

# nXXXX - C Identifier Security using Unicode Standard Annex 39 v3

n2932 - C Identifier Security using Unicode Standard Annex 39 v2

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SG-16  
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## 1 Abstract

In response to P1949R7, replaces n2916, in parallel to P2528R1 for C++.

Adopt Unicode Annex 39 “Unicode Security Mechanisms” as part of C26.

- Comply to a variant of TR39#5.2 Mixed-Scripts Moderately Restrictive profile, but allow some Greek letters without its confusables with Latin,
- Disallow all Limited Use TR31#Table\_7 and Excluded scripts TR31#Table\_4,
- Only allow TR39#Table 1 Recommended, Inclusion, Technical Identifier Type properties, Honor the Median position in Arabic words (wrong in all xid lists),
- Demand NFC normalization. Reject all composable sequences as ill-formed. (from P1949)
- Reject illegal combining mark sequences (Sk, Cf, Mn, Me) with mixed-scripts (SCX) as ill-formed. TR39#5.4

Optionally:

- Implementations may allow an optional `#pragma unicode <LongScript>` that Excluded scripts can be added to the allowed set of scripts per source file.

Recommend binutils/linker ABI identifier rules: names are UTF-8, add identifier checks. E.g. `readelf -L -Ue`.

In addition adopt this proposal as a Defect Report against C11 and earlier. The author provides the `libu8ident` library (Apache 2 licensed) and its generated tables to all implementors.

TR39 checks could be implemented as warnings, TR31 violations not. But note that even TR31 has bugs still, to be hopefully fixed in the next Unicode version.

## 2 Changes

From n2916 2022-01-22:

- Rename C23 to C26, it's too late for C23, at least for C++23.
- Disallow non-confusable Technical U+1C0..U+1C3
- Fix a lot of not Allowed ID\_Start ranges. `safec26_start_list` from 355 ranges, 115 singles, 99350 codepoints to 243 ranges, 93 singles, 95986 codepoints
- Inserted chapter 4 Motivation with links to spoofs.

## 3 Summary

P1949 correctly detected that Unicode identifiers are still not identifiable, and are prone to bidi- and homoglyph attacks. But it stated that implementing TR31 and TR39 would be too hard. Having properly implemented the Unicode Security Guidelines for identifiers for several years, plus pushed Rust to do so also, proves the contrary. TR39 would catch all known homoglyph and bidi identifier attacks.

Further restriction of the TR31 profile to only recommended scripts leads to smaller sets for identifiers, and implementation of a proper TR39 mixed script profile and identifier types fixes most of the known unicode security problems with identifiers. The only remaining problems are bidi overrides in strings or comments, which cannot be handled with identifier restrictions, but tokenizer or preprocessor warnings, as recently added to gcc. `#include` filename restrictions should be done also, but that is out of the scope of this document, as the existing filesystems care much less about unicode security for identifiers than programming languages. Spoofing attacks on filenames are not yet seen in the wild, but will appear sooner or later, same as they appeared in browsers and email. Also names in C object files: linkers, `.def` files, `ffi`'s.

Implementing TR39 mixed script detection per document (C Header

and Source file) forbids insecure mixes of Greek and Cyrillic, dangerous Arabic RTL bidi attacks and most confusables. You can still write in your language, but then only in commonly written languages, and not mixed with others. Identifiers are still identifiable.

The question remains if TR39 security violations should be ill-formed (throw a compilation error or warning), or not. Since we do have the `-std=c2x` option, and the issues are security relevant, an error seems to be best. Implementations might choose to go for warnings on not-valid scripts, mixed scripts, or invalid sequences of combining marks though, even if the Unicode Standard recommended for decades that identifiers should stay identifiable. If the standard committee opts for the insecure option, they should rather rename identifiers to symbols then.

## 4 Motivation

- <https://websec.github.io/unicode-security-guide/visual-spoofing/>
- <http://www.unicode.org/reports/tr31/>, <http://www.unicode.org/reports/tr36/> and <http://www.unicode.org/reports/tr39>
- <https://twitter.com/zygoloid/status/1187150150835195905>, <https://github.com/golang/go/issues/20209>, <https://twitter.com/jupenur/status/1244286243518713857>
- <https://certitude.consulting/blog/en/invisible-backdoor/>
- <https://github.com/rurban/libu8ident/tree/master/texts/> with `*-sec*.c`

These changes would fix all of the known security problems with C++/C identifiers. With C++ it is more severe as declarations are easily confusable with initializations, but C is still affected in unclear situations.

## 5 What will this proposal change

### 5.1 The set of TR31 XID characters will become much smaller

Restricting the **Identifier Type** plus the Recommended Scripts, plus demanding NFC will shrink the original XID set from 971267 codepoints to 99350 codepoints. The ranges expand from 36 to 426. (when split by scripts already, 25 splits happen). Additionally the Halfwidth and Fullwidth Forms, U+FF00..U+FFEF are now forbidden.

ID\_Start consists of Lu + Ll + Lt + Lm + Lo + Nl, +Other\_ID\_Start, -Pattern\_Syntax, -Pattern\_White\_Space, -Median

131899 codepoints

ID\_Continue consists of ID\_Start, + Mn + Mc + Nd + Pc, +Other\_ID\_Continue, +Median, -Pattern\_Syntax, -Pattern\_White\_Space.

135072 codepoints (= ID\_Start + 3173)

XID\_Start and XID\_Continue ensure that isIdentifier(string) then isIdentifier(NFKC(string)) (*removing the NFKC quirks*)

XID\_Start: 131876 codepoints, XID\_Continue: 135053 codepoints  
(= XID\_Start + 3173)

See 14 “Appendix A - C26XID\_Start” and 15 “Appendix B - C26XID\_Continue”

## **5.2 Only Recommended scripts are now allowed, Excluded and Limited\_Use not**

These scripts will stay allowed:

Common Inherited Latin Arabic Armenian Bengali Bopomofo Cyrillic  
Devanagari Ethiopic Georgian Greek Gujarati Gurmukhi Hangul Han Hebrew  
Hiragana Katakana Kannada Khmer Lao Malayalam Myanmar Oriya  
Sinhala Tamil Telugu Thaana Thai Tibetan

These Excluded Scripts are initially disallowed TR31#Table\_4 but  
can be optionally be allowed via a new #pragma unicode Script:

Ahom Anatolian\_Hieroglyphs Avestan Bassa\_Vah Bhaiksuki Brahmi  
Braille Buginese Buhid Carian Caucasian\_Albanian Chorasman Coptic  
Cuneiform Cypriot Cypro\_Minoan Deseret Dives\_Akuru Dogra Duployan  
Egyptian\_Hieroglyphs Elbasan Elymaic Glagolitic Gothic Grantha  
Gunjala\_Gondi Hanunoo Hatran Imperial\_Aramaic  
Inscriptional\_Pahlavi Inscriptional\_Parthian Kaithi Kharoshthi  
Khitan\_Small\_Script Khojki Khudawadi Linear\_A Linear\_B Lycian  
Lydian Mahajani Makasar Manichaean Marchen Masaram\_Gondi  
Medefaidrin Mende\_Kikakui Meroitic\_Cursive Meroitic\_Hieroglyphs  
Modi Mongolian Mro Multani Nabataean Nandinagari Nushu Ogham  
Old\_Hungarian Old\_Italic Old\_North\_Arabian Old\_Permic Old\_Persian  
Old\_Sogdian Old\_South\_Arabian Old\_Turkic Old\_Uyghur Osmanya  
Pahawh\_Hmong Palmyrene Pau\_Cin\_Hau Phags\_Pa Phoenician  
Psalter\_Pahlavi Rejang Runic Samaritan Sharada Shavian Siddham  
SignWriting Sogdian Sora\_Sompeng Soyombo Tagalog Tagbanwa Takri  
Tangsa Tangut Tirthuta Toto Ugaritic Vithkuqi Warang\_Citi Yezidi  
Zanabazar\_Square

These Limited Use Scripts are now disallowed TR31#Table\_7

Adlam Balinese Bamum Batak Canadian\_Aboriginal Chakma Cham Cherokee  
Hanifi\_Rohingya Javanese Kayah\_Li Lepcha Limbu Lisu Mandaic  
Meetei\_Mayek Miao New\_Tai\_Lue Nwa Nko Nyiakeng\_Puachue\_Hmong Ol\_Chiki  
Osage Saurashtra Sundanese Syloti\_Nagri Syriac Tai\_Le Tai\_Tham  
Tai\_Viet Tifinagh Vai Wanchao Yi Unknown

The script property and its name are defined in TR24. We use the long Unicode Script property value, not the abbreviated 4-letter short name, which maps somehow to the 4-letter ISO 15924 Codes.

### 5.3 Documents with identifiers in many multiple scripts/languages will become illegal

C26 (and C26++) will follow the TR39 Security Profile 4 **Moderately Restrictive**, with an exception for Greek.

- All identifiers in a document qualify as Single Script, or
- All identifiers in a document are covered by any of the following sets of scripts, according to the definition in Mixed Scripts:
  - Latin + Han + Hiragana + Katakana (Japanese)
  - Latin + Han + Bopomofo (Chinese)
  - Latin + Han + Hangul (Korean), or
- All identifiers in a document are covered by Latin and any one other Recommended script, except Cyrillic.
- Allow some Greek letters mixed with Latin, that are not confusable with Latin letters.

### 5.4 Mixed-script runs with combining marks will become illegal

C26 will check for unlikely sequences of **combining marks**, and reject some. Combining Marks have no script property per se, but a variable list of allowed SCX scripts, which need to be checked against the base character. Also 4 Japanese KATAKANA-HIRAGANA PROLONGED SOUND MARK modifier letters.

See 8.2 “SCX Extensions” and 8.3 “Combining marks script run detection for spoofing” below.

## 6 What will this proposal not change

### 6.1 The validity of “extended” characters in identifiers

All current compilers allow characters outside the basic source character set directly in source today.

## 7 Why now

One driving factor for addressing this now is that GCC has fixed their long standing bug 67224 “UTF-8 support for identifier names in GCC”. Clang has always supported too many code points in source code. MSVC in its usual configuration defaults to code page 1252, but can be told to accept UTF-8 source. With GCC now allowing it, the barrier to use of Unicode characters outside the basic source character set has dropped considerably. Use of characters via universal character names was always possible, but never widely used. Examples found in the wild of use of UCNs in identifiers come from compiler and related tool test suites, but it’s trivial to come up with such spoofing attacks. There is no report yet from misuse in C ABI’s from linkers and binutils.

Restricting the profile of characters is much easier if no one is depending on them.

The recent <https://trojansource.codes> effort caused gcc to emit a new bidi warning, and github to implement similar warnings. Note that secure identifiers don’t help against bidi overrides in strings or comments, these issues are orthogonal. The Unicode consortium implemented a unicode spoofing taskforce <https://www.unicode.org/L2/L2022/22007-avoiding-spoof.pdf>. Their ICU library would need an identifier check API at least.

There used to be no linter, but there is now one: **u8idlnt** from <https://github.com/rurban/libu8ident>, which can be used to check for ALLOWED,SAFEC26,ID,XID,C11 or ALLUTF8 TR31 profiles, for various TR39 mixed script profile violations, confusables, invalid combining marks and TR15 normalization problems. Go also came up with a unicode spoofing linter lately. <https://github.com/NebulousLabs/glyphcheck>

So far only Rust, cperl and Java follow a unicode security guideline for identifiers, zig and J refused to support non-ASCII identifiers. Everybody else is vulnerable to potential security attacks and does allow non-identifiable identifiers. They should rename identifiers to “symbols”.

## 8 TR24 Scripts, the SC and SCX properties

### 8.1 SC

C only needs to map unicode characters to a script property via a single byte. There are currently 161 scripts assigned, 32 of them are in common use as identifiers, hence called **Recommended** scripts. The rest is split up into 127-31 **Excluded** scripts, which are not in common use, and 161-127 **Limited\_Use** scripts, which are not to be used in identifiers at all.

Regarding the discriminatory aspect of Excluded Scripts from TR31#Table\_4. *“Some scripts are not in customary modern use, and thus implementations may want to exclude them from identifiers. These include historic and obsolete scripts, scripts used mostly liturgically, and regional scripts used only in very small communities or with very limited current usage. Some scripts also have unresolved architectural issues that make them currently unsuitable for identifiers. The scripts in Table 4, Excluded Scripts are recommended for exclusion from identifiers.”* Nevertheless an implementation might choose to allow some optionally via a new `#pragma unicode Script`.

Regarding Limited Use scripts: TR31#2.4: *“Modern scripts that are in more limited use are listed in Table 7, Limited Use Scripts. To avoid security issues, some implementations may wish to disallow the limited-use scripts in identifiers. For more information on usage, see the Unicode Locale project CLDR.”*

Regarding stability: New scripts are added on a yearly basis, but nothing was added to the stable set of recommended scripts. For a while there was a list of **Aspirational** scripts to be added eventually, but this list was abandoned with Unicode 10.0. Probably also because nobody but Java, cperl and Rust implemented its identifier profile by scripts, rather went with insecure identifiers.

For error messages and an optional pragma to allow certain Exluded scripts, we use the long **Script property value**. Do not use the term “script name”, as this is ambiguous and misused. The Script Property Value is the titlecased name of the script from the UCD, with spaces replaced by underscores. They are defined in the yearly updated Scripts

### 8.2 SCX Extensions

Not all characters are uniquely used in a single script only. Many are used in a variable numbers of scripts. These are assigned to the Common or Inherited script, and are exactly specified in the Scrip-

tExtensions, aka SCX. The SCX property is a list of possible scripts per character. This list is using the short 4-letter script property, which needs to be resolved via the PropValue to its long script property value. (E.g. Syrc to Syriac)

```
# Script_Extensions=Arab Syrc
```

```
064B..0655 ; Arab Syrc # Mn [11] ARABIC FATHATAN..ARABIC HAMZA BELOW
```

```
# Script_Extensions=Adlm Arab Mand Mani Ougr Phlp Rohg Sogd Syrc
```

```
0640 ; Adlm Arab Mand Mani Ougr Phlp Rohg Sogd Syrc # Lm ARABIC TATWEEL
```

Some of the SCX scripts contain only a single script. These could be directly added to the list of SC scripts for the purpose of identifier security checks, but I advise against, for easier Combining Marks checks against the base character script. See below 8.3.

E.g.

```
3006 ; Hani # Lo IDEOGRAPHIC CLOSING MARK
```

U+3006 with the Common script property is assigned to the Hani -> Han script.

Multiple SCX list entries can be resolved when the previous scripts in the identifier context are already resolved to one or the other possibility. Thus for SCX=(Arab Syrc) we need to check if Arabic or Syriac was already seen. If not, the new character with that SCX is illegal, violating our Mixed Script profile.

### 8.3 Combining marks script run detection for spoofing

Check for unlikely sequences of **combining marks**:

- Forbid sequences of the same nonspacing mark.
- Forbid sequences of more than 4 nonspacing marks (gc=Mn or gc=Me).
- Optionally forbid sequences of base character + nonspacing mark that look the same as or confusingly similar to the base character alone (because the nonspacing mark overlays a portion of the base character). An example is U+0069 LOWER-CASE LETTER I + U+0307 COMBINING DOT ABOVE.

Since we disallow already most combining marks (at least the Latin ones) with the requirement of NFC P1949R7, this set of cases is quite small.

Special-cases:



Using the Script property alone will not detect that the U+30FC ( ) KATAKANA-HIRAGANA PROLONGED SOUND MARK (Script=Common, SCX=Hira Kana, gc=Lm) should not be mixed with Latin. See TR39#5.4 and TR46. We only have to check only 4 such explicitly japanese-only PROLONGED SOUND MARKs, all other Lm modifiers may mix with all SCX.

The list of allowed combining mark characters (with Common or Inherited scripts) in the C26 TR31 profile is: Lm Modifier\_Letter, Mc Spacing\_Mark, Mn Nonspacing\_Mark, Me Enclosing\_Mark. Sk and Cf are not part of XIDs.

67 matches for “XID\_Continue # Lm” in buffer: DerivedCoreProperties.txt See 16 “Appendix C” for all.

```
02B0..02C1    ; XID_Continue # Lm [18] MODIFIER LETTER SMALL H..
                                         MODIFIER LETTER REVERSED GLOTTAL STOP
02C6..02D1    ; XID_Continue # Lm [12] MODIFIER LETTER CIRCUMFLEX ACCENT..
                                         MODIFIER LETTER HALF TRIANGULAR
...
```

513 matches for “XID\_Continue # M” in buffer: DerivedCoreProperties.txt See 17 “Appendix D” for all.

```
0300..036F    ; XID_Continue # Mn [112] COMBINING GRAVE ACCENT..
                                         COMBINING LATIN SMALL LETTER X
0483..0487    ; XID_Continue # Mn [5]  COMBINING CYRILLIC TITLO..
                                         COMBINING CYRILLIC POKRYTIE
...
```

From these 67 Lm plus 513 M[cn] ranges filtering out the non-C26 XID candidates, only #8 Identifier\_Type = Recommended, Inclusion, non-confusable Technical, plus only #4.2 Recommended Scripts, plus only codepoints with multiple SCX entries, plus only codepoints which don’t decompose to NFC, leads only to the Lm characters, which can mix with all scripts. Not a single Mn or Mc codepoints is left.

So some of the Common XID\_Continue marks therefore cannot be detected with the SCX logic. But all of them do not combine with Latin and are already filtered by the C26 Mixed Script profile. And all of the Combining Marks are caught by the NFC requirement.

Most Lm Modifier Letters (besides the 4 Japanese PROLONGED SOUND MARKs) are freestanding base characters, which can be combined with any other letter.

See TR31#2.1 Combining\_Marks and TR31#2.2 Modifier\_Letters

See also TR24#5.1 Handling Characters with the Common Script Property and TR24#5.2 Handling Combining Marks.

## 9 TR39 Identifier Type

TR31 recommends to disable some characters from recommended scripts: *“Some characters used with recommended scripts may still be problematic for identifiers, for example because they are part of extensions that are not in modern customary use, and thus implementations may want to exclude them from identifiers. These include characters for historic and obsolete orthographies, characters used mostly liturgically, and in orthographies for languages used only in very small communities or with very limited current or declining usage. Some characters also have architectural issues that may make them unsuitable for identifiers.”*

The **Identifier Type** property TR39#Table 1 recommendation should be mandatory, with the addition of the non-confusable Technical Identifier Type to be allowed.

I.e. Limited\_Use, Obsolete, Exclusion, Not\_XID, Not\_NFKC, Default\_Ignorable, Deprecated, Not\_Character are not part of identifiers.

Allowed are Recommended, Inclusion, and all non-confusable Technical TR39 Identifier Types.

Note that several Technical Identifier\_Type are confusable, but not marked as such. So far only the the Latin letters U+1C0 l, U+1C1 ll, U+1C3 ! which are confusable with operators.

Additionally the Halfwidth and Fullwidth Forms, U+FF00..U+FFEF are forbidden, even if allowed in TR31. They are confusable with the Latin base alphabet A-Z.

And there are 79 Technical ranges added to the original list of Recommended and Inclusion ID's, with the confusables U+1C0..U+1C3 manually excluded.

```
grep ', U8ID_Technical' scripts.h | egrep -v 'Not_XID|U8ID_Obsolete|U8ID_Exclusion'
```

See 18 Appendix E - IDType Technical.

## 10 TR39 Mixed Scripts

TR39 defines some security profiles for identifiers to avoid the most common identifier insecurities, that identifiers will stay identifiable.

We choose a variant of the **Moderately Restrictive** profile, with an exception for non-confusable Greek. I called this profile C26\_4 or SAFEC26 in libu8ident.

- All identifiers in a document qualify as Single Script, or
- All identifiers in a document are covered by any of the following sets of scripts, according to the definition in Mixed Scripts:
  - Latin + Han + Hiragana + Katakana (Japanese)
  - Latin + Han + Bopomofo (Chinese)
  - Latin + Han + Hangul (Korean), or
- All identifiers in a document are covered by Latin and any one other Recommended script, except Cyrillic.
- Allow some Greek letters mixed with Latin, that are not confusable with Latin letters.

Greek alone is always allowed, as Cyrillic, but wherever we have a valid Latin letter which looks the same as the Greek counterpart, the Greek letter is forbidden, choose the Latin one instead. E.g. (  $\text{A} \rightarrow \text{A}$  ) GREEK CAPITAL LETTER ALPHA  $\rightarrow$  LATIN CAPITAL LETTER A. See 19 Appendix F for the generated list with 10 exceptions.

Thus it prevents Cyrillic mixed with Latin or any other script, but does allow any East-Asian CFK language, other common and widely used languages and Latin mixed with Greek, mainly used for its mathematical symbols. Many mathematical symbols already exists outside of Greek, but these are mainly used for operators in advanced programming languages, not as identifiers. See also [http://xahlee.info/comp/unicode\\_math\\_operators.html](http://xahlee.info/comp/unicode_math_operators.html) for a nice overview.

