGCIEUC
314A	<free> 110E 1160	<compat> 110E	<trail> 11BE	% HANGUL LETTER CHIEUCH
314B	<free> 110F 1160	<compat> 110F	<trail> 11BF	% HANGUL LETTER KHIEUKH
314C	<free> 1110 1160	<compat> 1110	<trail> 11C0	% HANGUL LETTER THIEUTH
314D	<free> 1111 1160	<compat> 1111	<trail> 11C1	% HANGUL LETTER PHIEUPH
314E	<free> 1112 1160	<compat> 1112	<trail> 11C2	% HANGUL LETTER HIEUH
3165	<free> 1114 1160	<compat> 1114	<trail> 11AB 11AB	% HANGUL LETTER SSANGNIEUN
3166	<free> 1115 1160	<compat> 1115	<trail> 11C6	% HANGUL LETTER NIEUN-TIKEUT
3167	<free> 1102 1109 1160	<lead> 1102 1109	<compat> 11C7	% HANGUL LETTER NIEUN-SIOS
3168	<free> 1102 1140 1160	<lead> 1102 1140	<compat> 11C8	% HANGUL LETTER NIEUN-PANSIOS
3169	<free> 1105 1100 1109 1160	<lead> 1105 1100 1109	<compat> 11CC	% HANGUL LETTER RIEUL-KIYEOK-SIOS
316A	<free> 1105 1103 1160	<lead> 1105 1103	<compat> 11CE	% HANGUL LETTER RIEUL-TIKEUT
316B	<free> 1105 1107 1109 1160	<lead> 1105 1107 1109	<compat> 11D3	% HANGUL LETTER RIEUL-PIEUP-SIOS
316C	<free> 1105 1140 1160	<lead> 1105 1140	<compat> 11D7	% HANGUL LETTER RIEUL-PANSIOS
316D	<free> 1105 1159 1160	<lead> 1105 1159	<compat> 11D9	% HANGUL LETTER RIEUL-YEORINHIEUH
316E	<free> 111C 1160	<compat> 111C	<trail> 11DC	% HANGUL LETTER MIEUM-PIEUP
316F	<free> 1106 1109 1160	<lead> 1106 1109	<compat> 11DD	% HANGUL LETTER MIEUM-SIOS
3170	<free> 1106 1140 1160	<lead> 1106 1140	<compat> 11DF	% HANGUL LETTER MIEUM-PANSIOS
3171	<free> 111D 1160	<compat> 111D	<trail> 11E2	% HANGUL LETTER KAPYEOUNMIEUM
3172	<free> 111E 1160	<compat> 111E	<trail> 11B8 11A8	% HANGUL LETTER PIEUP-KIYEOK
3173	<free> 1120 1160	<compat> 1120	<trail> 11B8 11AE	% HANGUL LETTER PIEUP-TIKEUT
3174	<free> 1122 1160	<compat> 1122	<trail> 11B8 11BA 11A8	% HANGUL LETTER PIEUP-SIOS-KIYEOK
3175	<free> 1123 1160	<compat> 1123	<trail> 11B8 11BA 11AE	% HANGUL LETTER PIEUP-SIOS-TIKEUT
3176	<free> 1127 1160	<compat> 1127	<trail> 11B8 11BD	% HANGUL LETTER PIEUP-CIEUC
3177	<free> 1129 1160	<compat> 1129	<trail> 11B8 11C0	% HANGUL LETTER PIEUP-THIEUTH
3178	<free> 112B 1160	<compat> 112B	<trail> 11E6	% HANGUL LETTER KAPYEOUNPIEUP
3179	<free> 112C 1160	<compat> 112C	<trail> 11B8 11B8 11BC	% HANGUL LETTER KAPYEOUNSSANGPIEUP
317A	<free> 112D 1160	<compat> 112D	<trail> 11E7	% HANGUL LETTER SIOS-KIYEOK
317B	<free> 112E 1160	<compat> 112E	<trail> 11BA 11AB	% HANGUL LETTER SIOS-NIEUN
317C	<free> 112F 1160	<compat> 112F	<trail> 11E8	% HANGUL LETTER SIOS-TIKEUT
317D	<free> 1132 1160	<compat> 1132	<trail> 11EA	% HANGUL LETTER SIOS-PIEUP
317E	<free> 1136 1160	<compat> 1136	<trail> 11BA 11BD	% HANGUL LETTER SIOS-CIEUC
317F	<free> 1140 1160	<compat> 1140	<trail> 11EB	% HANGUL LETTER PANSIOS
3180	<free> 1147 1160	<compat> 1147	<trail> 11EE	% HANGUL LETTER SSANGIEUNG
3181	<free> 114C 1160	<compat> 114C	<trail> 11F0	% HANGUL LETTER YESIEUNG
3182	<free> 114C 1109 1160	<lead> 114C 1109	<compat> 11F1	% HANGUL LETTER YESIEUNG-SIOS
3183	<free> 114C 1140 1160	<lead> 114C 1140	<compat> 11F2	% HANGUL LETTER YESIEUNG-PANSIOS
3184	<free> 1157 1160	<compat> 1157	<trail> 11F4	% HANGUL LETTER KAPYEOUNPHIEUPH
3185	<free> 1158 1160	<compat> 1158	<trail> 11C2 11C2	% HANGUL LETTER SSANGHIEUH
3186	<free> 1159 1160	<compat> 1159	<trail> 11F9	% HANGUL LETTER YEORINHIEUH

For the Hangul compatibility vowels letters there are two different contexts. Most processes should again choose the free-standing context. Only processes that need to consider Hangul syllables consisting of Hangul compatibility letters, likely only for compatibility with old data, need consider the other context: in-syllable. Note that the in-syllable context is the one assumed in the main Unicode data-file.

pos.	free-standing	in-syllable	name
314F	<free> 115F 1161	<compat> 1161	% HANGUL LETTER A
3150	<free> 115F 1162	<compat> 1162	% HANGUL LETTER AE
3151	<free> 115F 1163	<compat> 1163	% HANGUL LETTER YA
3152	<free> 115F 1164	<compat> 1164	% HANGUL LETTER YAE
3153	<free> 115F 1165	<compat> 1165	% HANGUL LETTER EO
3154	<free> 115F 1166	<compat> 1166	% HANGUL LETTER E
3155	<free> 115F 1167	<compat> 1167	% HANGUL LETTER YEO
3156	<free> 115F 1168	<compat> 1168	% HANGUL LETTER YE
3157	<free> 115F 1169	<compat> 1169	% HANGUL LETTER O
3158	<free> 115F 116A	<compat> 116A	% HANGUL LETTER WA
3159	<free> 115F 116B	<compat> 116B	% HANGUL LETTER WAE
315A	<free> 115F 116C	<compat> 116C	% HANGUL LETTER OE
315B	<free> 115F 116D	<compat> 116D	% HANGUL LETTER YO
315C	<free> 115F 116E	<compat> 116E	% HANGUL LETTER U
315D	<free> 115F 116F	<compat> 116F	% HANGUL LETTER WEO
315E	<free> 115F 1170	<compat> 1170	% HANGUL LETTER WE
315F	<free> 115F 1171	<compat> 1171	% HANGUL LETTER WI
3160	<free> 115F 1172	<compat> 1172	% HANGUL LETTER YU
3161	<free> 115F 1173	<compat> 1173	% HANGUL LETTER EU
3162	<free> 115F 1174	<compat> 1174	% HANGUL LETTER YI
3163	<free> 115F 1175	<compat> 1175	% HANGUL LETTER I
3187	<free> 115F 1184	<compat> 1184	% HANGUL LETTER YO-YA
3188	<free> 115F 1185	<compat> 1185	% HANGUL LETTER YO-YAE
3189	<free> 115F 1188	<compat> 1188	% HANGUL LETTER YO-I
318A	<free> 115F 1191	<compat> 1191	% HANGUL LETTER YU-YEO
318B	<free> 115F 1192	<compat> 1192	% HANGUL LETTER YU-YE
318C	<free> 115F 1194	<compat> 1194	% HANGUL LETTER YU-I
318D	<free> 115F 119E	<compat> 119E	% HANGUL LETTER ARAEA
318E	<free> 115F 11A1	<compat> 11A1	% HANGUL LETTER ARAEAE

4 Other Hangul compatibility character weak decomposition adjustments

Collation, rendering, etc., except the Unicode compatibility normalisation forms themselves since they are frozen for already allocated characters, should regard Hangul parenthesised and circled characters as having the compatibility-like decompositions in the following table. These decompositions shall not be used inverted.