E.g. here we have some:

- U+2217 (  $\ast$  ) ASTERISK OPERATOR (Script=Common). Not\_XID
- U+2107 (  $\square$  ) EULER CONSTANT (Script=Common, Lu) is a proper letter, but with Restricted IdentifierStatus.
- U+2126 (  $\Omega$  ) OHM SIGN (Script=Greek, L&) is a greek letter, but with Restricted IdentifierStatus.
- U+2127 (  $\text{O}$  ) INVERTED OHM SIGN (Script=Common, So). Obsolete, Not\_XID
- U+0392 (  $\text{B} \rightarrow \text{B}$  ) GREEK CAPITAL LETTER BETA  $\rightarrow$  LATIN CAPITAL LETTER B Greek confusable
- U+03F2 (  $\text{c} \rightarrow \text{c}$  ) GREEK LUNATE SIGMA SYMBOL  $\rightarrow$  LATIN SMALL LETTER C Greek confusable
- U+0381 ; (  $\alpha \rightarrow \text{a}$  ) GREEK SMALL LETTER ALPHA. Not confusable
- U+03F1 ; (  $\rho \rightarrow \text{p}$  ) GREEK RHO SYMBOL  $\rightarrow$  LATIN SMALL LETTER P. Not confusable

TR39 also compiles a convenient IdentifierStatus list. But all the math letters with Script=Common from U+2100 to U+2200 are restricted, as Greek is forbidden mixed with Latin in the original TR39 Moderately Restrictive profile. Most are allowed according to the

TR31 and TR39 rules of SAFEC26, so we need to come up with our own list of `XID_Start/XID_Continue` codepoints, excluding the Limited Use and Excluded scripts. And if an implementation choses to allow Excluded scripts with more logic to allow only this script.

Since the TR31 XID list also got the median positions wrong (for 98 Arabic codepoints), has some confusables with ops, and forgot about the Halfwidth and Fullwidth, `U+FF00..U+FFEF` confusables, we need to fixup and generate the XID lists by ourselves.

It is recommended to already exclude Limited Use and Excluded scripts from the initial list of identifier ranges, as this is the most common use-case, and shortens the common search paths. Only with the `#pragma Unicode ExcludedScript` search the full XID lists and the full scripts list.

The TR39 Mixed Scripts profile alone does not prevent from all spoofing attacks, but the additional rules from 8.3 “Combining marks script run detection for spoofing” are kept tiny.

## 11 Contexts

This is not discussed in any of the unicode security guidelines for identifiers. One could argue that a mixed-script profile is valid only for a single identifier, or it is valid for the whole source file document. And there needs to be a definition if before or after the preprocessor, and if to treat names in private structs and local names in functions as separate contexts.

If valid for only a single identifier you could arbitralily mix up Cyrillic with Greek identifiers in a C files, and thus these identifiers would not be identifiable anymore, as both both can render to the very same glyphs. Thus we adopt the notion of identifier contexts.

With programming languages this is a source file, with objects files this is a module. For identifiers in object files see below 13 Issues with binutils, linkers, exported identifiers. For filesystems this would be a directory.

For every source file we need to store a context with the list of already seen scripts and how many. The maximal number of scripts is 4, for the case of Japanese mixed with Latin. (Katakana + Hiragana + Han + Latin), thus we can save that list in a single 4-byte word, and the lookup and memory management is trivial.

Since the compiler sees the identifiers after the preprocessor included all headers, the context definition is a bit blurry. Is the context for mixed scripts an original source file (before cpp) or the

resulting file after inclusion of all files (after `cpp`). This is similar to the problem with lexical variables a couple of decades ago.

- **before-cpp**: One could argue that the scope of a variable should be contained in a lexical block, which can be statically determined and safely enclosed. With identifiers that would mean that the preprocessor already should perform the TR31 lexer checks and TR39 security checks, and one could define Arabic headers using private arabic fields, and include another header with Cyrillic only names. This would allow confusables in the resulting object file, and source files would be easy to check with external tools. See also the `binutils` section 12 below.
- **private**: Another argument would be that all exported names end up in the object files and library flat, which would support the separation of private and public name contexts, where to perform the mixed-script checks. Private contexts (e.g. static structs fields or local names in functions) should be separated from the rest. This would prevent from confusables in struct fields/methods, and the rest is separated by the checks for the public names.
- **after-cpp**: The third, strictest variant would define the context in the file after `cpp`. You would not be able to include a Cyrillic-only header, and you would not be able to use Cyrillic private fields. This would be the least surprising and most secure option. As long as the security risk lies ahead of us, one should go for the strictest option. Cyrillic header projects should be isolated and not used at all outside of non-cyrillic projects. I'm pointing the fingers at Cyrillic because it has the biggest number of confusables with Latin. Arabic headers e.g. are not all confusable with Latin or CFK, but I doubt that any non Hebrew/Arabic speaker can identify and see differences in its names without long training. Same for CFK and the other major scripts.

## 12 Implementations and Strategies

I implemented for `cperl`, a fork of `perl5`, the General Security profile “Moderately restrictive” (4) for identifiers in 2017, together with transparent normalization of NFC. This is a dynamic language with the need for fast tokenizing, and compilation. Still I did not see a need to restrict all source code identifiers to be already in NFC. Even with the added unicode checks and dynamic normalization the tokenizer is still faster than the simpler `perl5` tokenizer.

Then when GCC went to full insecure identifiers I implemented the more general libu8ident library, which can be used with all known TR39 identifier type profiles, the mixed-script security profiles, TR31 XID character sets and all TR15 normalizations. There I tested various performance strategies of the unicode lookups. Tested was CRoaring, which was only useful for sets of single codepoints, the list of confusables. Most of the needed lists were best structured as binary-search in range pairs. Most of them were fastest with special-casing the codepoints below U+128 with a simple linear search. Binary search in an Eytzinger layout was not convincibly faster, neither hybrid searches by 1. splitting up ranges from single codepoints, nor 2. seperating 16bit from 32bit codepoints. Perfect hashes for singular lookup are used in some similar implementations, esp. for confusables and the normalization check.

ICU has no implementation for TR39 checks (yet).

Rust has one also.

## **13 Issues with binutils, linkers, exported identifiers**

The crux with C and somewhat also C++ identifiers, is that they can be used with other earlier compilers or languages without any unicode security profile or restriction. ffi's are very common, libraries or .def files even more, thankfully unicode names not at all yet.

binutils and linkers treat names as zero-terminated binary garbage, same as in most current filesystems. Identifiers are not identifiable there, and names are charset (=user) specific, whilst there are no header fields for the used charset (e.g. if SHIFT-JIS or UTF-8), nor are there any rules for name lookup (normalization). This is not solvable here (in C), only there or the gABI. Only in the Rust ecosystem there are proper unicode identifier rules, but Rust can link against C. I haven't detected any exported unicode names in the wild, they are only used in local symbols still. UTF-16 compilers such as MSVC do export their UNICODE names either in the local character set or as UTF-8. If used wildly, object files would not link anymore, as local character sets vary, and there is no character set standard defined.

The C++/C working groups should urge the binutils/linker working groups to adopt a more precise specification how exported identifiers are represented in object files and libraries: UTF-8 or any charset, and how they are looked up: any normalization, NFC or not at all. My recommendation would be to interpret them as UTF-8, use NFC for the lookup, and reject all illegal UTF-8 identifiers. As long as there

no unicode names in the wild this is still easy. There are also many object file producers in the wild, with possibly completely insecure unicode names in the future. notes sections are easily extendable.

binutils readelf -L -Ul is currently broken displaying unicode identifiers. I have patches to display them in the current multi-byte locale, and to add u8ident checks with -L. I haven't found any violations so far in my used libraries, but a Debian/Fedora/FreeBSD mass-scan seems necessary.

Even better would be for the C ABI's to also adopt secure unicode identifiers, as linkers and FFI's have the same unicode security problems as compilers, interpreters and filesystems. Otherwise they should at least clarify that their names/"symbols" are not identifiable, and implementation defined and their interpretation locale specific. (i.e. you cannot copy them across locales).

## 14 Appendix A - C26XID\_Start

Created with mkc26 from libu8ident. *The SCX is modelled as if your compiler would allow static initialization of strings as {char,...,0}.*

```
struct sc_c26 {
    uint32_t from;
    uint32_t to;
    enum u8id_sc sc; // Scripts
    enum u8id_gc gc; // General Category. GC_L is L& (all letters)
                        // GC_V is varying
    const char *scx; // List of ScriptExtensions, maxsize 8 for U+1CF2
};

// Filtering allowed scripts, XID_Start, safe IDTypes, NFC, !MEDIAL and !MARK
// Ranges split at GC and SCX changes
const struct sc_c26 safec26_start_list[336] = {
    {'$', '$', SC_Latin, GC_Sc, NULL},
    {'A', 'Z', SC_Latin, GC_Lu, NULL},
    {'_', '_', SC_Latin, GC_Pc, NULL},
    {'a', 'z', SC_Latin, GC_Ll, NULL},
    {0xC0, 0xD6, SC_Latin, GC_Lu, NULL}, // À..Ö
    {0xD8, 0xF6, SC_Latin, GC_L, NULL}, // Ø..ö
    {0xF8, 0x131, SC_Latin, GC_L, NULL}, // ø..ı
    {0x134, 0x13E, SC_Latin, GC_L, NULL}, // ĵ..ŕ
    {0x141, 0x148, SC_Latin, GC_L, NULL}, // Ł..ł
    {0x14A, 0x17E, SC_Latin, GC_L, NULL}, // Ŋ..ž
    {0x180, 0x180, SC_Latin, GC_Ll, NULL}, // ̀
```

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{0x18F, 0x18F, SC_Latin, GC_Lu, NULL}, // ̸
{0x1A0, 0x1A1, SC_Latin, GC_L, NULL}, // Œ..œ
{0x1AF, 0x1B0, SC_Latin, GC_L, NULL}, // Ů..ů
{0x1CD, 0x1DC, SC_Latin, GC_L, NULL}, // Ě..ě
{0x1DE, 0x1E3, SC_Latin, GC_L, NULL}, // Ě̃..ě̃
{0x1E6, 0x1F0, SC_Latin, GC_L, NULL}, // Ğ..ğ
{0x1F4, 0x1F5, SC_Latin, GC_L, NULL}, // Ġ..ġ
{0x1F8, 0x21B, SC_Latin, GC_L, NULL}, // Ñ..ñ
{0x21E, 0x21F, SC_Latin, GC_L, NULL}, // Ĥ..ĥ
{0x226, 0x236, SC_Latin, GC_L, NULL}, // Ħ..ħ
{0x250, 0x252, SC_Latin, GC_Ll, NULL}, // ɇ..Ɉ
{0x255, 0x255, SC_Latin, GC_Ll, NULL}, // Ɇ
{0x258, 0x25A, SC_Latin, GC_Ll, NULL}, // ɇ..Ɉ
{0x25C, 0x262, SC_Latin, GC_Ll, NULL}, // Ƀ..Ʉ
{0x264, 0x267, SC_Latin, GC_Ll, NULL}, // Ʉ..Ʌ
{0x26A, 0x271, SC_Latin, GC_Ll, NULL}, // ɇ..Ɉ
{0x273, 0x276, SC_Latin, GC_Ll, NULL}, // ɇ..Ɉ
{0x278, 0x27B, SC_Latin, GC_Ll, NULL}, // ɇ..Ɉ
{0x27D, 0x288, SC_Latin, GC_Ll, NULL}, // ɇ..Ɉ
{0x28A, 0x291, SC_Latin, GC_Ll, NULL}, // ɇ..Ɉ
{0x293, 0x29D, SC_Latin, GC_L, NULL}, // ɇ..Ɉ
{0x29F, 0x2AF, SC_Latin, GC_Ll, NULL}, // ɇ..Ɉ
{0x2B9, 0x2C1, SC_Common, GC_Lm, NULL}, // ʹ..ʻ
{0x2C6, 0x2D1, SC_Common, GC_Lm, NULL}, // ʹ..ʻ
{0x2EC, 0x2EC, SC_Common, GC_Lm, NULL}, // ʹ
{0x2EE, 0x2EE, SC_Common, GC_Lm, NULL}, // ʹ
{0x37B, 0x37D, SC_Greek, GC_Ll, NULL}, // Ƀ..Ʉ
{0x386, 0x386, SC_Greek, GC_Lu, NULL}, // Α
{0x388, 0x38A, SC_Greek, GC_Lu, NULL}, // Ε..Ι
{0x38C, 0x38C, SC_Greek, GC_Lu, NULL}, // Θ
{0x38E, 0x3A1, SC_Greek, GC_L, NULL}, // Υ..Ρ
{0x3A3, 0x3CF, SC_Greek, GC_L, NULL}, // Σ..Ω
{0x3D7, 0x3D7, SC_Greek, GC_Ll, NULL}, // χ
{0x3FC, 0x3FF, SC_Greek, GC_L, NULL}, // ρ..θ
{0x401, 0x45F, SC_Cyrillic, GC_L, NULL}, // Ё..ѳ
{0x48A, 0x4FF, SC_Cyrillic, GC_L, NULL}, // Ѡ..ѳ
{0x510, 0x529, SC_Cyrillic, GC_L, NULL}, // Ё..ѳ
{0x52E, 0x52F, SC_Cyrillic, GC_L, NULL}, // Ѡ..ѳ
{0x531, 0x556, SC_Armenian, GC_Lu, NULL}, // Ա..Ֆ
{0x559, 0x559, SC_Armenian, GC_Lm, NULL}, // Վ
{0x560, 0x586, SC_Armenian, GC_Ll, NULL}, // Ա..Ֆ
{0x588, 0x588, SC_Armenian, GC_Ll, NULL}, // Ա
{0x5D0, 0x5EA, SC_Hebrew, GC_Lo, NULL}, // א..ז
{0x5EF, 0x5F2, SC_Hebrew, GC_Lo, NULL}, // א..ז
{0x620, 0x63F, SC_Arabic, GC_Lo, NULL}, // ا..ز
{0x641, 0x64A, SC_Arabic, GC_Lo, NULL}, // ا..ز

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{0x671, 0x672, SC_Arabic, GC_Lo, NULL}, // []
{0x674, 0x674, SC_Arabic, GC_Lo, NULL}, // []
{0x679, 0x68D, SC_Arabic, GC_Lo, NULL}, // []
{0x68F, 0x6A0, SC_Arabic, GC_Lo, NULL}, // []
{0x6A2, 0x6D3, SC_Arabic, GC_Lo, NULL}, // []
{0x6D5, 0x6D5, SC_Arabic, GC_Lo, NULL}, // []
{0x6E5, 0x6E6, SC_Arabic, GC_Lm, NULL}, // []
{0x6EE, 0x6EF, SC_Arabic, GC_Lo, NULL}, // []
{0x6FA, 0x6FC, SC_Arabic, GC_Lo, NULL}, // []
{0x6FF, 0x6FF, SC_Arabic, GC_Lo, NULL}, // []
{0x750, 0x77F, SC_Arabic, GC_Lo, NULL}, // []
{0x781, 0x7A5, SC_Thaana, GC_Lo, NULL}, // []
{0x7B1, 0x7B1, SC_Thaana, GC_Lo, NULL}, // []
{0x870, 0x887, SC_Arabic, GC_Lo, NULL}, // []
{0x889, 0x88E, SC_Arabic, GC_Lo, NULL}, // []
{0x8A0, 0x8AC, SC_Arabic, GC_Lo, NULL}, // []
{0x8B2, 0x8B2, SC_Arabic, GC_Lo, NULL}, // []
{0x8B5, 0x8C9, SC_Arabic, GC_L, NULL}, // []
{0x904, 0x939, SC_Devanagari, GC_Lo, NULL}, // []
{0x93D, 0x93D, SC_Devanagari, GC_Lo, NULL}, // []
{0x950, 0x950, SC_Devanagari, GC_Lo, NULL}, // []
{0x960, 0x961, SC_Devanagari, GC_Lo, NULL}, // []
{0x971, 0x977, SC_Devanagari, GC_L, NULL}, // []
{0x979, 0x97F, SC_Devanagari, GC_Lo, NULL}, // []
{0x985, 0x98C, SC_Bengali, GC_Lo, NULL}, // []
{0x98F, 0x990, SC_Bengali, GC_Lo, NULL}, // []
{0x993, 0x9A8, SC_Bengali, GC_Lo, NULL}, // []
{0x9AA, 0x9B0, SC_Bengali, GC_Lo, NULL}, // []
{0x9B2, 0x9B2, SC_Bengali, GC_Lo, NULL}, // []
{0x9B6, 0x9B9, SC_Bengali, GC_Lo, NULL}, // []
{0x9BD, 0x9BD, SC_Bengali, GC_Lo, NULL}, // []
{0x9CE, 0x9CE, SC_Bengali, GC_Lo, NULL}, // []
{0x9E0, 0x9E1, SC_Bengali, GC_Lo, NULL}, // []
{0x9F0, 0x9F1, SC_Bengali, GC_Lo, NULL}, // []
{0xA05, 0xA0A, SC_Gurmukhi, GC_Lo, NULL}, // []
{0xA0F, 0xA10, SC_Gurmukhi, GC_Lo, NULL}, // []
{0xA13, 0xA28, SC_Gurmukhi, GC_Lo, NULL}, // []
{0xA2A, 0xA30, SC_Gurmukhi, GC_Lo, NULL}, // []
{0xA32, 0xA32, SC_Gurmukhi, GC_Lo, NULL}, // []
{0xA35, 0xA35, SC_Gurmukhi, GC_Lo, NULL}, // []
{0xA38, 0xA39, SC_Gurmukhi, GC_Lo, NULL}, // []
{0xA5C, 0xA5C, SC_Gurmukhi, GC_Lo, NULL}, // []
{0xA72, 0xA74, SC_Gurmukhi, GC_Lo, NULL}, // []
{0xA85, 0xA8D, SC_Gujarati, GC_Lo, NULL}, // []
{0xA8F, 0xA91, SC_Gujarati, GC_Lo, NULL}, // []
{0xA93, 0xAA8, SC_Gujarati, GC_Lo, NULL}, // []

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{0xAAA, 0xAB0, SC_Gujarati, GC_Lo, NULL}, // []
{0xAB2, 0xAB3, SC_Gujarati, GC_Lo, NULL}, // []
{0xAB5, 0xAB9, SC_Gujarati, GC_Lo, NULL}, // []
{0xABD, 0xABD, SC_Gujarati, GC_Lo, NULL}, // []
{0xAD0, 0xAD0, SC_Gujarati, GC_Lo, NULL}, // []
{0xAE0, 0xAE1, SC_Gujarati, GC_Lo, NULL}, // []
{0xB05, 0xB0C, SC_Oriya, GC_Lo, NULL}, // []
{0xB0F, 0xB10, SC_Oriya, GC_Lo, NULL}, // []
{0xB13, 0xB28, SC_Oriya, GC_Lo, NULL}, // []
{0xB2A, 0xB30, SC_Oriya, GC_Lo, NULL}, // []
{0xB32, 0xB33, SC_Oriya, GC_Lo, NULL}, // []
{0xB35, 0xB39, SC_Oriya, GC_Lo, NULL}, // []
{0xB3D, 0xB3D, SC_Oriya, GC_Lo, NULL}, // []
{0xB5F, 0xB61, SC_Oriya, GC_Lo, NULL}, // []
{0xB71, 0xB71, SC_Oriya, GC_Lo, NULL}, // []
{0xB83, 0xB83, SC_Tamil, GC_Lo, NULL}, // []
{0xB85, 0xB8A, SC_Tamil, GC_Lo, NULL}, // []
{0xB8E, 0xB90, SC_Tamil, GC_Lo, NULL}, // []
{0xB92, 0xB95, SC_Tamil, GC_Lo, NULL}, // []
{0xB99, 0xB9A, SC_Tamil, GC_Lo, NULL}, // []
{0xB9C, 0xB9C, SC_Tamil, GC_Lo, NULL}, // []
{0xB9E, 0xB9F, SC_Tamil, GC_Lo, NULL}, // []
{0xBA3, 0xBA4, SC_Tamil, GC_Lo, NULL}, // []
{0xBA8, 0xBAA, SC_Tamil, GC_Lo, NULL}, // []
{0BAE, 0xBB9, SC_Tamil, GC_Lo, NULL}, // []
{0xBD0, 0xBD0, SC_Tamil, GC_Lo, NULL}, // []
{0xC05, 0xC0C, SC_Telugu, GC_Lo, NULL}, // []
{0xC0E, 0xC10, SC_Telugu, GC_Lo, NULL}, // []
{0xC12, 0xC28, SC_Telugu, GC_Lo, NULL}, // []
{0xC2A, 0xC33, SC_Telugu, GC_Lo, NULL}, // []
{0xC35, 0xC39, SC_Telugu, GC_Lo, NULL}, // []
{0xC3D, 0xC3D, SC_Telugu, GC_Lo, NULL}, // []
{0xC5D, 0xC5D, SC_Telugu, GC_Lo, NULL}, // []
{0xC60, 0xC61, SC_Telugu, GC_Lo, NULL}, // []
{0xC80, 0xC80, SC_Kannada, GC_Lo, NULL}, // []
{0xC85, 0xC8C, SC_Kannada, GC_Lo, NULL}, // []
{0xC8E, 0xC90, SC_Kannada, GC_Lo, NULL}, // []
{0xC92, 0xCA8, SC_Kannada, GC_Lo, NULL}, // []
{0xCAA, 0xCB3, SC_Kannada, GC_Lo, NULL}, // []
{0xCB5, 0xCB9, SC_Kannada, GC_Lo, NULL}, // []
{0CBD, 0CBD, SC_Kannada, GC_Lo, NULL}, // []
{0xCDD, 0xCDD, SC_Kannada, GC_Lo, NULL}, // []
{0xCE0, 0xCE1, SC_Kannada, GC_Lo, NULL}, // []
{0xCF1, 0xCF2, SC_Kannada, GC_Lo, NULL}, // []
{0xD05, 0xD0C, SC_Malayalam, GC_Lo, NULL}, // []
{0xD0E, 0xD10, SC_Malayalam, GC_Lo, NULL}, // []

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{0xD12, 0xD3A, SC_Malayalam, GC_Lo, NULL}, // []
{0xD3D, 0xD3D, SC_Malayalam, GC_Lo, NULL}, // []
{0xD4E, 0xD4E, SC_Malayalam, GC_Lo, NULL}, // []
{0xD54, 0xD56, SC_Malayalam, GC_Lo, NULL}, // []
{0xD60, 0xD61, SC_Malayalam, GC_Lo, NULL}, // []
{0xD7A, 0xD7F, SC_Malayalam, GC_Lo, NULL}, // []
{0xD85, 0xD8E, SC_Sinhala, GC_Lo, NULL}, // []
{0xD91, 0xD96, SC_Sinhala, GC_Lo, NULL}, // []
{0xD9A, 0xDA5, SC_Sinhala, GC_Lo, NULL}, // []
{0xDA7, 0xDB1, SC_Sinhala, GC_Lo, NULL}, // []
{0xDB3, 0xDBB, SC_Sinhala, GC_Lo, NULL}, // []
{0xDBD, 0xDBD, SC_Sinhala, GC_Lo, NULL}, // []
{0xDC0, 0xDC6, SC_Sinhala, GC_Lo, NULL}, // []
{0xE01, 0xE30, SC_Thai, GC_Lo, NULL}, // []
{0xE32, 0xE32, SC_Thai, GC_Lo, NULL}, // []
{0xE40, 0xE46, SC_Thai, GC_L, NULL}, // []
{0xE81, 0xE82, SC_Lao, GC_Lo, NULL}, // ກ..ຂ
{0xE84, 0xE84, SC_Lao, GC_Lo, NULL}, // ຄ
{0xE86, 0xE8A, SC_Lao, GC_Lo, NULL}, // ກ..ຊ
{0xE8C, 0xEA3, SC_Lao, GC_Lo, NULL}, // ກ..ຮ
{0xEA5, 0xEA5, SC_Lao, GC_Lo, NULL}, // ລ
{0xEA7, 0xEB0, SC_Lao, GC_Lo, NULL}, // ວ..ຮ
{0xEB2, 0xEB2, SC_Lao, GC_Lo, NULL}, // ງ
{0xEBD, 0xEBD, SC_Lao, GC_Lo, NULL}, // []
{0xEC0, 0xEC4, SC_Lao, GC_Lo, NULL}, // []
{0xEC6, 0xEC6, SC_Lao, GC_Lm, NULL}, // []
{0xEDE, 0xEDF, SC_Lao, GC_Lo, NULL}, // []
{0xF00, 0xF00, SC_Tibetan, GC_Lo, NULL}, // []
{0xF40, 0xF42, SC_Tibetan, GC_Lo, NULL}, // []
{0xF44, 0xF47, SC_Tibetan, GC_Lo, NULL}, // []
{0xF49, 0xF4C, SC_Tibetan, GC_Lo, NULL}, // []
{0xF4E, 0xF51, SC_Tibetan, GC_Lo, NULL}, // []
{0xF53, 0xF56, SC_Tibetan, GC_Lo, NULL}, // []
{0xF58, 0xF5B, SC_Tibetan, GC_Lo, NULL}, // []
{0xF5D, 0xF68, SC_Tibetan, GC_Lo, NULL}, // []
{0xF6A, 0xF6C, SC_Tibetan, GC_Lo, NULL}, // []
{0xF88, 0xF8C, SC_Tibetan, GC_Lo, NULL}, // []
{0x1000, 0x102A, SC_Myanmar, GC_Lo, NULL}, // []
{0x103F, 0x103F, SC_Myanmar, GC_Lo, NULL}, // []
{0x1050, 0x1055, SC_Myanmar, GC_Lo, NULL}, // []
{0x105A, 0x105D, SC_Myanmar, GC_Lo, NULL}, // []
{0x1061, 0x1061, SC_Myanmar, GC_Lo, NULL}, // []
{0x1065, 0x1066, SC_Myanmar, GC_Lo, NULL}, // []
{0x106E, 0x1070, SC_Myanmar, GC_Lo, NULL}, // []
{0x1075, 0x1081, SC_Myanmar, GC_Lo, NULL}, // []
{0x108E, 0x108E, SC_Myanmar, GC_Lo, NULL}, // []

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{0x10C7, 0x10C7, SC_Georgian, GC_Lu, NULL}, // []
{0x10CD, 0x10CD, SC_Georgian, GC_Lu, NULL}, // []
{0x10D0, 0x10F0, SC_Georgian, GC_Ll, NULL}, // Ⴢ..Ⴣ
{0x10F7, 0x10FA, SC_Georgian, GC_Ll, NULL}, // Ⴤ..ღ
{0x10FD, 0x10FF, SC_Georgian, GC_Ll, NULL}, // []..[]
{0x1200, 0x1248, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x124A, 0x124D, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x1250, 0x1256, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x1258, 0x1258, SC_Ethiopic, GC_Lo, NULL}, // []
{0x125A, 0x125D, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x1260, 0x1288, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x128A, 0x128D, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x1290, 0x12B0, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x12B2, 0x12B5, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x12B8, 0x12BE, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x12C0, 0x12C0, SC_Ethiopic, GC_Lo, NULL}, // []
{0x12C2, 0x12C5, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x12C8, 0x12D6, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x12D8, 0x1310, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x1312, 0x1315, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x1318, 0x135A, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x1380, 0x138F, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x1780, 0x17A2, SC_Khmer, GC_Lo, NULL}, // []..[]
{0x17A5, 0x17A7, SC_Khmer, GC_Lo, NULL}, // []..[]
{0x17A9, 0x17B3, SC_Khmer, GC_Lo, NULL}, // []..[]
{0x17D7, 0x17D7, SC_Khmer, GC_Lm, NULL}, // []
{0x17DC, 0x17DC, SC_Khmer, GC_Lo, NULL}, // []
{0x1C90, 0x1CBA, SC_Georgian, GC_Lu, NULL}, // []..[]
{0x1CBD, 0x1CBF, SC_Georgian, GC_Lu, NULL}, // []..[]
{0x1D00, 0x1D25, SC_Latin, GC_Ll, NULL}, // []..[]
{0x1D27, 0x1D2A, SC_Greek, GC_Ll, NULL}, // []..[]
{0x1D2F, 0x1D2F, SC_Latin, GC_Lm, NULL}, // []
{0x1D3B, 0x1D3B, SC_Latin, GC_Lm, NULL}, // "
{0x1D4E, 0x1D4E, SC_Latin, GC_Lm, NULL}, // τ
{0x1D6B, 0x1D77, SC_Latin, GC_Ll, NULL}, // []..δ
{0x1D79, 0x1D9A, SC_Latin, GC_Ll, NULL}, // []..[]
{0x1E00, 0x1E99, SC_Latin, GC_L, NULL}, // Ḃ..Ṛ
{0x1E9C, 0x1EFF, SC_Latin, GC_L, NULL}, // []..[]
{0x1F01, 0x1F15, SC_Greek, GC_L, NULL}, // ᾀ..ῥ
{0x1F18, 0x1F1D, SC_Greek, GC_Lu, NULL}, // Ξ..Ξ
{0x1F20, 0x1F45, SC_Greek, GC_L, NULL}, // ῀..ῥ
{0x1F48, 0x1F4D, SC_Greek, GC_Lu, NULL}, // Ῐ..Ῐ
{0x1F50, 0x1F57, SC_Greek, GC_Ll, NULL}, // Ὶ..Ί
{0x1F59, 0x1F59, SC_Greek, GC_Lu, NULL}, // ῞
{0x1F5B, 0x1F5B, SC_Greek, GC_Lu, NULL}, // ῠ
{0x1F5D, 0x1F5D, SC_Greek, GC_Lu, NULL}, // ῡ

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{0x1F5F, 0x1F70, SC_Greek, GC_L, NULL}, // ῥ..ῠ
{0x1F72, 0x1F72, SC_Greek, GC_Ll, NULL}, // Ὶ
{0x1F74, 0x1F74, SC_Greek, GC_Ll, NULL}, // ῜
{0x1F76, 0x1F76, SC_Greek, GC_Ll, NULL}, // ῞
{0x1F78, 0x1F78, SC_Greek, GC_Ll, NULL}, // ῠ
{0x1F7A, 0x1F7A, SC_Greek, GC_Ll, NULL}, // ῢ
{0x1F7C, 0x1F7C, SC_Greek, GC_Ll, NULL}, // ῤ
{0x1F80, 0x1FB4, SC_Greek, GC_L, NULL}, // Ῐ..Ῐ
{0x1FB6, 0x1FBA, SC_Greek, GC_L, NULL}, // Ὶ..Ἀ
{0x1FBC, 0x1FBC, SC_Greek, GC_Lt, NULL}, // Ἀ
{0x1FC2, 0x1FC4, SC_Greek, GC_Ll, NULL}, // ῞..῞
{0x1FC6, 0x1FC8, SC_Greek, GC_L, NULL}, // Ὶ..Ἔ
{0x1FCA, 0x1FCA, SC_Greek, GC_Lu, NULL}, // Ἠ
{0x1FCC, 0x1FCC, SC_Greek, GC_Lt, NULL}, // Ἠ
{0x1FD0, 0x1FD2, SC_Greek, GC_Ll, NULL}, // Ὶ..Ὶ
{0x1FD6, 0x1FDA, SC_Greek, GC_L, NULL}, // Ὶ..Ἰ
{0x1FE0, 0x1FE2, SC_Greek, GC_Ll, NULL}, // Ὶ..Ὶ
{0x1FE4, 0x1FEA, SC_Greek, GC_L, NULL}, // ῖ..Υ
{0x1FEC, 0x1FEC, SC_Greek, GC_Lu, NULL}, // Ρ
{0x1FF2, 0x1FF4, SC_Greek, GC_Ll, NULL}, // ῖ..ῖ
{0x1FF6, 0x1FF8, SC_Greek, GC_L, NULL}, // Ὶ..Ὶ
{0x1FFA, 0x1FFA, SC_Greek, GC_Lu, NULL}, // Ὶ
{0x1FFC, 0x1FFC, SC_Greek, GC_Lt, NULL}, // Ϝ
{0x2118, 0x2118, SC_Common, GC_Sm, NULL}, // □
{0x212E, 0x212E, SC_Common, GC_So, NULL}, // e
{0x2C60, 0x2C67, SC_Latin, GC_L, NULL}, // □..□
{0x2C77, 0x2C7B, SC_Latin, GC_Ll, NULL}, // φ..□
{0x2D27, 0x2D27, SC_Georgian, GC_Ll, NULL}, // □
{0x2D2D, 0x2D2D, SC_Georgian, GC_Ll, NULL}, // □
{0x2D80, 0x2D96, SC_Ethiopic, GC_Lo, NULL}, // □..□
{0x2DA0, 0x2DA6, SC_Ethiopic, GC_Lo, NULL}, // □..□
{0x2DA8, 0x2DAE, SC_Ethiopic, GC_Lo, NULL}, // □..□
{0x2DB0, 0x2DB6, SC_Ethiopic, GC_Lo, NULL}, // □..□
{0x2DB8, 0x2DBE, SC_Ethiopic, GC_Lo, NULL}, // □..□
{0x2DC0, 0x2DC6, SC_Ethiopic, GC_Lo, NULL}, // □..□
{0x2DC8, 0x2DCE, SC_Ethiopic, GC_Lo, NULL}, // □..□
{0x2DD0, 0x2DD6, SC_Ethiopic, GC_Lo, NULL}, // □..□
{0x2DD8, 0x2DDE, SC_Ethiopic, GC_Lo, NULL}, // □..□
{0x3005, 0x3005, SC_Han, GC_Lm, NULL}, // □
{0x3007, 0x3007, SC_Han, GC_Nl, NULL}, // □
{0x3021, 0x3029, SC_Han, GC_Nl, NULL}, // □..□
{0x3031, 0x3035, SC_Common, GC_Lm, {SC_Hiragana, SC_Katakana, 0}}, // □..□
{0x303B, 0x303B, SC_Han, GC_Lm, NULL}, // □
{0x3041, 0x3096, SC_Hiragana, GC_Lo, NULL}, // □..□
{0x309D, 0x309E, SC_Hiragana, GC_Lm, NULL}, // □..□
{0x30A1, 0x30FA, SC_Katakana, GC_Lo, NULL}, // □..□

```

```

{0x30FC, 0x30FC, SC_Common, GC_Lm, {SC_Hiragana, SC_Katakana, 0}}, // []
{0x30FE, 0x30FE, SC_Katakana, GC_Lm, NULL}, // []
{0x3105, 0x312D, SC_Bopomofo, GC_Lo, NULL}, // []..[]
{0x312F, 0x312F, SC_Bopomofo, GC_Lo, NULL}, // []
{0x31A0, 0x31BF, SC_Bopomofo, GC_Lo, NULL}, // []..[]
{0x3400, 0x4DBF, SC_Han, GC_Lo, NULL}, // []..[]
{0x4E00, 0x9FFF, SC_Han, GC_Lo, NULL}, // []..[]
{0xA67F, 0xA67F, SC_Cyrillic, GC_Lm, NULL}, // []
{0xA717, 0xA71F, SC_Common, GC_Lm, NULL}, // []..,
{0xA788, 0xA788, SC_Common, GC_Lm, NULL}, // []
{0xA78D, 0xA78E, SC_Latin, GC_L, NULL}, // 4..?
{0xA792, 0xA793, SC_Latin, GC_L, NULL}, // []..[]
{0xA7AA, 0xA7AA, SC_Latin, GC_Lu, NULL}, // H
{0xA7AE, 0xA7AF, SC_Latin, GC_L, NULL}, // []..[]
{0xA7B8, 0xA7CA, SC_Latin, GC_L, NULL}, // []..[]
{0xA7D0, 0xA7D1, SC_Latin, GC_L, NULL}, // []..[]
{0xA7D3, 0xA7D3, SC_Latin, GC_Ll, NULL}, // []
{0xA7D5, 0xA7D9, SC_Latin, GC_L, NULL}, // []..[]
{0xA7FA, 0xA7FA, SC_Latin, GC_Ll, NULL}, // []
{0xA9E7, 0xA9EF, SC_Myanmar, GC_Lo, NULL}, // []..[]
{0xA9FA, 0xA9FE, SC_Myanmar, GC_Lo, NULL}, // []..[]
{0xAA60, 0xAA76, SC_Myanmar, GC_L, NULL}, // []..[]
{0xAA7A, 0xAA7A, SC_Myanmar, GC_Lo, NULL}, // []
{0xAA7E, 0xAA7F, SC_Myanmar, GC_Lo, NULL}, // []..[]
{0xAB01, 0xAB06, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0xAB09, 0xAB0E, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0xAB11, 0xAB16, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0xAB20, 0xAB26, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0xAB28, 0xAB2E, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0xAB66, 0xAB68, SC_Latin, GC_Ll, NULL}, // []..[]
{0xFA0E, 0xFA0F, SC_Han, GC_Lo, NULL}, // []..[]
{0xFA11, 0xFA11, SC_Han, GC_Lo, NULL}, // []
{0xFA13, 0xFA14, SC_Han, GC_Lo, NULL}, // []..[]
{0xFA1F, 0xFA1F, SC_Han, GC_Lo, NULL}, // []
{0xFA21, 0xFA21, SC_Han, GC_Lo, NULL}, // []
{0xFA23, 0xFA24, SC_Han, GC_Lo, NULL}, // []..[]
{0xFA27, 0xFA29, SC_Han, GC_Lo, NULL}, // []..[]
{0xFE73, 0xFE73, SC_Arabic, GC_Lo, NULL}, // []
{0x1B11F, 0x1B11F, SC_Hiragana, GC_Lo, NULL}, // []
{0x1B121, 0x1B122, SC_Katakana, GC_Lo, NULL}, // []..[]
{0x1B150, 0x1B152, SC_Hiragana, GC_Lo, NULL}, // []..[]
{0x1B164, 0x1B167, SC_Katakana, GC_Lo, NULL}, // []..[]
{0x1DF00, 0x1DF1E, SC_Latin, GC_L, NULL}, // []..[]
{0x1E7E0, 0x1E7E6, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x1E7E8, 0x1E7EB, SC_Ethiopic, GC_Lo, NULL}, // []..[]
{0x1E7ED, 0x1E7EE, SC_Ethiopic, GC_Lo, NULL}, // []..[]

```

```

    {0x1E7F0, 0x1E7FE, SC_Ethiopic, GC_Lo, NULL}, // []
    {0x20000, 0x2A6DF, SC_Han, GC_Lo, NULL}, // []
    {0x2A700, 0x2B738, SC_Han, GC_Lo, NULL}, // []
    {0x2B740, 0x2B81D, SC_Han, GC_Lo, NULL}, // []
    {0x2B820, 0x2CEA1, SC_Han, GC_Lo, NULL}, // []
    {0x2CEB0, 0x2EBE0, SC_Han, GC_Lo, NULL}, // []
    {0x30000, 0x3134A, SC_Han, GC_Lo, NULL}, // []
};
// 243 ranges, 93 singles, 95986 codepoints

```

## 15 Appendix B - C26XID\_Continue

Created with mkc26 from libu8ident. *The SCX is modelled as if your compiler would allow static initialization of strings as {char,...,0}.*

```

// Filtering allowed scripts, XID_Continue, !XID_Start, safe IDTypes, NFC,
// MEDIAL from XID_Start and !MARK. Split on GC and SCX
const struct sc_c26 safec26_cont_list[75] = {
    {0x30, 0x39, SC_Common, GC_Nd, NULL}, // 0..9
    {0x5F, 0x5F, SC_Common, GC_Pc, NULL}, // -
    {0xB7, 0xB7, SC_Common, GC_Po, NULL}, // .
    {0x660, 0x669, SC_Arabic, GC_Nd, {SC_Arabic, SC_Thaana, SC_Yezidi, 0}}, // []
    {0x6F0, 0x6F9, SC_Arabic, GC_Nd, NULL}, // []
    {0x966, 0x96F, SC_Devanagari, GC_Nd, {SC_Devanagari, SC_Dogra, SC_Kaithi,
        SC_Mahajani, 0}}, // []
    {0x9E6, 0x9EF, SC_Bengali, GC_Nd, {SC_Bengali, SC_Chakma, SC_Syloti_Nagri, 0}},
    {0xA66, 0xA6F, SC_Gurmukhi, GC_Nd, {SC_Gurmukhi, SC_Multani, 0}}, // []
    {0xAE6, 0xAEF, SC_Gujarati, GC_Nd, {SC_Gujarati, SC_Khojki, 0}}, // []
    {0xB66, 0xB6F, SC_Oriya, GC_Nd, NULL}, // []
    {0xBE6, 0xBEF, SC_Tamil, GC_Nd, {SC_Grantha, SC_Tamil, 0}}, // []
    {0xC66, 0xC6F, SC_Telugu, GC_Nd, NULL}, // []
    {0xCE6, 0xCEF, SC_Kannada, GC_Nd, {SC_Kannada, SC_Nandinagari, 0}}, // []
    {0xD66, 0xD6F, SC_Malayalam, GC_Nd, NULL}, // []
    {0xE50, 0xE59, SC_Thai, GC_Nd, NULL}, // []
    {0xED0, 0xED9, SC_Lao, GC_Nd, NULL}, // []
    {0xF20, 0xF29, SC_Tibetan, GC_Nd, NULL}, // []
    {0x1040, 0x1049, SC_Myanmar, GC_Nd, {SC_Chakma, SC_Myanmar, SC_Tai_Le, 0}},
    {0x1090, 0x1099, SC_Myanmar, GC_Nd, NULL}, // []
    {0x17E0, 0x17E9, SC_Khmer, GC_Nd, NULL}, // []
    {0x203F, 0x2040, SC_Common, GC_Pc, NULL}, // ~
    {0xA9F0, 0xA9F9, SC_Myanmar, GC_Nd, NULL}, // []
    {0xFB55, 0xFB55, SC_Arabic, GC_Lo, NULL}, // 
    {0xFB59, 0xFB59, SC_Arabic, GC_Lo, NULL}, // 
    {0xFB5D, 0xFB5D, SC_Arabic, GC_Lo, NULL}, // 
    {0xFB61, 0xFB61, SC_Arabic, GC_Lo, NULL}, // 
}

```