pos.	free-standing	name
3200	<free> 0028 1100 1160 0029	% PARENTHESIZED HANGUL KIYEOK
3201	<free> 0028 1102 1160 0029	% PARENTHESIZED HANGUL NIEUN
3202	<free> 0028 1103 1160 0029	% PARENTHESIZED HANGUL TIKEUT
3203	<free> 0028 1105 1160 0029	% PARENTHESIZED HANGUL RIEUL
3204	<free> 0028 1106 1160 0029	% PARENTHESIZED HANGUL MIEUM
3205	<free> 0028 1107 1160 0029	% PARENTHESIZED HANGUL PIEUP
3206	<free> 0028 1109 1160 0029	% PARENTHESIZED HANGUL SIOS
3207	<free> 0028 110B 1160 0029	% PARENTHESIZED HANGUL IEUNG
3208	<free> 0028 110C 1160 0029	% PARENTHESIZED HANGUL CIEUC
3209	<free> 0028 110E 1160 0029	% PARENTHESIZED HANGUL CHIEUCH
320A	<free> 0028 110F 1160 0029	% PARENTHESIZED HANGUL KHIEUKH
320B	<free> 0028 1110 1160 0029	% PARENTHESIZED HANGUL THIEUTH
320C	<free> 0028 1111 1160 0029	% PARENTHESIZED HANGUL PHIEUPH
320D	<free> 0028 1112 1160 0029	% PARENTHESIZED HANGUL HIEUH
3260	<free> 1100 1160 20DD	% CIRCLED HANGUL KIYEOK
3261	<free> 1102 1160 20DD	% CIRCLED HANGUL NIEUN
3262	<free> 1103 1160 20DD	% CIRCLED HANGUL TIKEUT
3263	<free> 1105 1160 20DD	% CIRCLED HANGUL RIEUL
3264	<free> 1106 1160 20DD	% CIRCLED HANGUL MIEUM
3265	<free> 1107 1160 20DD	% CIRCLED HANGUL PIEUP
3266	<free> 1109 1160 20DD	% CIRCLED HANGUL SIOS
3267	<free> 110B 1160 20DD	% CIRCLED HANGUL IEUNG
3268	<free> 110C 1160 20DD	% CIRCLED HANGUL CIEUC
3269	<free> 110E 1160 20DD	% CIRCLED HANGUL CHIEUCH
326A	<free> 110F 1160 20DD	% CIRCLED HANGUL KHIEUKH
326B	<free> 1110 1160 20DD	% CIRCLED HANGUL THIEUTH
326C	<free> 1111 1160 20DD	% CIRCLED HANGUL PHIEUPH
326D	<free> 1112 1160 20DD	% CIRCLED HANGUL HIEUH

Note that 20DD COMBINING ENCLOSING CIRCLE applies to the entire Hangul syllable preceding it (but not any further lead consonants before the compatibility character; these are compatibility-like decompositions).

5 Possibly missing Hangul characters

As noted, the consonant variant characters are only allocated as lead, not as trail, despite that any Hangul consonant can be used as lead and as trail. DPR of Korea has also pointed out that a few variants of Hangul consonants are missing. Still awaiting a detailed proposal with evidence that they have been used, they are not yet allocated.

5.1 Trailing versions of consonants that are already allocated as lead characters

The consonant variants that were invented after the first publication of the Hangul script have been allocated only as lead consonants. In general all consonants have both lead and trail versions, which is part of the design of Hangul. For completion these should be allocated as trail consonants too. Note though that these consonant variants have fallen out of use. The code positions here are only suggestive. They are not allocated as yet. No implementation should use these allocations until, and if, they have been formally accepted into 10646/Unicode, possibly at other code positions.

```
11FA?? HANGUL JONGSEONG CHITUEUMSIOS (trailing counterpart of existing variant)
11FB?? HANGUL JONGSEONG CEONGCHIEUMSIOS (trailing counterpart of existing variant)
11FC?? HANGUL JONGSEONG CHITUEUMCIEUC (trailing counterpart of existing variant)
11FD?? HANGUL JONGSEONG CEONGCHIEUMCIEUC (trailing counterpart of existing variant)
11FE?? HANGUL JONGSEONG CHITUEUMCHIEUCH (trailing counterpart of existing variant)
11FF?? HANGUL JONGSEONG CEONGCHIEUMCHIEUCH (trailing counterpart of existing variant)
```

5.2 Hangul consonants that may be missing altogether in the current UCS

References to some as yet unallocated single-letter Hangul jamo variant letters have been suggested to SC/2/WG2, however without providing any evidence that they have actually existed in any historic document. If proper evidence for them are presented, they should be allocated. The code positions here are only suggestive. They are not allocated as yet. No implementation should use these allocations until, and if, they have been formally accepted into 10646/Unicode, possibly at other code positions.

```
115A?? HANGUL CHOSEONG HYEOPATAKSORI NIEUN (possibly missing variant)
115B?? HANGUL CHOSEONG HYEOPATAKSORI TIKEUT (possibly missing variant)
115C?? HANGUL CHOSEONG MAREUMMIEUM (possibly missing variant)
115D?? HANGUL CHOSEONG HYEOPATAKSORI THIEUTH (possibly missing variant)

11A4?? HANGUL JONGSEONG HYEOPATAKSORI NIEUN (trailing counterpart of possibly missing variant)
11A5?? HANGUL JONGSEONG HYEOPATAKSORI TIKEUT (trailing counterpart of possibly missing variant)
11A6?? HANGUL JONGSEONG MAREUMMIEUM (trailing counterpart of possibly missing variant)
11A7?? HANGUL JONGSEONG HYEOPATAKSORI THIEUTH (trailing counterpart of possibly missing variant)
```

The here suggested allocations leave only 11A3 as unallocated in the Hangul jamo block.

6 References

[1] Han'gŭl matchumpŏp (The hangŭl spelling conventions). Ministry of Education. Mun'gyobu. Seoul. 1988.

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[4] Orthographic divergence in South and North Korea: Toward a unified spelling system. SOHN Ho-Min. In 'The Korean Alphabet', ed. Young-Key Kim-Renaud, University of Hawaii Press. 1997.

[5] The Korean Language. Ho-Min Sohn. Cambridge University Press, 1999.

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