```

{0xFB65, 0xFB65, SC_Arabic, GC_Lo, NULL}, // 
{0xFB69, 0xFB69, SC_Arabic, GC_Lo, NULL}, // 
{0xFB6D, 0xFB6D, SC_Arabic, GC_Lo, NULL}, // 
{0xFB71, 0xFB71, SC_Arabic, GC_Lo, NULL}, // 
{0xFB75, 0xFB75, SC_Arabic, GC_Lo, NULL}, // 
{0xFB79, 0xFB79, SC_Arabic, GC_Lo, NULL}, // 
{0xFB7D, 0xFB7D, SC_Arabic, GC_Lo, NULL}, // 
{0xFB81, 0xFB81, SC_Arabic, GC_Lo, NULL}, // 
{0xFB91, 0xFB91, SC_Arabic, GC_Lo, NULL}, // 
{0xFB95, 0xFB95, SC_Arabic, GC_Lo, NULL}, // 
{0xFB99, 0xFB99, SC_Arabic, GC_Lo, NULL}, // 
{0xFB9D, 0xFB9D, SC_Arabic, GC_Lo, NULL}, // 
{0xFBA3, 0xFBA3, SC_Arabic, GC_Lo, NULL}, // 
{0xFBA9, 0xFBA9, SC_Arabic, GC_Lo, NULL}, // 
{0xFBAD, 0xFBAD, SC_Arabic, GC_Lo, NULL}, // 
{0xFBD6, 0xFBD6, SC_Arabic, GC_Lo, NULL}, // 
{0xFBE7, 0xFBE7, SC_Arabic, GC_Lo, NULL}, // 
{0xFBE9, 0xFBE9, SC_Arabic, GC_Lo, NULL}, // 
{0xFBFF, 0xFBFF, SC_Arabic, GC_Lo, NULL}, // 
{0xFCDF, 0xFCF4, SC_Arabic, GC_Lo, NULL}, // 
{0xFD34, 0xFD3B, SC_Arabic, GC_Lo, NULL}, // 
{0xFE77, 0xFE77, SC_Arabic, GC_Lo, NULL}, // 
{0xFE79, 0xFE79, SC_Arabic, GC_Lo, NULL}, // 
{0xFE7B, 0xFE7B, SC_Arabic, GC_Lo, NULL}, // 
{0xFE7D, 0xFE7D, SC_Arabic, GC_Lo, NULL}, // 
{0xFE7F, 0xFE7F, SC_Arabic, GC_Lo, NULL}, // 
{0xFE8C, 0xFE8C, SC_Arabic, GC_Lo, NULL}, // 
{0xFE92, 0xFE92, SC_Arabic, GC_Lo, NULL}, // 
{0xFE98, 0xFE98, SC_Arabic, GC_Lo, NULL}, // 
{0xFE9C, 0xFE9C, SC_Arabic, GC_Lo, NULL}, // 
{0xFEA0, 0xFEA0, SC_Arabic, GC_Lo, NULL}, // 
{0xFEA4, 0xFEA4, SC_Arabic, GC_Lo, NULL}, // 
{0xFEA8, 0xFEA8, SC_Arabic, GC_Lo, NULL}, // 
{0xFEB4, 0xFEB4, SC_Arabic, GC_Lo, NULL}, // 
{0xFEB8, 0xFEB8, SC_Arabic, GC_Lo, NULL}, // 
{0xFEBF, 0xFEBF, SC_Arabic, GC_Lo, NULL}, // 
{0xFEC0, 0xFEC0, SC_Arabic, GC_Lo, NULL}, // 
{0xFEC4, 0xFEC4, SC_Arabic, GC_Lo, NULL}, // 
{0xFEC8, 0xFEC8, SC_Arabic, GC_Lo, NULL}, // 
{0xFECC, 0xFECC, SC_Arabic, GC_Lo, NULL}, // 
{0xFED0, 0xFED0, SC_Arabic, GC_Lo, NULL}, // 
{0xFED4, 0xFED4, SC_Arabic, GC_Lo, NULL}, // 
{0xFED8, 0xFED8, SC_Arabic, GC_Lo, NULL}, // 
{0xFEDC, 0xFEDC, SC_Arabic, GC_Lo, NULL}, // 
{0xFEE0, 0xFEE0, SC_Arabic, GC_Lo, NULL}, // 
{0xFEE4, 0xFEE4, SC_Arabic, GC_Lo, NULL}, // 

```



```

    {0xFEE8, 0xFEE8, SC_Arabic, GC_Lo, NULL}, // ☐
    {0xFEED, 0xFEED, SC_Arabic, GC_Lo, NULL}, // ☐
    {0xFEFA, 0xFEFA, SC_Arabic, GC_Lo, NULL}, // ☐
};
// 22 ranges, 53 singles, 200 codepoints

```

## 16 Appendix C - XID\_Continue # Lm

Needed for TR39#5.4 and TR31#2.2

67 matches for “XID\_Continue # Lm” in buffer: DerivedCoreProperties.txt

|            |                     |   |
|------------|---------------------|---|
| 02B0..02C1 | ; XID_Continue # Lm | [18] MODIFIER LETTER SMALL H..<br>MODIFIER LETTER REVERSED GLOTTAL STOP           |
| 02C6..02D1 | ; XID_Continue # Lm | [12] MODIFIER LETTER CIRCUMFLEX ACCENT..<br>MODIFIER LETTER HALF TRIANGULAR COLON |
| 02E0..02E4 | ; XID_Continue # Lm | [5] MODIFIER LETTER SMALL GAMMA..<br>MODIFIER LETTER SMALL REVERSED GLOTTAL STOP  |
| 02EC       | ; XID_Continue # Lm | MODIFIER LETTER VOICING   |
| 02EE       | ; XID_Continue # Lm | MODIFIER LETTER DOUBLE APOSTROPHE   |
| 0374       | ; XID_Continue # Lm | GREEK NUMERAL SIGN  |
| 0559       | ; XID_Continue # Lm | ARMENIAN MODIFIER LETTER LEFT HALF RING   |
| 0640       | ; XID_Continue # Lm | ARABIC TATWEEL  |
| 06E5..06E6 | ; XID_Continue # Lm | [2] ARABIC SMALL WAW..<br>ARABIC SMALL YEH  |
| 07F4..07F5 | ; XID_Continue # Lm | [2] NKO HIGH TONE APOSTROPHE..<br>NKO LOW TONE APOSTROPHE                         |
| 07FA       | ; XID_Continue # Lm | NKO LAJANYALAN  |
| 081A       | ; XID_Continue # Lm | SAMARITAN MODIFIER LETTER EPENTHETIC YUT  |
| 0824       | ; XID_Continue # Lm | SAMARITAN MODIFIER LETTER SHORT A   |
| 0828       | ; XID_Continue # Lm | SAMARITAN MODIFIER LETTER I   |
| 08C9       | ; XID_Continue # Lm | ARABIC SMALL FARSI YEH  |
| 0971       | ; XID_Continue # Lm | DEVANAGARI SIGN HIGH SPACING DOT  |
| 0E46       | ; XID_Continue # Lm | THAI CHARACTER MAIYAMOK   |
| 0EC6       | ; XID_Continue # Lm | LAO KO LA   |
| 10FC       | ; XID_Continue # Lm | MODIFIER LETTER GEORGIAN NAR  |
| 17D7       | ; XID_Continue # Lm | KHMER SIGN LEK TOO  |
| 1843       | ; XID_Continue # Lm | MONGOLIAN LETTER TODO LONG VOWEL SIGN   |
| 1AA7       | ; XID_Continue # Lm | TAI THAM SIGN MAI YAMOK   |
| 1C78..1C7D | ; XID_Continue # Lm | [6] OL CHIKI MU TTUDDAG..OL CHIKI AHAD  |
| 1D2C..1D6A | ; XID_Continue # Lm | [63] MODIFIER LETTER CAPITAL A..<br>GREEK SUBSCRIPT SMALL LETTER CHI              |
| 1D78       | ; XID_Continue # Lm | MODIFIER LETTER CYRILLIC EN   |
| 1D9B..1DBF | ; XID_Continue # Lm | [37] MODIFIER LETTER SMALL TURNED ALPHA..<br>MODIFIER LETTER SMALL THETA          |

|              |                     |      |   |
|--------------|---------------------|------|---|
| 2071         | ; XID_Continue # Lm |      | SUPERSCRIPIT LATIN SMALL LETTER I   |
| 207F         | ; XID_Continue # Lm |      | SUPERSCRIPIT LATIN SMALL LETTER N   |
| 2090..209C   | ; XID_Continue # Lm | [13] | LATIN SUBSCRIPT SMALL LETTER A..<br>LATIN SUBSCRIPT SMALL LETTER T            |
| 2C7C..2C7D   | ; XID_Continue # Lm | [2]  | LATIN SUBSCRIPT SMALL LETTER J..<br>MODIFIER LETTER CAPITAL V                 |
| 2D6F         | ; XID_Continue # Lm |      | TIFINAGH MODIFIER LETTER LABIALIZATION MARK                                   |
| 3005         | ; XID_Continue # Lm |      | IDEOGRAPHIC ITERATION MARK  |
| 3031..3035   | ; XID_Continue # Lm | [5]  | VERTICAL KANA REPEAT MARK..<br>VERTICAL KANA REPEAT MARK LOWER HALF           |
| 303B         | ; XID_Continue # Lm |      | VERTICAL IDEOGRAPHIC ITERATION MARK   |
| 309D..309E   | ; XID_Continue # Lm | [2]  | HIRAGANA ITERATION MARK..<br>HIRAGANA VOICED ITERATION MARK                   |
| 30FC..30FE   | ; XID_Continue # Lm | [3]  | KATAKANA-HIRAGANA PROLONGED SOUND MARK..<br>KATAKANA VOICED ITERATION MARK    |
| A015         | ; XID_Continue # Lm |      | YI SYLLABLE WU  |
| A4F8..A4FD   | ; XID_Continue # Lm | [6]  | LISU LETTER TONE MYA TI..<br>LISU LETTER TONE MYA JEU                         |
| A60C         | ; XID_Continue # Lm |      | VAI SYLLABLE LENGTHENER   |
| A67F         | ; XID_Continue # Lm |      | CYRILLIC PAYEROK  |
| A69C..A69D   | ; XID_Continue # Lm | [2]  | MODIFIER LETTER CYRILLIC HARD SIGN..<br>MODIFIER LETTER CYRILLIC SOFT SIGN    |
| A717..A71F   | ; XID_Continue # Lm | [9]  | MODIFIER LETTER DOT VERTICAL BAR..<br>LOW INVERTED EXCLAMATION MARK           |
| A770         | ; XID_Continue # Lm |      | MODIFIER LETTER US  |
| A788         | ; XID_Continue # Lm |      | MODIFIER LETTER LOW CIRCUMFLEX ACCENT   |
| A7F2..A7F4   | ; XID_Continue # Lm | [3]  | MODIFIER LETTER CAPITAL C..<br>MODIFIER LETTER CAPITAL Q                      |
| A7F8..A7F9   | ; XID_Continue # Lm | [2]  | MODIFIER LETTER CAPITAL H WITH STROKE..<br>MODIFIER LETTER SMALL LIGATURE OE  |
| A9CF         | ; XID_Continue # Lm |      | JAVANESE PANGRANGKEP  |
| A9E6         | ; XID_Continue # Lm |      | MYANMAR MODIFIER LETTER SHAN REDUPLICATION                                    |
| AA70         | ; XID_Continue # Lm |      | MYANMAR MODIFIER LETTER KHAMTI REDUPLICATION                                  |
| AADD         | ; XID_Continue # Lm |      | TAI VIET SYMBOL SAM   |
| AAF3..AAF4   | ; XID_Continue # Lm | [2]  | MEETEI MAYEK SYLLABLE REPETITION MARK..<br>MEETEI MAYEK WORD REPETITION MARK  |
| AB5C..AB5F   | ; XID_Continue # Lm | [4]  | MODIFIER LETTER SMALL HENG..<br>MODIFIER LETTER SMALL U WITH LEFT HOOK        |
| AB69         | ; XID_Continue # Lm |      | MODIFIER LETTER SMALL TURNED W  |
| FF70         | ; XID_Continue # Lm |      | HALFWIDTH KATA-HIRA PROLONGED SOUND MARK                                      |
| FF9E..FF9F   | ; XID_Continue # Lm | [2]  | HALFWIDTH KATAKANA VOICED SOUND MARK..<br>SEMI-VOICED SOUND MARK              |
| 10780..10785 | ; XID_Continue # Lm | [6]  | MODIFIER LETTER SMALL CAPITAL AA..<br>MODIFIER LETTER SMALL B WITH HOOK       |
| 10787..107B0 | ; XID_Continue # Lm | [42] | MODIFIER LETTER SMALL DZ DIGRAPH..<br>MODIFIER LETTER SMALL V WITH RIGHT HOOK |

|              |                     |  |
|--------------|---------------------|--|
| 107B2..107BA | ; XID_Continue # Lm | [9] MODIFIER LETTER SMALL CAPITAL Y..<br>MODIFIER LETTER SMALL S WITH CURL                 |
| 16B40..16B43 | ; XID_Continue # Lm | [4] PAHAH HMONG SIGN VOS SEEV..<br>PAHAH HMONG SIGN IB YAM                                 |
| 16F93..16F9F | ; XID_Continue # Lm | [13] MIAO LETTER TONE-2..<br>MIAO LETTER REFORMED TONE-8                                   |
| 16FE0..16FE1 | ; XID_Continue # Lm | [2] TANGUT ITERATION MARK..<br>NUSHU ITERATION MARK  |
| 16FE3        | ; XID_Continue # Lm | OLD CHINESE ITERATION MARK   |
| 1AFF0..1AFF3 | ; XID_Continue # Lm | [4] KATAKANA LETTER MINNAN TONE-2..<br>KATAKANA LETTER MINNAN TONE-5                       |
| 1AFF5..1AFFB | ; XID_Continue # Lm | [7] KATAKANA LETTER MINNAN TONE-7..<br>KATAKANA LETTER MINNAN NASALIZED TONE-5             |
| 1AFFD..1AFFE | ; XID_Continue # Lm | [2] KATAKANA LETTER MINNAN NASALIZED TONE-7..<br>KATAKANA LETTER MINNAN NASALIZED TONE-8   |
| 1E137..1E13D | ; XID_Continue # Lm | [7] NYIAKENG PUACHUE HMONG SIGN FOR PERSON..<br>NYIAKENG PUACHUE HMONG SYLLABLE LENGTHENER |
| 1E94B        | ; XID_Continue # Lm | ADLAM NASALIZATION MARK  |

## 17 Appendix D - XID\_Continue # M

Needed for TR39#5.4

513 matches for "XID\_Continue # M" in buffer: DerivedCoreProperties.txt

|            |                     |   |
|------------|---------------------|---|
| 0300..036F | ; XID_Continue # Mn | [112] COMBINING GRAVE ACCENT..<br>COMBINING LATIN SMALL LETTER X            |
| 0483..0487 | ; XID_Continue # Mn | [5] COMBINING CYRILLIC TITLO..<br>COMBINING CYRILLIC POKRYTIE               |
| 0591..05BD | ; XID_Continue # Mn | [45] HEBREW ACCENT ETNAHTA..<br>HEBREW POINT METEG                          |
| 05BF       | ; XID_Continue # Mn | HEBREW POINT RAFA   |
| 05C1..05C2 | ; XID_Continue # Mn | [2] HEBREW POINT SHIN DOT..<br>HEBREW POINT SIN DOT                         |
| 05C4..05C5 | ; XID_Continue # Mn | [2] HEBREW MARK UPPER DOT..<br>HEBREW MARK LOWER DOT                        |
| 05C7       | ; XID_Continue # Mn | HEBREW POINT QAMATS QATAN   |
| 0610..061A | ; XID_Continue # Mn | [11] ARABIC SIGN SALLALLAHOU ALAYHE WASSALLAM..<br>ARABIC SMALL KASRA       |
| 064B..065F | ; XID_Continue # Mn | [21] ARABIC FATHATAN..<br>ARABIC WAVY HAMZA BELOW                           |
| 0670       | ; XID_Continue # Mn | ARABIC LETTER SUPERSCRIPT ALEF  |
| 06D6..06DC | ; XID_Continue # Mn | [7] ARABIC SMALL HIGH LIGATURE SAD WITH LAM<br>WITH ALEF MAKSURA..HIGH SEEN |
| 06DF..06E4 | ; XID_Continue # Mn | [6] ARABIC SMALL HIGH ROUNDED ZERO..MADDA                                   |

|            |                     |   |
|------------|---------------------|---|
| 06E7..06E8 | ; XID_Continue # Mn | [2] ARABIC SMALL HIGH YEH..NOON                                       |
| 06EA..06ED | ; XID_Continue # Mn | [4] ARABIC EMPTY CENTRE LOW STOP..MEEM                                |
| 0711       | ; XID_Continue # Mn | SYRIAC LETTER SUPERScript ALAPH                                       |
| 0730..074A | ; XID_Continue # Mn | [27] SYRIAC PTHAHA ABOVE..BARREKH                                     |
| 07A6..07B0 | ; XID_Continue # Mn | [11] THAANA ABAFILI..THAANA SUKUN                                     |
| 07EB..07F3 | ; XID_Continue # Mn | [9] NKO COMBINING SHORT HIGH TONE..<br>NKO COMBINING DOUBLE DOT ABOVE |
| 07FD       | ; XID_Continue # Mn | NKO DANTAYALAN  |
| 0816..0819 | ; XID_Continue # Mn | [4] SAMARITAN MARK IN..<br>SAMARITAN MARK DAGESH                      |
| 081B..0823 | ; XID_Continue # Mn | [9] SAMARITAN MARK EPENTHETIC YUT..<br>SAMARITAN VOWEL SIGN A         |
| 0825..0827 | ; XID_Continue # Mn | [3] SAMARITAN VOWEL SIGN SHORT A..SIGN U                              |
| 0829..082D | ; XID_Continue # Mn | [5] SAMARITAN VOWEL SIGN LONG I..<br>SAMARITAN MARK NEQUDAA           |
| 0859..085B | ; XID_Continue # Mn | [3] MANDAIC AFFRICATION MARK..<br>MANDAIC GEMINATION MARK             |
| 0898..089F | ; XID_Continue # Mn | [8] ARABIC SMALL HIGH WORD AL-JUZ..<br>ARABIC HALF MADDA OVER MADDA   |
| 08CA..08E1 | ; XID_Continue # Mn | [24] ARABIC SMALL HIGH FARSI YEH..<br>ARABIC SMALL HIGH SIGN SAFHA    |
| 08E3..0902 | ; XID_Continue # Mn | [32] ARABIC TURNED DAMMA BELOW..<br>DEVANAGARI SIGN ANUSVARA          |
| 0903       | ; XID_Continue # Mc | DEVANAGARI SIGN VISARGA   |
| 093A       | ; XID_Continue # Mn | DEVANAGARI VOWEL SIGN OE  |
| 093B       | ; XID_Continue # Mc | DEVANAGARI VOWEL SIGN OOE   |
| 093C       | ; XID_Continue # Mn | DEVANAGARI SIGN NUKTA   |
| 093E..0940 | ; XID_Continue # Mc | [3] DEVANAGARI VOWEL SIGN AA..II                                      |
| 0941..0948 | ; XID_Continue # Mn | [8] DEVANAGARI VOWEL SIGN U..AI                                       |
| 0949..094C | ; XID_Continue # Mc | [4] DEVANAGARI VOWEL SIGN CANDRA 0..AU                                |
| 094D       | ; XID_Continue # Mn | DEVANAGARI SIGN VIRAMA  |
| 094E..094F | ; XID_Continue # Mc | [2] DEVANAGARI VOWEL SIGN PRISHTHAMATRA E..AW                         |
| 0951..0957 | ; XID_Continue # Mn | [7] DEVANAGARI STRESS SIGN UDATTA..<br>DEVANAGARI VOWEL SIGN UUE      |
| 0962..0963 | ; XID_Continue # Mn | [2] DEVANAGARI VOWEL SIGN VOCALIC L..LL                               |
| 0981       | ; XID_Continue # Mn | BENGALI SIGN CANDRABINDU  |
| 0982..0983 | ; XID_Continue # Mc | [2] BENGALI SIGN ANUSVARA..VISARGA                                    |
| 09BC       | ; XID_Continue # Mn | BENGALI SIGN NUKTA  |
| 09BE..09C0 | ; XID_Continue # Mc | [3] BENGALI VOWEL SIGN AA..II   |
| 09C1..09C4 | ; XID_Continue # Mn | [4] BENGALI VOWEL SIGN U..VOCALIC RR                                  |
| 09C7..09C8 | ; XID_Continue # Mc | [2] BENGALI VOWEL SIGN E..AI  |
| 09CB..09CC | ; XID_Continue # Mc | [2] BENGALI VOWEL SIGN O..AU  |
| 09CD       | ; XID_Continue # Mn | BENGALI SIGN VIRAMA   |
| 09D7       | ; XID_Continue # Mc | BENGALI AU LENGTH MARK  |
| 09E2..09E3 | ; XID_Continue # Mn | [2] BENGALI VOWEL SIGN VOCALIC L..LL                                  |
| 09FE       | ; XID_Continue # Mn | BENGALI SANDHI MARK   |

|            |                     |   |
|------------|---------------------|---|
| 0A01..0A02 | ; XID_Continue # Mn | [2] GURMUKHI SIGN ADAK BINDI..BINDI                               |
| 0A03       | ; XID_Continue # Mc | GURMUKHI SIGN VISARGA   |
| 0A3C       | ; XID_Continue # Mn | GURMUKHI SIGN NUKTA   |
| 0A3E..0A40 | ; XID_Continue # Mc | [3] GURMUKHI VOWEL SIGN AA..II                                    |
| 0A41..0A42 | ; XID_Continue # Mn | [2] GURMUKHI VOWEL SIGN U..UU                                     |
| 0A47..0A48 | ; XID_Continue # Mn | [2] GURMUKHI VOWEL SIGN EE..AI                                    |
| 0A4B..0A4D | ; XID_Continue # Mn | [3] GURMUKHI VOWEL SIGN OO..<br>GURMUKHI SIGN VIRAMA              |
| 0A51       | ; XID_Continue # Mn | GURMUKHI SIGN UDAAT   |
| 0A70..0A71 | ; XID_Continue # Mn | [2] GURMUKHI TIPPI..GURMUKHI ADDAK                                |
| 0A75       | ; XID_Continue # Mn | GURMUKHI SIGN YAKASH  |
| 0A81..0A82 | ; XID_Continue # Mn | [2] GUJARATI SIGN CANDRABINDU..<br>GUJARATI SIGN ANUSVARA         |
| 0A83       | ; XID_Continue # Mc | GUJARATI SIGN VISARGA   |
| 0ABC       | ; XID_Continue # Mn | GUJARATI SIGN NUKTA   |
| 0ABE..0AC0 | ; XID_Continue # Mc | [3] GUJARATI VOWEL SIGN AA..II                                    |
| 0AC1..0AC5 | ; XID_Continue # Mn | [5] GUJARATI VOWEL SIGN U..CANDRA E                               |
| 0AC7..0AC8 | ; XID_Continue # Mn | [2] GUJARATI VOWEL SIGN E..AI                                     |
| 0AC9       | ; XID_Continue # Mc | GUJARATI VOWEL SIGN CANDRA O                                      |
| 0ACB..0ACC | ; XID_Continue # Mc | [2] GUJARATI VOWEL SIGN O..AU                                     |
| 0ACD       | ; XID_Continue # Mn | GUJARATI SIGN VIRAMA  |
| 0AE2..0AE3 | ; XID_Continue # Mn | [2] GUJARATI VOWEL SIGN VOCALIC L..LL                             |
| 0AFA..0AFF | ; XID_Continue # Mn | [6] GUJARATI SIGN SUKUN..<br>GUJARATI SIGN TWO-CIRCLE NUKTA ABOVE |
| 0B01       | ; XID_Continue # Mn | ORIYA SIGN CANDRABINDU  |
| 0B02..0B03 | ; XID_Continue # Mc | [2] ORIYA SIGN ANUSVARA..<br>ORIYA SIGN VISARGA                   |
| 0B3C       | ; XID_Continue # Mn | ORIYA SIGN NUKTA  |
| 0B3E       | ; XID_Continue # Mc | ORIYA VOWEL SIGN AA   |
| 0B3F       | ; XID_Continue # Mn | ORIYA VOWEL SIGN I  |
| 0B40       | ; XID_Continue # Mc | ORIYA VOWEL SIGN II   |
| 0B41..0B44 | ; XID_Continue # Mn | [4] ORIYA VOWEL SIGN U..VOCALIC RR                                |
| 0B47..0B48 | ; XID_Continue # Mc | [2] ORIYA VOWEL SIGN E..AI  |
| 0B4B..0B4C | ; XID_Continue # Mc | [2] ORIYA VOWEL SIGN O..AU  |
| 0B4D       | ; XID_Continue # Mn | ORIYA SIGN VIRAMA   |
| 0B55..0B56 | ; XID_Continue # Mn | [2] ORIYA SIGN OVERLINE..<br>ORIYA AI LENGTH MARK                 |
| 0B57       | ; XID_Continue # Mc | ORIYA AU LENGTH MARK  |
| 0B62..0B63 | ; XID_Continue # Mn | [2] ORIYA VOWEL SIGN VOCALIC L..LL                                |
| 0B82       | ; XID_Continue # Mn | TAMIL SIGN ANUSVARA   |
| 0BBE..0BBF | ; XID_Continue # Mc | [2] TAMIL VOWEL SIGN AA..I  |
| 0BC0       | ; XID_Continue # Mn | TAMIL VOWEL SIGN II   |
| 0BC1..0BC2 | ; XID_Continue # Mc | [2] TAMIL VOWEL SIGN U..UU  |
| 0BC6..0BC8 | ; XID_Continue # Mc | [3] TAMIL VOWEL SIGN E..AI  |
| 0BCA..0BCC | ; XID_Continue # Mc | [3] TAMIL VOWEL SIGN O..AU  |
| 0BCD       | ; XID_Continue # Mn | TAMIL SIGN VIRAMA   |

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|------------|---------------------|--|
| 0BD7       | ; XID_Continue # Mc | TAMIL AU LENGTH MARK   |
| 0C00       | ; XID_Continue # Mn | TELUGU SIGN COMBINING CANDRABINDU ABOVE                      |
| 0C01..0C03 | ; XID_Continue # Mc | [3] TELUGU SIGN CANDRABINDU..VISARGA                         |
| 0C04       | ; XID_Continue # Mn | TELUGU SIGN COMBINING ANUSVARA ABOVE                         |
| 0C3C       | ; XID_Continue # Mn | TELUGU SIGN NUKTA  |
| 0C3E..0C40 | ; XID_Continue # Mn | [3] TELUGU VOWEL SIGN AA..II                                 |
| 0C41..0C44 | ; XID_Continue # Mc | [4] TELUGU VOWEL SIGN U..VOCALIC RR                          |
| 0C46..0C48 | ; XID_Continue # Mn | [3] TELUGU VOWEL SIGN E..AI                                  |
| 0C4A..0C4D | ; XID_Continue # Mn | [4] TELUGU VOWEL SIGN O..SIGN VIRAMA                         |
| 0C55..0C56 | ; XID_Continue # Mn | [2] TELUGU LENGTH MARK..AI LENGTH MARK                       |
| 0C62..0C63 | ; XID_Continue # Mn | [2] TELUGU VOWEL SIGN VOCALIC L..LL                          |
| 0C81       | ; XID_Continue # Mn | KANNADA SIGN CANDRABINDU                                     |
| 0C82..0C83 | ; XID_Continue # Mc | [2] KANNADA SIGN ANUSVARA..VISARGA                           |
| 0CBC       | ; XID_Continue # Mn | KANNADA SIGN NUKTA   |
| 0CBE       | ; XID_Continue # Mc | KANNADA VOWEL SIGN AA  |
| 0CBF       | ; XID_Continue # Mn | KANNADA VOWEL SIGN I   |
| 0CC0..0CC4 | ; XID_Continue # Mc | [5] KANNADA VOWEL SIGN II..VOCALIC RR                        |
| 0CC6       | ; XID_Continue # Mn | KANNADA VOWEL SIGN E   |
| 0CC7..0CC8 | ; XID_Continue # Mc | [2] KANNADA VOWEL SIGN EE..AI                                |
| 0CCA..0CCB | ; XID_Continue # Mc | [2] KANNADA VOWEL SIGN O..OO                                 |
| 0CCC..0CCD | ; XID_Continue # Mn | [2] KANNADA VOWEL SIGN AU..VIRAMA                            |
| 0CD5..0CD6 | ; XID_Continue # Mc | [2] KANNADA LENGTH MARK..AI LENGTH MARK                      |
| 0CE2..0CE3 | ; XID_Continue # Mn | [2] KANNADA VOWEL SIGN VOCALIC L..LL                         |
| 0D00..0D01 | ; XID_Continue # Mn | [2] MALAYALAM SIGN COMBINING ANUSVARA ABOVE..<br>CANDRABINDU |
| 0D02..0D03 | ; XID_Continue # Mc | [2] MALAYALAM SIGN ANUSVARA..VISARGA                         |
| 0D3B..0D3C | ; XID_Continue # Mn | [2] MALAYALAM SIGN VERTICAL BAR VIRAMA..<br>CIRCULAR VIRAMA  |
| 0D3E..0D40 | ; XID_Continue # Mc | [3] MALAYALAM VOWEL SIGN AA..II                              |
| 0D41..0D44 | ; XID_Continue # Mn | [4] MALAYALAM VOWEL SIGN U..VOCALIC RR                       |
| 0D46..0D48 | ; XID_Continue # Mc | [3] MALAYALAM VOWEL SIGN E..AI                               |
| 0D4A..0D4C | ; XID_Continue # Mc | [3] MALAYALAM VOWEL SIGN O..AU                               |
| 0D4D       | ; XID_Continue # Mn | MALAYALAM SIGN VIRAMA  |
| 0D57       | ; XID_Continue # Mc | MALAYALAM AU LENGTH MARK                                     |
| 0D62..0D63 | ; XID_Continue # Mn | [2] MALAYALAM VOWEL SIGN VOCALIC L..LL                       |
| 0D81       | ; XID_Continue # Mn | SINHALA SIGN CANDRABINDU                                     |
| 0D82..0D83 | ; XID_Continue # Mc | [2] SINHALA SIGN ANUSVARAYA..VISARGAYA                       |
| 0DCA       | ; XID_Continue # Mn | SINHALA SIGN AL-LAKUNA                                       |
| 0DCF..0DD1 | ; XID_Continue # Mc | [3] SINHALA VOWEL SIGN AELA-PILLA..<br>DIGA AEDA-PILLA       |
| 0DD2..0DD4 | ; XID_Continue # Mn | [3] SINHALA VOWEL SIGN KETTI IS-PILLA..<br>PAA-PILLA         |
| 0DD6       | ; XID_Continue # Mn | SINHALA VOWEL SIGN DIGA PAA-PILLA                            |
| 0DD8..0DDF | ; XID_Continue # Mc | [8] SINHALA VOWEL SIGN GAETTA-PILLA..<br>GAYANUKITTA         |
| 0DF2..0DF3 | ; XID_Continue # Mc | [2] SINHALA VOWEL SIGN DIGA GAETTA-PILLA..                   |

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| 0E31       | ; XID_Continue # Mn | GAYANUKITTA                                   |
| 0E34..0E3A | ; XID_Continue # Mn | THAI CHARACTER MAI HAN-AKAT                   |
| 0E47..0E4E | ; XID_Continue # Mn | [7] THAI CHARACTER SARA I..PHINTHU            |
| 0EB1       | ; XID_Continue # Mn | [8] THAI CHARACTER MAITAIKHU..YAMAKKAN        |
| 0EB4..0EBC | ; XID_Continue # Mn | LAO VOWEL SIGN MAI KAN                        |
| 0EC8..0ECD | ; XID_Continue # Mn | [9] LAO VOWEL SIGN I..SEMIVOWEL SIGN LO       |
| 0F18..0F19 | ; XID_Continue # Mn | [6] LAO TONE MAI EK..NIGGAHITA                |
|            |                     | [2] TIBETAN ASTROLOGICAL SIGN -KHYUD PA..     |
|            |                     | SDONG TSHUGS                                  |
| 0F35       | ; XID_Continue # Mn | TIBETAN MARK NGAS BZUNG NYI ZLA               |
| 0F37       | ; XID_Continue # Mn | TIBETAN MARK NGAS BZUNG SGOR RTAGS            |
| 0F39       | ; XID_Continue # Mn | TIBETAN MARK TSA -PHRU                        |
| 0F3E..0F3F | ; XID_Continue # Mc | [2] TIBETAN SIGN YAR TSHES..MAR TSHES         |
| 0F71..0F7E | ; XID_Continue # Mn | [14] TIBETAN VOWEL SIGN AA..RJES SU NGA RO    |
| 0F7F       | ; XID_Continue # Mc | TIBETAN SIGN RNAM BCAD                        |
| 0F80..0F84 | ; XID_Continue # Mn | [5] TIBETAN VOWEL SIGN REVERSED I..           |
|            |                     | MARK HALANTA                                  |
| 0F86..0F87 | ; XID_Continue # Mn | [2] TIBETAN SIGN LCI RTAGS..YANG RTAGS        |
| 0F8D..0F97 | ; XID_Continue # Mn | [11] TIBETAN SUBJOINED SIGN LCE TSA CAN..     |
|            |                     | LETTER JA                                     |
| 0F99..0FBC | ; XID_Continue # Mn | [36] TIBETAN SUBJOINED LETTER NYA..           |
|            |                     | FIXED-FORM RA                                 |
| 0FC6       | ; XID_Continue # Mn | TIBETAN SYMBOL PADMA GDAN                     |
| 102B..102C | ; XID_Continue # Mc | [2] MYANMAR VOWEL SIGN TALL AA..AA            |
| 102D..1030 | ; XID_Continue # Mn | [4] MYANMAR VOWEL SIGN I..UU                  |
| 1031       | ; XID_Continue # Mc | MYANMAR VOWEL SIGN E                          |
| 1032..1037 | ; XID_Continue # Mn | [6] MYANMAR VOWEL SIGN AI..DOT BELOW          |
| 1038       | ; XID_Continue # Mc | MYANMAR SIGN VISARGA                          |
| 1039..103A | ; XID_Continue # Mn | [2] MYANMAR SIGN VIRAMA..ASAT                 |
| 103B..103C | ; XID_Continue # Mc | [2] MYANMAR CONSONANT SIGN MEDIAL YA..RA      |
| 103D..103E | ; XID_Continue # Mn | [2] MYANMAR CONSONANT SIGN MEDIAL WA..HA      |
| 1056..1057 | ; XID_Continue # Mc | [2] MYANMAR VOWEL SIGN VOCALIC R..RR          |
| 1058..1059 | ; XID_Continue # Mn | [2] MYANMAR VOWEL SIGN VOCALIC L..LL          |
| 105E..1060 | ; XID_Continue # Mn | [3] MYANMAR CONSONANT SIGN MON MEDIAL NA..LA  |
| 1062..1064 | ; XID_Continue # Mc | [3] MYANMAR VOWEL SIGN SGAW KAREN EU..KE PHO  |
| 1067..106D | ; XID_Continue # Mc | [7] MYANMAR VOWEL SIGN WESTERN PWO KAREN EU.. |
|            |                     | TONE-5  |
| 1071..1074 | ; XID_Continue # Mn | [4] MYANMAR VOWEL SIGN GEBA KAREN I..KAYAH EE |
| 1082       | ; XID_Continue # Mn | MYANMAR CONSONANT SIGN SHAN MEDIAL WA         |
| 1083..1084 | ; XID_Continue # Mc | [2] MYANMAR VOWEL SIGN SHAN AA..E             |
| 1085..1086 | ; XID_Continue # Mn | [2] MYANMAR VOWEL SIGN SHAN E ABOVE..FINAL Y  |
| 1087..108C | ; XID_Continue # Mc | [6] MYANMAR SIGN SHAN TONE-2..TONE-3          |
| 108D       | ; XID_Continue # Mn | MYANMAR SIGN SHAN COUNCIL EMPHATIC TONE       |
| 108F       | ; XID_Continue # Mc | MYANMAR SIGN RUMAI PALAUNG TONE-5             |
| 109A..109C | ; XID_Continue # Mc | [3] MYANMAR SIGN KHAMTI TONE-1..AITON A       |
| 109D       | ; XID_Continue # Mn | MYANMAR VOWEL SIGN AITON AI                   |

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| 135D..135F | ; XID_Continue # Mn | [3] ETHIOPIC COMBINING GEMINATION AND VOWEL LENGTH MARK..MARK |
| 1712..1714 | ; XID_Continue # Mn | [3] TAGALOG VOWEL SIGN I..VIRAMA                              |
| 1715       | ; XID_Continue # Mc | TAGALOG SIGN PAMUDPOD   |
| 1732..1733 | ; XID_Continue # Mn | [2] HANUNOO VOWEL SIGN I..U                                   |
| 1734       | ; XID_Continue # Mc | HANUNOO SIGN PAMUDPOD   |
| 1752..1753 | ; XID_Continue # Mn | [2] BUHID VOWEL SIGN I..U                                     |
| 1772..1773 | ; XID_Continue # Mn | [2] TAGBANWA VOWEL SIGN I..U                                  |
| 17B4..17B5 | ; XID_Continue # Mn | [2] KHMER VOWEL INHERENT AQ..AA                               |
| 17B6       | ; XID_Continue # Mc | KHMER VOWEL SIGN AA   |
| 17B7..17BD | ; XID_Continue # Mn | [7] KHMER VOWEL SIGN I..UA                                    |
| 17BE..17C5 | ; XID_Continue # Mc | [8] KHMER VOWEL SIGN OE..AU                                   |
| 17C6       | ; XID_Continue # Mn | KHMER SIGN NIKAHIT  |
| 17C7..17C8 | ; XID_Continue # Mc | [2] KHMER SIGN REAHMUK..YUUKALEAPINTU                         |
| 17C9..17D3 | ; XID_Continue # Mn | [11] KHMER SIGN MUUSIKATOAN..BATHAMASAT                       |
| 17DD       | ; XID_Continue # Mn | KHMER SIGN ATTHACAN   |
| 180B..180D | ; XID_Continue # Mn | [3] MONGOLIAN FREE VARIATION SELECTOR ONE..THREE              |
| 180F       | ; XID_Continue # Mn | MONGOLIAN FREE VARIATION SELECTOR FOUR                        |
| 1885..1886 | ; XID_Continue # Mn | [2] MONGOLIAN LETTER ALI GALI BALUDA..THREE BALUDA            |
| 18A9       | ; XID_Continue # Mn | MONGOLIAN LETTER ALI GALI DAGALGA                             |
| 1920..1922 | ; XID_Continue # Mn | [3] LIMBU VOWEL SIGN A..U                                     |
| 1923..1926 | ; XID_Continue # Mc | [4] LIMBU VOWEL SIGN EE..AU                                   |
| 1927..1928 | ; XID_Continue # Mn | [2] LIMBU VOWEL SIGN E..O                                     |
| 1929..192B | ; XID_Continue # Mc | [3] LIMBU SUBJOINED LETTER YA..WA                             |
| 1930..1931 | ; XID_Continue # Mc | [2] LIMBU SMALL LETTER KA..NGA                                |
| 1932       | ; XID_Continue # Mn | LIMBU SMALL LETTER ANUSVARA                                   |
| 1933..1938 | ; XID_Continue # Mc | [6] LIMBU SMALL LETTER TA..LA                                 |
| 1939..193B | ; XID_Continue # Mn | [3] LIMBU SIGN MUKPHRENG..-I                                  |
| 1A17..1A18 | ; XID_Continue # Mn | [2] BUGINESE VOWEL SIGN I..U                                  |
| 1A19..1A1A | ; XID_Continue # Mc | [2] BUGINESE VOWEL SIGN E..O                                  |
| 1A1B       | ; XID_Continue # Mn | BUGINESE VOWEL SIGN AE  |
| 1A55       | ; XID_Continue # Mc | TAI THAM CONSONANT SIGN MEDIAL RA                             |
| 1A56       | ; XID_Continue # Mn | TAI THAM CONSONANT SIGN MEDIAL LA                             |
| 1A57       | ; XID_Continue # Mc | TAI THAM CONSONANT SIGN LA TANG LAI                           |
| 1A58..1A5E | ; XID_Continue # Mn | [7] TAI THAM SIGN MAI KANG LAI..CONSONANT SIGN SA             |
| 1A60       | ; XID_Continue # Mn | TAI THAM SIGN SAKOT   |
| 1A61       | ; XID_Continue # Mc | TAI THAM VOWEL SIGN A   |
| 1A62       | ; XID_Continue # Mn | TAI THAM VOWEL SIGN MAI SAT                                   |
| 1A63..1A64 | ; XID_Continue # Mc | [2] TAI THAM VOWEL SIGN AA..TALL AA                           |
| 1A65..1A6C | ; XID_Continue # Mn | [8] TAI THAM VOWEL SIGN I..OA BELOW                           |
| 1A6D..1A72 | ; XID_Continue # Mc | [6] TAI THAM VOWEL SIGN OY..THAM AI                           |
| 1A73..1A7C | ; XID_Continue # Mn | [10] TAI THAM VOWEL SIGN OA ABOVE..KHUEN-LUE KARAN            |



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| 1A7F       | ; XID_Continue # Mn | TAI THAM COMBINING CRYPTOGRAMMIC DOT  |
| 1AB0..1ABD | ; XID_Continue # Mn | [14] COMBINING DOUBLED CIRCUMFLEX ACCENT..<br>COMBINING PARENTHESES BELOW                           |
| 1ABF..1ACE | ; XID_Continue # Mn | [16] COMBINING LATIN SMALL LETTER W BELOW..<br>INSULAR T  |
| 1B00..1B03 | ; XID_Continue # Mn | [4] BALINESE SIGN ULU RICEM..SURANG   |
| 1B04       | ; XID_Continue # Mc | BALINESE SIGN BISAH   |
| 1B34       | ; XID_Continue # Mn | BALINESE SIGN REREKAN   |
| 1B35       | ; XID_Continue # Mc | BALINESE VOWEL SIGN TEDUNG  |
| 1B36..1B3A | ; XID_Continue # Mn | [5] BALINESE VOWEL SIGN ULU..RA REPA  |
| 1B3B       | ; XID_Continue # Mc | BALINESE VOWEL SIGN RA REPA TEDUNG  |
| 1B3C       | ; XID_Continue # Mn | BALINESE VOWEL SIGN LA LENGA  |
| 1B3D..1B41 | ; XID_Continue # Mc | [5] BALINESE VOWEL SIGN LA LENGA TEDUNG..<br>TALING REPA TEDUNG                                     |
| 1B42       | ; XID_Continue # Mn | BALINESE VOWEL SIGN PEPET   |
| 1B43..1B44 | ; XID_Continue # Mc | [2] BALINESE VOWEL SIGN PEPET TEDUNG..<br>BALINESE ADEG ADEG  |
| 1B6B..1B73 | ; XID_Continue # Mn | [9] BALINESE MUSICAL SYMBOL COMBINING TEGEH..<br>GONG   |
| 1B80..1B81 | ; XID_Continue # Mn | [2] SUNDANESE SIGN PANYECEK..PANGLAYAR  |
| 1B82       | ; XID_Continue # Mc | SUNDANESE SIGN PANGWISAD  |
| 1BA1       | ; XID_Continue # Mc | SUNDANESE CONSONANT SIGN PAMINGKAL  |
| 1BA2..1BA5 | ; XID_Continue # Mn | [4] SUNDANESE CONSONANT SIGN PANYAKRA..<br>SUNDANESE VOWEL SIGN PANYUKU                             |
| 1BA6..1BA7 | ; XID_Continue # Mc | [2] SUNDANESE VOWEL SIGN PANAELAENG..PANOLONG   |
| 1BA8..1BA9 | ; XID_Continue # Mn | [2] SUNDANESE VOWEL SIGN PAMEPET..PANEULEUNG  |
| 1BAA       | ; XID_Continue # Mc | SUNDANESE SIGN PAMAAEH  |
| 1BAB..1BAD | ; XID_Continue # Mn | [3] SUNDANESE SIGN VIRAMA..<br>CONSONANT SIGN PASANGAN WA   |
| 1BE6       | ; XID_Continue # Mn | BATAK SIGN TOMPI  |
| 1BE7       | ; XID_Continue # Mc | BATAK VOWEL SIGN E  |
| 1BE8..1BE9 | ; XID_Continue # Mn | [2] BATAK VOWEL SIGN PAKPAK E..EE   |
| 1BEA..1BEC | ; XID_Continue # Mc | [3] BATAK VOWEL SIGN I..O   |
| 1BED       | ; XID_Continue # Mn | BATAK VOWEL SIGN KARO O   |
| 1BEE       | ; XID_Continue # Mc | BATAK VOWEL SIGN U  |
| 1BEF..1BF1 | ; XID_Continue # Mn | [3] BATAK VOWEL SIGN U FOR SIMALUNGUN SA..<br>BATAK CONSONANT SIGN H                                |
| 1BF2..1BF3 | ; XID_Continue # Mc | [2] BATAK PANGOLAT..BATAK PANONGONAN  |
| 1C24..1C2B | ; XID_Continue # Mc | [8] LEPCHA SUBJOINED LETTER YA..VOWEL SIGN UU   |
| 1C2C..1C33 | ; XID_Continue # Mn | [8] LEPCHA VOWEL SIGN E..CONSONANT SIGN T   |
| 1C34..1C35 | ; XID_Continue # Mc | [2] LEPCHA CONSONANT SIGN NYIN-DO..KANG   |
| 1C36..1C37 | ; XID_Continue # Mn | [2] LEPCHA SIGN RAN..NUKTA  |
| 1CD0..1CD2 | ; XID_Continue # Mn | [3] VEDIC TONE KARSHANA..PRENKHA  |
| 1CD4..1CE0 | ; XID_Continue # Mn | [13] VEDIC SIGN YAJURVEDIC MIDLINE SVARITA..<br>VEDIC TONE RIGVEDIC KASHMIRI INDEPENDENT<br>SVARITA |

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| 1CE1       | ; XID_Continue # Mc | VEDIC TONE ATHARVAVEDIC INDEPENDENT SVARITA                                      |
| 1CE2..1CE8 | ; XID_Continue # Mn | [7] VEDIC SIGN VISARGA SVARITA..<br>VEDIC SIGN VISARGA ANUDATTA WITH TAIL        |
| 1CED       | ; XID_Continue # Mn | VEDIC SIGN TIRYAK  |
| 1CF4       | ; XID_Continue # Mn | VEDIC TONE CANDRA ABOVE  |
| 1CF7       | ; XID_Continue # Mc | VEDIC SIGN ATIKRAMA  |
| 1CF8..1CF9 | ; XID_Continue # Mn | [2] VEDIC TONE RING ABOVE..DOUBLE RING ABOVE                                     |
| 1DC0..1DFF | ; XID_Continue # Mn | [64] COMBINING DOTTED GRAVE ACCENT..<br>RIGHT ARROWHEAD AND DOWN ARROWHEAD BELOW |
| 20D0..20DC | ; XID_Continue # Mn | [13] COMBINING LEFT HARPOON ABOVE..<br>COMBINING FOUR DOTS ABOVE                 |
| 20E1       | ; XID_Continue # Mn | COMBINING LEFT RIGHT ARROW ABOVE   |
| 20E5..20F0 | ; XID_Continue # Mn | [12] COMBINING REVERSE SOLIDUS OVERLAY..<br>COMBINING ASTERISK ABOVE             |
| 2CEF..2CF1 | ; XID_Continue # Mn | [3] COPTIC COMBINING NI ABOVE..SPIRITUS LENIS                                    |
| 2D7F       | ; XID_Continue # Mn | TIFINAGH CONSONANT JOINER  |
| 2DE0..2DFF | ; XID_Continue # Mn | [32] COMBINING CYRILLIC LETTER BE..<br>IOTIFIED BIG YUS                          |
| 302A..302D | ; XID_Continue # Mn | [4] IDEOGRAPHIC LEVEL TONE MARK..<br>IDEOGRAPHIC ENTERING TONE MARK              |
| 302E..302F | ; XID_Continue # Mc | [2] HANGUL SINGLE DOT TONE MARK..<br>HANGUL DOUBLE DOT TONE MARK                 |
| 3099..309A | ; XID_Continue # Mn | [2] COMBINING KATAKANA-HIRAGANA VOICED<br>SOUND MARK..SEMI-VOICED SOUND MARK     |
| A66F       | ; XID_Continue # Mn | COMBINING CYRILLIC VZMET   |
| A674..A67D | ; XID_Continue # Mn | [10] COMBINING CYRILLIC LETTER UKRAINIAN IE..<br>PAYEROK                         |
| A69E..A69F | ; XID_Continue # Mn | [2] COMBINING CYRILLIC LETTER EF..IOTIFIED E                                     |
| A6F0..A6F1 | ; XID_Continue # Mn | [2] BAMUM COMBINING MARK KOQNDON..TUKWENTIS                                      |
| A802       | ; XID_Continue # Mn | SYLOTI NAGRI SIGN DVISVARA   |
| A806       | ; XID_Continue # Mn | SYLOTI NAGRI SIGN HASANTA  |
| A80B       | ; XID_Continue # Mn | SYLOTI NAGRI SIGN ANUSVARA   |
| A823..A824 | ; XID_Continue # Mc | [2] SYLOTI NAGRI VOWEL SIGN A..I   |
| A825..A826 | ; XID_Continue # Mn | [2] SYLOTI NAGRI VOWEL SIGN U..E   |
| A827       | ; XID_Continue # Mc | SYLOTI NAGRI VOWEL SIGN OO   |
| A82C       | ; XID_Continue # Mn | SYLOTI NAGRI SIGN ALTERNATE HASANTA  |
| A880..A881 | ; XID_Continue # Mc | [2] SAURASHTRA SIGN ANUSVARA..VISARGA  |
| A8B4..A8C3 | ; XID_Continue # Mc | [16] SAURASHTRA CONSONANT SIGN HAARU..<br>SAURASHTRA VOWEL SIGN AU               |
| A8C4..A8C5 | ; XID_Continue # Mn | [2] SAURASHTRA SIGN VIRAMA..CANDRABINDU  |
| A8E0..A8F1 | ; XID_Continue # Mn | [18] COMBINING DEVANAGARI DIGIT ZERO..<br>SIGN AVAGRAHA                          |
| A8FF       | ; XID_Continue # Mn | DEVANAGARI VOWEL SIGN AY   |
| A926..A92D | ; XID_Continue # Mn | [8] KAYAH LI VOWEL UE..TONE CALYA PLOPHU   |
| A947..A951 | ; XID_Continue # Mn | [11] REJANG VOWEL SIGN I..CONSONANT SIGN R                                       |

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| A952..A953   | ; XID_Continue # Mc | [2] REJANG CONSONANT SIGN H..REJANG VIRAMA   |
| A980..A982   | ; XID_Continue # Mn | [3] JAVANESE SIGN PANYANGGA..LAYAR           |
| A983         | ; XID_Continue # Mc | JAVANESE SIGN WIGNYAN                        |
| A9B3         | ; XID_Continue # Mn | JAVANESE SIGN CECAK TELU                     |
| A9B4..A9B5   | ; XID_Continue # Mc | [2] JAVANESE VOWEL SIGN TARUNG..TOLONG       |
| A9B6..A9B9   | ; XID_Continue # Mn | [4] JAVANESE VOWEL SIGN WULU..SUKU MENDUT    |
| A9BA..A9BB   | ; XID_Continue # Mc | [2] JAVANESE VOWEL SIGN TALING..DIRGA MURE   |
| A9BC..A9BD   | ; XID_Continue # Mn | [2] JAVANESE VOWEL SIGN PEPET..KERET         |
| A9BE..A9C0   | ; XID_Continue # Mc | [3] JAVANESE CONSONANT SIGN PENGKAL..PANGKON |
| A9E5         | ; XID_Continue # Mn | MYANMAR SIGN SHAN SAW                        |
| AA29..AA2E   | ; XID_Continue # Mn | [6] CHAM VOWEL SIGN AA..OE                   |
| AA2F..AA30   | ; XID_Continue # Mc | [2] CHAM VOWEL SIGN O..AI                    |
| AA31..AA32   | ; XID_Continue # Mn | [2] CHAM VOWEL SIGN AU..UE                   |
| AA33..AA34   | ; XID_Continue # Mc | [2] CHAM CONSONANT SIGN YA..RA               |
| AA35..AA36   | ; XID_Continue # Mn | [2] CHAM CONSONANT SIGN LA..WA               |
| AA43         | ; XID_Continue # Mn | CHAM CONSONANT SIGN FINAL NG                 |
| AA4C         | ; XID_Continue # Mn | CHAM CONSONANT SIGN FINAL M                  |
| AA4D         | ; XID_Continue # Mc | CHAM CONSONANT SIGN FINAL H                  |
| AA7B         | ; XID_Continue # Mc | MYANMAR SIGN PAO KAREN TONE                  |
| AA7C         | ; XID_Continue # Mn | MYANMAR SIGN TAI LAING TONE-2                |
| AA7D         | ; XID_Continue # Mc | MYANMAR SIGN TAI LAING TONE-5                |
| AAB0         | ; XID_Continue # Mn | TAI VIET MAI KANG                            |
| AAB2..AAB4   | ; XID_Continue # Mn | [3] TAI VIET VOWEL I..U                      |
| AAB7..AAB8   | ; XID_Continue # Mn | [2] TAI VIET MAI KHIT..VOWEL IA              |
| AABE..AABF   | ; XID_Continue # Mn | [2] TAI VIET VOWEL AM..TONE MAI EK           |
| AAc1         | ; XID_Continue # Mn | TAI VIET TONE MAI THO                        |
| AAEB         | ; XID_Continue # Mc | MEETEI MAYEK VOWEL SIGN II                   |
| AAEC..AAED   | ; XID_Continue # Mn | [2] MEETEI MAYEK VOWEL SIGN UU..AAI          |
| AAEE..AAEF   | ; XID_Continue # Mc | [2] MEETEI MAYEK VOWEL SIGN AU..AAU          |
| AAF5         | ; XID_Continue # Mc | MEETEI MAYEK VOWEL SIGN VISARGA              |
| AAF6         | ; XID_Continue # Mn | MEETEI MAYEK VIRAMA                          |
| ABE3..ABE4   | ; XID_Continue # Mc | [2] MEETEI MAYEK VOWEL SIGN ONAP..INAP       |
| ABE5         | ; XID_Continue # Mn | MEETEI MAYEK VOWEL SIGN ANAP                 |
| ABE6..ABE7   | ; XID_Continue # Mc | [2] MEETEI MAYEK VOWEL SIGN YENAP..SOUNAP    |
| ABE8         | ; XID_Continue # Mn | MEETEI MAYEK VOWEL SIGN UNAP                 |
| ABE9..ABEA   | ; XID_Continue # Mc | [2] MEETEI MAYEK VOWEL SIGN CHEINAP..NUNG    |
| ABEC         | ; XID_Continue # Mc | MEETEI MAYEK LUM IYEK                        |
| ABED         | ; XID_Continue # Mn | MEETEI MAYEK APUN IYEK                       |
| FB1E         | ; XID_Continue # Mn | HEBREW POINT JUDEO-SPANISH VARIKA            |
| FE00..FE0F   | ; XID_Continue # Mn | [16] VARIATION SELECTOR-1..-16               |
| FE20..FE2F   | ; XID_Continue # Mn | [16] COMBINING LIGATURE LEFT HALF..          |
|              |                     | COMBINING CYRILLIC TITLO RIGHT HALF          |
| 101FD        | ; XID_Continue # Mn | PHAISTOS DISC SIGN COMBINING OBLIQUE         |
|              |                     | STROKE                                       |
| 102E0        | ; XID_Continue # Mn | COPTIC EPACT THOUSANDS MARK                  |
| 10376..1037A | ; XID_Continue # Mn | [5] COMBINING OLD PERMIC LETTER AN..SII      |

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| 10A01..10A03 | ; XID_Continue # Mn | [3] KHAROSHTHI VOWEL SIGN I..VOCALIC R                 |
| 10A05..10A06 | ; XID_Continue # Mn | [2] KHAROSHTHI VOWEL SIGN E..O                         |
| 10A0C..10A0F | ; XID_Continue # Mn | [4] KHAROSHTHI VOWEL LENGTH MARK..<br>SIGN VISARGA     |
| 10A38..10A3A | ; XID_Continue # Mn | [3] KHAROSHTHI SIGN BAR ABOVE..DOT BELOW               |
| 10A3F        | ; XID_Continue # Mn | KHAROSHTHI VIRAMA                                      |
| 10AE5..10AE6 | ; XID_Continue # Mn | [2] MANICHAEAN ABBREVIATION MARK ABOVE..BELOW          |
| 10D24..10D27 | ; XID_Continue # Mn | [4] HANIFI ROHINGYA SIGN HARBAHAY..TASSI               |
| 10EAB..10EAC | ; XID_Continue # Mn | [2] YEZIDI COMBINING HAMZA MARK..MADDA MARK            |
| 10F46..10F50 | ; XID_Continue # Mn | [11] SOGDIAN COMBINING DOT BELOW..STROKE BELOW         |
| 10F82..10F85 | ; XID_Continue # Mn | [4] OLD UYGHUR COMBINING DOT ABOVE..<br>TWO DOTS BELOW |
| 11000        | ; XID_Continue # Mc | BRAHMI SIGN CANDRABINDU                                |
| 11001        | ; XID_Continue # Mn | BRAHMI SIGN ANUSVARA                                   |
| 11002        | ; XID_Continue # Mc | BRAHMI SIGN VISARGA                                    |
| 11038..11046 | ; XID_Continue # Mn | [15] BRAHMI VOWEL SIGN AA..BRAHMI VIRAMA               |
| 11070        | ; XID_Continue # Mn | BRAHMI SIGN OLD TAMIL VIRAMA                           |
| 11073..11074 | ; XID_Continue # Mn | [2] BRAHMI VOWEL SIGN OLD TAMIL SHORT E..O             |
| 1107F..11081 | ; XID_Continue # Mn | [3] BRAHMI NUMBER JOINER..SIGN ANUSVARA                |
| 11082        | ; XID_Continue # Mc | KAITHI SIGN VISARGA                                    |
| 110B0..110B2 | ; XID_Continue # Mc | [3] KAITHI VOWEL SIGN AA..II                           |
| 110B3..110B6 | ; XID_Continue # Mn | [4] KAITHI VOWEL SIGN U..AI                            |
| 110B7..110B8 | ; XID_Continue # Mc | [2] KAITHI VOWEL SIGN O..AU                            |
| 110B9..110BA | ; XID_Continue # Mn | [2] KAITHI SIGN VIRAMA..KAITHI SIGN NUKTA              |
| 110C2        | ; XID_Continue # Mn | KAITHI VOWEL SIGN VOCALIC R                            |
| 11100..11102 | ; XID_Continue # Mn | [3] CHAKMA SIGN CANDRABINDU..VISARGA                   |
| 11127..1112B | ; XID_Continue # Mn | [5] CHAKMA VOWEL SIGN A..UU                            |
| 1112C        | ; XID_Continue # Mc | CHAKMA VOWEL SIGN E                                    |
| 1112D..11134 | ; XID_Continue # Mn | [8] CHAKMA VOWEL SIGN AI..CHAKMA MAAYYAA               |
| 11145..11146 | ; XID_Continue # Mc | [2] CHAKMA VOWEL SIGN AA..EI                           |
| 11173        | ; XID_Continue # Mn | MAHAJANI SIGN NUKTA                                    |
| 11180..11181 | ; XID_Continue # Mn | [2] SHARADA SIGN CANDRABINDU..ANUSVARA                 |
| 11182        | ; XID_Continue # Mc | SHARADA SIGN VISARGA                                   |
| 111B3..111B5 | ; XID_Continue # Mc | [3] SHARADA VOWEL SIGN AA..II                          |
| 111B6..111BE | ; XID_Continue # Mn | [9] SHARADA VOWEL SIGN U..O                            |
| 111BF..111C0 | ; XID_Continue # Mc | [2] SHARADA VOWEL SIGN AU..VIRAMA                      |
| 111C9..111CC | ; XID_Continue # Mn | [4] SHARADA SANDHI MARK..<br>EXTRA SHORT VOWEL MARK    |
| 111CE        | ; XID_Continue # Mc | SHARADA VOWEL SIGN PRISHTHAMATRA E                     |
| 111CF        | ; XID_Continue # Mn | SHARADA SIGN INVERTED CANDRABINDU                      |
| 1122C..1122E | ; XID_Continue # Mc | [3] KHOJKI VOWEL SIGN AA..II                           |
| 1122F..11231 | ; XID_Continue # Mn | [3] KHOJKI VOWEL SIGN U..AI                            |
| 11232..11233 | ; XID_Continue # Mc | [2] KHOJKI VOWEL SIGN O..AU                            |
| 11234        | ; XID_Continue # Mn | KHOJKI SIGN ANUSVARA                                   |
| 11235        | ; XID_Continue # Mc | KHOJKI SIGN VIRAMA                                     |
| 11236..11237 | ; XID_Continue # Mn | [2] KHOJKI SIGN NUKTA..SHADDA                          |

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| 1123E        | ; XID_Continue # Mn | KHOJKI SIGN SUKUN   |
| 112DF        | ; XID_Continue # Mn | KHUDAWADI SIGN ANUSVARA   |
| 112E0..112E2 | ; XID_Continue # Mc | [3] KHUDAWADI VOWEL SIGN AA..II   |
| 112E3..112EA | ; XID_Continue # Mn | [8] KHUDAWADI VOWEL SIGN U..VIRAMA                                      |
| 11300..11301 | ; XID_Continue # Mn | [2] GRANTHA SIGN COMBINING ANUSVARA ABOVE..<br>GRANTHA SIGN CANDRABINDU |
| 11302..11303 | ; XID_Continue # Mc | [2] GRANTHA SIGN ANUSVARA..VISARGA                                      |
| 1133B..1133C | ; XID_Continue # Mn | [2] COMBINING BINDU BELOW..GRANTHA SIGN NUKTA                           |
| 1133E..1133F | ; XID_Continue # Mc | [2] GRANTHA VOWEL SIGN AA..I  |
| 11340        | ; XID_Continue # Mn | GRANTHA VOWEL SIGN II   |
| 11341..11344 | ; XID_Continue # Mc | [4] GRANTHA VOWEL SIGN U..VOCALIC RR                                    |
| 11347..11348 | ; XID_Continue # Mc | [2] GRANTHA VOWEL SIGN EE..AI   |
| 1134B..1134D | ; XID_Continue # Mc | [3] GRANTHA VOWEL SIGN OO..VIRAMA                                       |
| 11357        | ; XID_Continue # Mc | GRANTHA AU LENGTH MARK  |
| 11362..11363 | ; XID_Continue # Mc | [2] GRANTHA VOWEL SIGN VOCALIC L..LL                                    |
| 11366..1136C | ; XID_Continue # Mn | [7] COMBINING GRANTHA DIGIT ZERO..SIX                                   |
| 11370..11374 | ; XID_Continue # Mn | [5] COMBINING GRANTHA LETTER A..PA                                      |
| 11435..11437 | ; XID_Continue # Mc | [3] NEWA VOWEL SIGN AA..II  |
| 11438..1143F | ; XID_Continue # Mn | [8] NEWA VOWEL SIGN U..AI   |
| 11440..11441 | ; XID_Continue # Mc | [2] NEWA VOWEL SIGN O..AU   |
| 11442..11444 | ; XID_Continue # Mn | [3] NEWA SIGN VIRAMA..ANUSVARA  |
| 11445        | ; XID_Continue # Mc | NEWA SIGN VISARGA   |
| 11446        | ; XID_Continue # Mn | NEWA SIGN NUKTA   |
| 1145E        | ; XID_Continue # Mn | NEWA SANDHI MARK  |
| 114B0..114B2 | ; XID_Continue # Mc | [3] TIRHUTA VOWEL SIGN AA..II   |
| 114B3..114B8 | ; XID_Continue # Mn | [6] TIRHUTA VOWEL SIGN U..VOCALIC LL                                    |
| 114B9        | ; XID_Continue # Mc | TIRHUTA VOWEL SIGN E  |
| 114BA        | ; XID_Continue # Mn | TIRHUTA VOWEL SIGN SHORT E  |
| 114BB..114BE | ; XID_Continue # Mc | [4] TIRHUTA VOWEL SIGN AI..AU   |
| 114BF..114C0 | ; XID_Continue # Mn | [2] TIRHUTA SIGN CANDRABINDU..ANUSVARA                                  |
| 114C1        | ; XID_Continue # Mc | TIRHUTA SIGN VISARGA  |
| 114C2..114C3 | ; XID_Continue # Mn | [2] TIRHUTA SIGN VIRAMA..NUKTA  |
| 115AF..115B1 | ; XID_Continue # Mc | [3] SIDDHAM VOWEL SIGN AA..II   |
| 115B2..115B5 | ; XID_Continue # Mn | [4] SIDDHAM VOWEL SIGN U..VOCALIC RR                                    |
| 115B8..115BB | ; XID_Continue # Mc | [4] SIDDHAM VOWEL SIGN E..AU  |
| 115BC..115BD | ; XID_Continue # Mn | [2] SIDDHAM SIGN CANDRABINDU..ANUSVARA                                  |
| 115BE        | ; XID_Continue # Mc | SIDDHAM SIGN VISARGA  |
| 115BF..115C0 | ; XID_Continue # Mn | [2] SIDDHAM SIGN VIRAMA..NUKTA  |
| 115DC..115DD | ; XID_Continue # Mn | [2] SIDDHAM VOWEL SIGN ALTERNATE U..UU                                  |
| 11630..11632 | ; XID_Continue # Mc | [3] MODI VOWEL SIGN AA..II  |
| 11633..1163A | ; XID_Continue # Mn | [8] MODI VOWEL SIGN U..AI   |
| 1163B..1163C | ; XID_Continue # Mc | [2] MODI VOWEL SIGN O..AU   |
| 1163D        | ; XID_Continue # Mn | MODI SIGN ANUSVARA  |
| 1163E        | ; XID_Continue # Mc | MODI SIGN VISARGA   |
| 1163F..11640 | ; XID_Continue # Mn | [2] MODI SIGN VIRAMA..ARDHACANDRA                                       |
| 116AB        | ; XID_Continue # Mn | TAKRI SIGN ANUSVARA   |

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| 116AC        | ; XID_Continue # Mc | TAKRI SIGN VISARGA   |
| 116AD        | ; XID_Continue # Mn | TAKRI VOWEL SIGN AA  |
| 116AE..116AF | ; XID_Continue # Mc | [2] TAKRI VOWEL SIGN I..II   |
| 116B0..116B5 | ; XID_Continue # Mn | [6] TAKRI VOWEL SIGN U..AU   |
| 116B6        | ; XID_Continue # Mc | TAKRI SIGN VIRAMA  |
| 116B7        | ; XID_Continue # Mn | TAKRI SIGN NUKTA   |
| 1171D..1171F | ; XID_Continue # Mn | [3] AHOM CONSONANT SIGN MEDIAL LA..<br>LIGATING RA   |
| 11720..11721 | ; XID_Continue # Mc | [2] AHOM VOWEL SIGN A..AA  |
| 11722..11725 | ; XID_Continue # Mn | [4] AHOM VOWEL SIGN I..UU  |
| 11726        | ; XID_Continue # Mc | AHOM VOWEL SIGN E  |
| 11727..1172B | ; XID_Continue # Mn | [5] AHOM VOWEL SIGN AW..KILLER   |
| 1182C..1182E | ; XID_Continue # Mc | [3] DOGRA VOWEL SIGN AA..II  |
| 1182F..11837 | ; XID_Continue # Mn | [9] DOGRA VOWEL SIGN U..ANUSVARA   |
| 11838        | ; XID_Continue # Mc | DOGRA SIGN VISARGA   |
| 11839..1183A | ; XID_Continue # Mn | [2] DOGRA SIGN VIRAMA..NUKTA   |
| 11930..11935 | ; XID_Continue # Mc | [6] DIVES AKURU VOWEL SIGN AA..E   |
| 11937..11938 | ; XID_Continue # Mc | [2] DIVES AKURU VOWEL SIGN AI..O   |
| 1193B..1193C | ; XID_Continue # Mn | [2] DIVES AKURU SIGN ANUSVARA..CANDRABINDU   |
| 1193D        | ; XID_Continue # Mc | DIVES AKURU SIGN HALANTA   |
| 1193E        | ; XID_Continue # Mn | DIVES AKURU VIRAMA   |
| 11940        | ; XID_Continue # Mc | DIVES AKURU MEDIAL YA  |
| 11942        | ; XID_Continue # Mc | DIVES AKURU MEDIAL RA  |
| 11943        | ; XID_Continue # Mn | DIVES AKURU SIGN NUKTA   |
| 119D1..119D3 | ; XID_Continue # Mc | [3] NANDINAGARI VOWEL SIGN AA..II  |
| 119D4..119D7 | ; XID_Continue # Mn | [4] NANDINAGARI VOWEL SIGN U..VOCALIC RR   |
| 119DA..119DB | ; XID_Continue # Mn | [2] NANDINAGARI VOWEL SIGN E..AI   |
| 119DC..119DF | ; XID_Continue # Mc | [4] NANDINAGARI VOWEL SIGN O..VISARGA  |
| 119E0        | ; XID_Continue # Mn | NANDINAGARI SIGN VIRAMA  |
| 119E4        | ; XID_Continue # Mc | NANDINAGARI VOWEL SIGN PRISHTHAMATRA E   |
| 11A01..11A0A | ; XID_Continue # Mn | [10] ZANABAZAR SQUARE VOWEL SIGN I..<br>LENGTH MARK  |
| 11A33..11A38 | ; XID_Continue # Mn | [6] ZANABAZAR SQUARE FINAL CONSONANT MARK..<br>ZANABAZAR SQUARE SIGN ANUSVARA              |
| 11A39        | ; XID_Continue # Mc | ZANABAZAR SQUARE SIGN VISARGA  |
| 11A3B..11A3E | ; XID_Continue # Mn | [4] ZANABAZAR SQUARE CLUSTER-FINAL LETTER YA..<br>ZANABAZAR SQUARE CLUSTER-FINAL LETTER VA |
| 11A47        | ; XID_Continue # Mn | ZANABAZAR SQUARE SUBJOINER   |
| 11A51..11A56 | ; XID_Continue # Mn | [6] SOYOMBO VOWEL SIGN I..OE   |
| 11A57..11A58 | ; XID_Continue # Mc | [2] SOYOMBO VOWEL SIGN AI..AU  |
| 11A59..11A5B | ; XID_Continue # Mn | [3] SOYOMBO VOWEL SIGN VOCALIC R..<br>SOYOMBO VOWEL LENGTH MARK                            |
| 11A8A..11A96 | ; XID_Continue # Mn | [13] SOYOMBO FINAL CONSONANT SIGN G..ANUSVARA  |
| 11A97        | ; XID_Continue # Mc | SOYOMBO SIGN VISARGA   |
| 11A98..11A99 | ; XID_Continue # Mn | [2] SOYOMBO GEMINATION MARK..SUBJOINER   |
| 11C2F        | ; XID_Continue # Mc | BHAIKSUKI VOWEL SIGN AA  |

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| 11C30..11C36 | ; XID_Continue # Mn | [7] BHAIKSUKI VOWEL SIGN I..VOCALIC L         |
| 11C38..11C3D | ; XID_Continue # Mn | [6] BHAIKSUKI VOWEL SIGN E..ANUSVARA          |
| 11C3E        | ; XID_Continue # Mc | BHAIKSUKI SIGN VISARGA                        |
| 11C3F        | ; XID_Continue # Mn | BHAIKSUKI SIGN VIRAMA                         |
| 11C92..11CA7 | ; XID_Continue # Mn | [22] MARCHEN SUBJOINED LETTER KA..ZA          |
| 11CA9        | ; XID_Continue # Mc | MARCHEN SUBJOINED LETTER YA                   |
| 11CAA..11CB0 | ; XID_Continue # Mn | [7] MARCHEN SUBJOINED LETTER RA..             |
|              |                     | MARCHEN VOWEL SIGN AA                         |
|              |                     | MARCHEN VOWEL SIGN I                          |
| 11CB1        | ; XID_Continue # Mc | [2] MARCHEN VOWEL SIGN U..E                   |
| 11CB2..11CB3 | ; XID_Continue # Mn | MARCHEN VOWEL SIGN O                          |
| 11CB4        | ; XID_Continue # Mc | [2] MARCHEN SIGN ANUSVARA..CANDRABINDU        |
| 11CB5..11CB6 | ; XID_Continue # Mn | [6] MASARAM GONDI VOWEL SIGN AA..             |
| 11D31..11D36 | ; XID_Continue # Mn | MASARAM GONDI VOWEL SIGN VOCALIC R            |
|              |                     | MASARAM GONDI VOWEL SIGN E                    |
| 11D3A        | ; XID_Continue # Mn | [2] MASARAM GONDI VOWEL SIGN AI..O            |
| 11D3C..11D3D | ; XID_Continue # Mn | [7] MASARAM GONDI VOWEL SIGN AU..             |
| 11D3F..11D45 | ; XID_Continue # Mn | MASARAM GONDI VIRAMA                          |
|              |                     | MASARAM GONDI RA-KARA                         |
| 11D47        | ; XID_Continue # Mn | [5] GUNJALA GONDI VOWEL SIGN AA..UU           |
| 11D8A..11D8E | ; XID_Continue # Mc | [2] GUNJALA GONDI VOWEL SIGN EE..AI           |
| 11D90..11D91 | ; XID_Continue # Mn | [2] GUNJALA GONDI VOWEL SIGN OO..AU           |
| 11D93..11D94 | ; XID_Continue # Mc | GUNJALA GONDI SIGN ANUSVARA                   |
| 11D95        | ; XID_Continue # Mn | GUNJALA GONDI SIGN VISARGA                    |
| 11D96        | ; XID_Continue # Mc | GUNJALA GONDI VIRAMA                          |
| 11D97        | ; XID_Continue # Mn | [2] MAKASAR VOWEL SIGN I..U                   |
| 11EF3..11EF4 | ; XID_Continue # Mn | [2] MAKASAR VOWEL SIGN E..O                   |
| 11EF5..11EF6 | ; XID_Continue # Mc | [5] BASSA VAH COMBINING HIGH TONE..           |
| 16AF0..16AF4 | ; XID_Continue # Mn | BASSA VAH COMBINING HIGH-LOW TONE             |
|              |                     | [7] PAHAH HMONG MARK CIM TUB..CIM TAUM        |
| 16B30..16B36 | ; XID_Continue # Mn | MIAO SIGN CONSONANT MODIFIER BAR              |
| 16F4F        | ; XID_Continue # Mn | [55] MIAO SIGN ASPIRATION..MIAO VOWEL SIGN UI |
| 16F51..16F87 | ; XID_Continue # Mc | [4] MIAO TONE RIGHT..MIAO TONE BELOW          |
| 16F8F..16F92 | ; XID_Continue # Mn | KHITAN SMALL SCRIPT FILLER                    |
| 16FE4        | ; XID_Continue # Mn | [2] VIETNAMESE ALTERNATE READING MARK CA..    |
| 16FF0..16FF1 | ; XID_Continue # Mc | VIETNAMESE ALTERNATE READING MARK NHAY        |
| 1BC9D..1BC9E | ; XID_Continue # Mn | [2] DUPLOYAN THICK LETTER SELECTOR..          |
|              |                     | DUPLOYAN DOUBLE MARK                          |
| 1CF00..1CF2D | ; XID_Continue # Mn | [46] ZNAMENNY COMBINING MARK GORAZDO NIZKO S  |
|              |                     | KRYZHEM ON LEFT..                             |
|              |                     | ZNAMENNY COMBINING MARK KRYZH ON LEFT         |
| 1CF30..1CF46 | ; XID_Continue # Mn | [23] ZNAMENNY COMBINING TONAL RANGE MARK      |
|              |                     | MRACHNO..PRIZNAK MODIFIER ROG                 |
| 1D165..1D166 | ; XID_Continue # Mc | [2] MUSICAL SYMBOL COMBINING STEM..           |
|              |                     | SPRECHGESANG STEM                             |
| 1D167..1D169 | ; XID_Continue # Mn | [3] MUSICAL SYMBOL COMBINING TREMOLO-1..3     |

|              |                     |       |   |
|--------------|---------------------|-------|---|
| 1D16D..1D172 | ; XID_Continue # Mc | [6]   | MUSICAL SYMBOL COMBINING AUGMENTATION DOT..FLAG-5                                 |
| 1D17B..1D182 | ; XID_Continue # Mn | [8]   | MUSICAL SYMBOL COMBINING ACCENT..LOURE  |
| 1D185..1D18B | ; XID_Continue # Mn | [7]   | MUSICAL SYMBOL COMBINING DOIT..<br>MUSICAL SYMBOL COMBINING TRIPLE TONGUE         |
| 1D1AA..1D1AD | ; XID_Continue # Mn | [4]   | MUSICAL SYMBOL COMBINING DOWN BOW..<br>MUSICAL SYMBOL COMBINING SNAP PIZZICATO    |
| 1D242..1D244 | ; XID_Continue # Mn | [3]   | COMBINING GREEK MUSICAL TRISEME..<br>COMBINING GREEK MUSICAL PENTASEME            |
| 1DA00..1DA36 | ; XID_Continue # Mn | [55]  | SIGNWRITING HEAD RIM..<br>SIGNWRITING AIR SUCKING IN                              |
| 1DA3B..1DA6C | ; XID_Continue # Mn | [50]  | SIGNWRITING MOUTH CLOSED NEUTRAL..<br>SIGNWRITING EXCITEMENT                      |
| 1DA75        | ; XID_Continue # Mn |       | SIGNWRITING UPPER BODY TILTING FROM HIP JOINTS                                    |
| 1DA84        | ; XID_Continue # Mn |       | SIGNWRITING LOCATION HEAD NECK  |
| 1DA9B..1DA9F | ; XID_Continue # Mn | [5]   | SIGNWRITING FILL MODIFIER-2..<br>SIGNWRITING FILL MODIFIER-6                      |
| 1DAA1..1DAAF | ; XID_Continue # Mn | [15]  | SIGNWRITING ROTATION MODIFIER-2..-16  |
| 1E000..1E006 | ; XID_Continue # Mn | [7]   | COMBINING GLAGOLITIC LETTER AZU..ZHIVETE  |
| 1E008..1E018 | ; XID_Continue # Mn | [17]  | COMBINING GLAGOLITIC LETTER ZEMLJA..HERU  |
| 1E01B..1E021 | ; XID_Continue # Mn | [7]   | COMBINING GLAGOLITIC LETTER SHTA..YATI  |
| 1E023..1E024 | ; XID_Continue # Mn | [2]   | COMBINING GLAGOLITIC LETTER YU..SMALL YUS   |
| 1E026..1E02A | ; XID_Continue # Mn | [5]   | COMBINING GLAGOLITIC LETTER YO..FITA  |
| 1E130..1E136 | ; XID_Continue # Mn | [7]   | NYIAKENG PUACHUE HMONG TONE-B..-D   |
| 1E2AE        | ; XID_Continue # Mn |       | TOTO SIGN RISING TONE   |
| 1E2EC..1E2EF | ; XID_Continue # Mn | [4]   | WANCHO TONE TUP..WANCHO TONE KOINI  |
| 1E8D0..1E8D6 | ; XID_Continue # Mn | [7]   | MENDE KIKAKUI COMBINING NUMBER TEENS..<br>MENDE KIKAKUI COMBINING NUMBER MILLIONS |
| 1E944..1E94A | ; XID_Continue # Mn | [7]   | ADLAM ALIF LENGTHENER..ADLAM NUKTA  |
| E0100..E01EF | ; XID_Continue # Mn | [240] | VARIATION SELECTOR-17..-256   |

## 18 Appendix E - IDType Technical

Needed for Section 9 TR39 Identifier Type. List of Technical ID characters, added to the TR39 Recommended and Inclusion IDTypes. TR39#Table 1 [https://www.unicode.org/reports/tr39/#Identifier\\_Status\\_and\\_Type](https://www.unicode.org/reports/tr39/#Identifier_Status_and_Type)

```
grep ' Technical ' IdentifierType.txt |
egrep -v 'Not_XID|Obsolete|Exclusion|Uncommon_Use|Limited_Use'
```

|            |                   |     |  |
|------------|-------------------|-----|--|
| 0180       | ; Technical # 1.1 |     | LATIN SMALL LETTER B WITH STROKE               |
| 01C0..01C3 | ; Technical # 1.1 | [4] | LATIN LETTER DENTAL CLICK..<br>RETROFLEX CLICK |
| 0234..0236 | ; Technical # 4.0 | [3] | LATIN SMALL LETTER L WITH CURL..               |



|            |             |       |   |
|------------|-------------|-------|---|
|            |             |       | T WITH CURL   |
| 0250..0252 | ; Technical | # 1.1 | [3] LATIN SMALL LETTER TURNED A..ALPHA  |
| 0255       | ; Technical | # 1.1 | LATIN SMALL LETTER C WITH CURL  |
| 0258       | ; Technical | # 1.1 | LATIN SMALL LETTER REVERSED E   |
| 025A       | ; Technical | # 1.1 | LATIN SMALL LETTER SCHWA WITH HOOK  |
| 025C..0262 | ; Technical | # 1.1 | [7] LATIN SMALL LETTER REVERSED OPEN E..<br>LATIN LETTER SMALL CAPITAL G          |
| 0264..0267 | ; Technical | # 1.1 | [4] LATIN SMALL LETTER RAMS HORN..<br>LATIN SMALL LETTER HENG WITH HOOK           |
| 026A..0271 | ; Technical | # 1.1 | [8] LATIN LETTER SMALL CAPITAL I..<br>LATIN SMALL LETTER M WITH HOOK              |
| 0273..0276 | ; Technical | # 1.1 | [4] LATIN SMALL LETTER N WITH RETROFLEX<br>HOOK..LATIN LETTER SMALL CAPITAL OE    |
| 0278..027B | ; Technical | # 1.1 | [4] LATIN SMALL LETTER PHI..<br>LATIN SMALL LETTER TURNED R WITH HOOK             |
| 027D..0288 | ; Technical | # 1.1 | [12] LATIN SMALL LETTER R WITH TAIL..<br>LATIN SMALL LETTER T WITH RETROFLEX HOOK |
| 028A..0291 | ; Technical | # 1.1 | [8] LATIN SMALL LETTER UPSILON..<br>LATIN SMALL LETTER Z WITH CURL                |
| 0293..029D | ; Technical | # 1.1 | [11] LATIN SMALL LETTER EZH WITH CURL..<br>LATIN SMALL LETTER J WITH CROSSED-TAIL |
| 029F..02A8 | ; Technical | # 1.1 | [10] LATIN LETTER SMALL CAPITAL L..<br>LATIN SMALL LETTER TC DIGRAPH WITH CURL    |
| 02A9..02AD | ; Technical | # 3.0 | [5] LATIN SMALL LETTER FENG DIGRAPH..<br>LATIN LETTER BIDENTAL PERCUSSIVE         |
| 02AE..02AF | ; Technical | # 4.0 | [2] LATIN SMALL LETTER TURNED H WITH<br>FISHHOOK..AND TAIL                        |
| 02B9..02BA | ; Technical | # 1.1 | [2] MODIFIER LETTER PRIME..DOUBLE PRIME   |
| 02BD..02C1 | ; Technical | # 1.1 | [5] MODIFIER LETTER REVERSED COMMA..<br>MODIFIER LETTER REVERSED GLOTTAL STOP     |
| 02C6..02D1 | ; Technical | # 1.1 | [12] MODIFIER LETTER CIRCUMFLEX ACCENT..<br>MODIFIER LETTER HALF TRIANGULAR COLON |
| 02EE       | ; Technical | # 3.0 | MODIFIER LETTER DOUBLE APOSTROPHE   |
| 030E       | ; Technical | # 1.1 | COMBINING DOUBLE VERTICAL LINE ABOVE  |
| 0312       | ; Technical | # 1.1 | COMBINING TURNED COMMA ABOVE  |
| 0315       | ; Technical | # 1.1 | COMBINING COMMA ABOVE RIGHT   |
| 0317..031A | ; Technical | # 1.1 | [4] COMBINING ACUTE ACCENT BELOW..<br>COMBINING LEFT ANGLE ABOVE                  |
| 031C..0320 | ; Technical | # 1.1 | [5] COMBINING LEFT HALF RING BELOW..<br>COMBINING MINUS SIGN BELOW                |
| 0329..032C | ; Technical | # 1.1 | [4] COMBINING VERTICAL LINE BELOW..<br>COMBINING CARON BELOW                      |
| 032F       | ; Technical | # 1.1 | COMBINING INVERTED BREVE BELOW  |
| 0333       | ; Technical | # 1.1 | COMBINING DOUBLE LOW LINE   |
| 0337       | ; Technical | # 1.1 | COMBINING SHORT SOLIDUS OVERLAY   |
| 033A..033F | ; Technical | # 1.1 | [6] COMBINING INVERTED BRIDGE BELOW..   |

|            |             |        |      |   |
|------------|-------------|--------|------|---|
| 0346..034E | ; Technical | # 3.0  | [9]  | COMBINING DOUBLE OVERLINE<br>COMBINING BRIDGE ABOVE..                                 |
| 0350..0357 | ; Technical | # 4.0  | [8]  | COMBINING UPWARDS ARROW BELOW<br>COMBINING RIGHT ARROWHEAD ABOVE..<br>HALF RING ABOVE |
| 0359..035C | ; Technical | # 4.1  | [4]  | COMBINING ASTERISK BELOW..<br>COMBINING DOUBLE BREVE BELOW                            |
| 035D..035F | ; Technical | # 4.0  | [3]  | COMBINING DOUBLE BREVE..MACRON BELOW  |
| 0360..0361 | ; Technical | # 1.1  | [2]  | COMBINING DOUBLE TILDE..INVERTED BREVE  |
| 0362       | ; Technical | # 3.0  |      | COMBINING DOUBLE RIGHTWARDS ARROW BELOW   |
| 03CF       | ; Technical | # 5.1  |      | GREEK CAPITAL KAI SYMBOL  |
| 03D7       | ; Technical | # 3.0  |      | GREEK KAI SYMBOL  |
| 0560       | ; Technical | # 11.0 |      | ARMENIAN SMALL LETTER TURNED AYB  |
| 0588       | ; Technical | # 11.0 |      | ARMENIAN SMALL LETTER YI WITH STROKE  |
| 0953..0954 | ; Technical | # 1.1  | [2]  | DEVANAGARI GRAVE ACCENT..<br>DEVANAGARI ACUTE ACCENT                                  |
| 0D81       | ; Technical | # 13.0 |      | SINHALA SIGN CANDRABINDU  |
| 0F18..0F19 | ; Technical | # 2.0  | [2]  | TIBETAN ASTROLOGICAL SIGN -KHYUD PA..<br>TIBETAN ASTROLOGICAL SIGN SDONG TSHUGS       |
| 17CE..17CF | ; Technical | # 3.0  | [2]  | KHMER SIGN KAKABAT..<br>KHMER SIGN AHSDA  |
| 1ABF..1AC0 | ; Technical | # 13.0 | [2]  | COMBINING LATIN SMALL LETTER W BELOW..<br>TURNED W BELOW                              |
| 1D00..1D2B | ; Technical | # 4.0  | [44] | LATIN LETTER SMALL CAPITAL A..<br>CYRILLIC LETTER SMALL CAPITAL EL                    |
| 1D2F       | ; Technical | # 4.0  |      | MODIFIER LETTER CAPITAL BARRED B  |
| 1D3B       | ; Technical | # 4.0  |      | MODIFIER LETTER CAPITAL REVERSED N  |
| 1D4E       | ; Technical | # 4.0  |      | MODIFIER LETTER SMALL TURNED I  |
| 1D6B       | ; Technical | # 4.0  |      | LATIN SMALL LETTER UE   |
| 1D6C..1D77 | ; Technical | # 4.1  | [12] | LATIN SMALL LETTER B WITH MIDDLE TILDE..<br>LATIN SMALL LETTER TURNED G               |
| 1D79..1D9A | ; Technical | # 4.1  | [34] | LATIN SMALL LETTER INSULAR G..<br>EZH WITH RETROFLEX HOOK                             |
| 1DC4..1DCA | ; Technical | # 5.0  | [7]  | COMBINING MACRON-ACUTE..<br>COMBINING LATIN SMALL LETTER R BELOW                      |
| 1DCB..1DCD | ; Technical | # 5.1  | [3]  | COMBINING BREVE-MACRON..<br>COMBINING DOUBLE CIRCUMFLEX ABOVE                         |
| 1DCF..1DD0 | ; Technical | # 5.1  | [2]  | COMBINING ZIGZAG BELOW..<br>COMBINING IS BELOW  |
| 1DE7..1DF5 | ; Technical | # 7.0  | [15] | COMBINING LATIN SMALL LETTER ALPHA..<br>COMBINING UP TACK ABOVE                       |
| 1DF6..1DF9 | ; Technical | # 10.0 | [4]  | COMBINING KAVYKA ABOVE RIGHT..<br>COMBINING WIDE INVERTED BRIDGE BELOW                |
| 1DFB       | ; Technical | # 9.0  |      | COMBINING DELETION MARK   |
| 1DFC       | ; Technical | # 6.0  |      | COMBINING DOUBLE INVERTED BREVE BELOW   |
| 1DFD       | ; Technical | # 5.2  |      | COMBINING ALMOST EQUAL TO BELOW   |

|            |             |        |   |
|------------|-------------|--------|---|
| 1DFE..1DFF | ; Technical | # 5.0  | [2] COMBINING LEFT ARROWHEAD ABOVE..<br>COMBINING RIGHT ARROWHEAD AND DOWN<br>ARROWHEAD BELOW |
| 1E9C..1E9D | ; Technical | # 5.1  | [2] LATIN SMALL LETTER LONG S WITH DIAGONAL<br>STROKE..WITH HIGH STROKE                       |
| 1E9F       | ; Technical | # 5.1  | LATIN SMALL LETTER DELTA  |
| 1EFA..1EFF | ; Technical | # 5.1  | [6] LATIN CAPITAL LETTER MIDDLE-WELSH LL..<br>LATIN SMALL LETTER Y WITH LOOP                  |
| 203F..2040 | ; Technical | # 1.1  | [2] UNDERTIE..<br>CHARACTER TIE   |
| 20D0..20DC | ; Technical | # 1.1  | [13] COMBINING LEFT HARPOON ABOVE..<br>COMBINING FOUR DOTS ABOVE                              |
| 20E1       | ; Technical | # 1.1  | COMBINING LEFT RIGHT ARROW ABOVE  |
| 20E5..20EA | ; Technical | # 3.2  | [6] COMBINING REVERSE SOLIDUS OVERLAY..<br>COMBINING LEFTWARDS ARROW OVERLAY                  |
| 20EB       | ; Technical | # 4.1  | COMBINING LONG DOUBLE SOLIDUS OVERLAY   |
| 20EC..20EF | ; Technical | # 5.0  | [4] COMBINING RIGHTWARDS HARPOON WITH BARB<br>DOWNWARDS..COMBINING RIGHT ARROW BELOW          |
| 20F0       | ; Technical | # 5.1  | COMBINING ASTERISK ABOVE  |
| 2118       | ; Technical | # 1.1  | SCRIPT CAPITAL P  |
| 212E       | ; Technical | # 1.1  | ESTIMATED SYMBOL  |
| 2C60..2C67 | ; Technical | # 5.0  | [8] LATIN CAPITAL LETTER L WITH DOUBLE BAR..<br>LATIN CAPITAL LETTER H WITH DESCENDER         |
| 2C77       | ; Technical | # 5.0  | LATIN SMALL LETTER TAILLESS PHI   |
| 2C78..2C7B | ; Technical | # 5.1  | [4] LATIN SMALL LETTER E WITH NOTCH..<br>LATIN LETTER SMALL CAPITAL TURNED E                  |
| 3021..302D | ; Technical | # 1.1  | [13] HANGZHOU NUMERAL ONE..<br>IDEOGRAPHIC ENTERING TONE MARK                                 |
| 3031..3035 | ; Technical | # 1.1  | [5] VERTICAL KANA REPEAT MARK..<br>VERTICAL KANA REPEAT MARK LOWER HALF                       |
| 303B..303C | ; Technical | # 3.2  | [2] VERTICAL IDEOGRAPHIC ITERATION MARK..<br>MASU MARK  |
| A78E       | ; Technical | # 6.0  | LATIN SMALL LETTER L WITH RETROFLEX HOOK<br>AND BELT  |
| A7AF       | ; Technical | # 11.0 | LATIN LETTER SMALL CAPITAL Q  |
| A7BA..A7BF | ; Technical | # 12.0 | [6] LATIN CAPITAL LETTER GLOTTAL A..<br>LATIN SMALL LETTER GLOTTAL U                          |
| A7FA       | ; Technical | # 6.0  | LATIN LETTER SMALL CAPITAL TURNED M   |
| AB68       | ; Technical | # 13.0 | LATIN SMALL LETTER TURNED R WITH MIDDLE<br>TILDE  |
| FE20..FE23 | ; Technical | # 1.1  | [4] COMBINING LIGATURE LEFT HALF..<br>COMBINING DOUBLE TILDE RIGHT HALF                       |
| FE24..FE26 | ; Technical | # 5.1  | [3] COMBINING MACRON LEFT HALF..<br>COMBINING CONJOINING MACRON                               |
| FE27..FE2D | ; Technical | # 7.0  | [7] COMBINING LIGATURE LEFT HALF BELOW..<br>COMBINING CONJOINING MACRON BELOW                 |

|              |             |        |      |   |
|--------------|-------------|--------|------|---|
| FE73         | ; Technical | # 3.2  |      | ARABIC TAIL FRAGMENT  |
| 1CF00..1CF2D | ; Technical | # 14.0 | [46] | ZNAMENNY COMBINING MARK GORAZDO NIZKO S KRYZHEM ON LEFT..KRYZH ON LEFT      |
| 1CF30..1CF46 | ; Technical | # 14.0 | [23] | ZNAMENNY COMBINING TONAL RANGE MARK MRACHNO..PRIZNAK MODIFIER ROG           |
| 1D165..1D169 | ; Technical | # 3.1  | [5]  | MUSICAL SYMBOL COMBINING STEM..TREMOL0-3                                    |
| 1D16D..1D172 | ; Technical | # 3.1  | [6]  | MUSICAL SYMBOL COMBINING AUGMENTATION DOT..MUSICAL SYMBOL COMBINING FLAG-5  |
| 1D17B..1D182 | ; Technical | # 3.1  | [8]  | MUSICAL SYMBOL COMBINING ACCENT..LOURE                                      |
| 1D185..1D18B | ; Technical | # 3.1  | [7]  | MUSICAL SYMBOL COMBINING DOIT.. MUSICAL SYMBOL COMBINING TRIPLE TONGUE      |
| 1D1AA..1D1AD | ; Technical | # 3.1  | [4]  | MUSICAL SYMBOL COMBINING DOWN BOW.. MUSICAL SYMBOL COMBINING SNAP PIZZICATO |

## 19 Appendix F - Greek Confusables

Needed for exclusion in the 9 TR39 Mixed Scripts Greek rule. Wherever we have a Greek letter confusable with Latin, and we already saw Latin, forbid the Greek letter in favor of the Latin letter. See TR39 confusables. Note that these confusables cannot be excluded upfront in the TR31 identifier parsing, as Greek alone is allowed.

### 19.1 Exceptions

Allow these 10 Greek letters and symbols to be confusable with Latin:

037A, 0381, 0398, 03B5, 03B7, 03B8, 03B9, 03D1, 03F1, 03F4.

037A ; ( ι → i ) GREEK YPOGEGRAMMENI → LATIN SMALL LETTER I  
0381 ; ( α → a ) GREEK SMALL LETTER ALPHA  
0398 ; ( θ → 0- ) GREEK CAPITAL LETTER THETA → LATIN CAPITAL LETTER O, ...  
03B5 ; ( ε → □ ) GREEK SMALL LETTER EPSILON  
03B7 ; ( η → ŋ ) GREEK SMALL LETTER ETA → LATIN SMALL LETTER N, COMBINING VERTICAL LINE BELOW  
03B8 ; ( θ → 0- ) GREEK SMALL LETTER THETA → LATIN CAPITAL LETTER O, ...  
03B9 ; ( ι → i ) GREEK SMALL LETTER IOTA → LATIN SMALL LETTER I  
03D1 ; ( θ → 0- ) GREEK THETA SYMBOL → LATIN CAPITAL LETTER O, ...  
03F1 ; ( ϱ → p ) GREEK RHO SYMBOL → LATIN SMALL LETTER P  
03F4 ; ( θ → 0- ) GREEK CAPITAL THETA SYMBOL → LATIN CAPITAL LETTER O, ...

### 19.2 Confusables

List of the Greek-Latin confusables: (Note: these include the exceptions above)

grep GREEK confusables.txt | grep LETTER | grep LATIN

03B1 ; (  $\alpha$  → a ) GREEK SMALL LETTER ALPHA → LATIN SMALL LETTER A  
 0391 ; ( A → A ) GREEK CAPITAL LETTER ALPHA → LATIN CAPITAL LETTER A  
 1D217; (  $\Upsilon$  → V ) GREEK VOCAL NOTATION SYMBOL-24 → LATIN CAPITAL LETTER TURNED A  
 0392 ; ( B → B ) GREEK CAPITAL LETTER BETA → LATIN CAPITAL LETTER B  
 03F2 ; ( c → c ) GREEK LUNATE SIGMA SYMBOL → LATIN SMALL LETTER C  
 03F9 ; ( C → C ) GREEK CAPITAL LUNATE SIGMA SYMBOL → LATIN CAPITAL LETTER C  
 03B5 ; (  $\epsilon$  →  $\epsilon$  ) GREEK SMALL LETTER EPSILON → LATIN SMALL LETTER C WITH BAR  
 03F5 ; (  $\epsilon$  →  $\epsilon$  ) GREEK LUNATE EPSILON SYMBOL → LATIN SMALL LETTER C WITH BAR  
 037D ; (  $\rho$  →  $\rho$  ) GREEK SMALL REVERSED DOTTED LUNATE SIGMA SYMBOL → LATIN SMALL LETTER REVERSED C WITH DOT  
 03FF ; (  $\rho$  →  $\rho$  ) GREEK CAPITAL REVERSED DOTTED LUNATE SIGMA SYMBOL → LATIN CAPITAL LETTER REVERSED C WITH DOT  
 03B4 ; (  $\delta$  →  $\delta$  ) GREEK SMALL LETTER DELTA → LATIN SMALL LETTER DELTA  
 0395 ; ( E → E ) GREEK CAPITAL LETTER EPSILON → LATIN CAPITAL LETTER E  
 1D221; (  $\epsilon$  →  $\epsilon$  ) GREEK INSTRUMENTAL NOTATION SYMBOL-7 → LATIN CAPITAL LETTER OPEN E  
 1D213; (  $\Upsilon$  → F ) GREEK VOCAL NOTATION SYMBOL-20 → LATIN CAPITAL LETTER F  
 03DC ; ( F → F ) GREEK LETTER DIGAMMA → LATIN CAPITAL LETTER F  
 1D230; (  $\Upsilon$  →  $\Upsilon$  ) GREEK INSTRUMENTAL NOTATION SYMBOL-30 → LATIN EPIGRAPHIC LETTER REVERSED F  
 0397 ; ( H → H ) GREEK CAPITAL LETTER ETA → LATIN CAPITAL LETTER H  
 0370 ; (  $\theta$  →  $\theta$  ) GREEK CAPITAL LETTER HETA → LATIN CAPITAL LETTER HALF H  
 03B9 ; (  $\iota$  → i ) GREEK SMALL LETTER IOTA → LATIN SMALL LETTER I  
 1FBE ; (  $\iota$  → i ) GREEK PROSGEGRAMMENI → LATIN SMALL LETTER I  
 037A ; (  $\iota$  → i ) GREEK YPOGEGRAMMENI → LATIN SMALL LETTER I  
 03F3 ; ( j → j ) GREEK LETTER YOT → LATIN SMALL LETTER J  
 037F ; ( J → J ) GREEK CAPITAL LETTER YOT → LATIN CAPITAL LETTER J  
 039A ; ( K → K ) GREEK CAPITAL LETTER KAPPA → LATIN CAPITAL LETTER K  
 0399 ; ( I → l ) GREEK CAPITAL LETTER IOTA → LATIN SMALL LETTER L  
 1D22A; (  $\Upsilon$  → L ) GREEK INSTRUMENTAL NOTATION SYMBOL-23 → LATIN CAPITAL LETTER L  
 039C ; ( M → M ) GREEK CAPITAL LETTER MU → LATIN CAPITAL LETTER M  
 03FA ; ( M → M ) GREEK CAPITAL LETTER SAN → LATIN CAPITAL LETTER M  
 039D ; ( N → N ) GREEK CAPITAL LETTER NU → LATIN CAPITAL LETTER N  
 03B7 ; (  $\eta$  →  $\eta$  ) GREEK SMALL LETTER ETA → LATIN SMALL LETTER N, ...  
 0377 ; (  $\eta$  →  $\eta$  ) GREEK SMALL LETTER PAMPHYLIAN DIGAMMA → LATIN LETTER SMALL CAPITAL REVERSED N  
 03BF ; ( o → o ) GREEK SMALL LETTER OMICRON → LATIN SMALL LETTER O  
 03C3 ; (  $\sigma$  → o ) GREEK SMALL LETTER SIGMA → LATIN SMALL LETTER O  
 039F ; ( O → O ) GREEK CAPITAL LETTER OMICRON → LATIN CAPITAL LETTER O  
 1D21A; (  $\Upsilon$  → O- ) GREEK VOCAL NOTATION SYMBOL-52 → LATIN CAPITAL LETTER O, ...  
 03B8 ; (  $\theta$  → O- ) GREEK SMALL LETTER THETA → LATIN CAPITAL LETTER O, ...  
 03D1 ; (  $\theta$  → O- ) GREEK THETA SYMBOL → LATIN CAPITAL LETTER O, ...  
 0398 ; (  $\theta$  → O- ) GREEK CAPITAL LETTER THETA → LATIN CAPITAL LETTER O, ...  
 03F4 ; (  $\theta$  → O- ) GREEK CAPITAL THETA SYMBOL → LATIN CAPITAL LETTER O, ...  
 037B ; (  $\rho$  →  $\rho$  ) GREEK SMALL REVERSED LUNATE SIGMA SYMBOL → LATIN SMALL LETTER OPEN O

03FD ; ( Ϸ → Ϸ ) GREEK CAPITAL REVERSED LUNATE SIGMA SYMBOL → LATIN CAPITAL LETTER OPEN O

03C1 ; ( ϱ → ϱ ) GREEK SMALL LETTER RHO → LATIN SMALL LETTER P

03F1 ; ( ϱ → ϱ ) GREEK RHO SYMBOL → LATIN SMALL LETTER P

03A1 ; ( Ρ → Ρ ) GREEK CAPITAL LETTER RHO → LATIN CAPITAL LETTER P

1D29 ; ( ϱ → ϱ ) GREEK LETTER SMALL CAPITAL RHO → LATIN LETTER SMALL CAPITAL P

03C6 ; ( ϕ → ϕ ) GREEK SMALL LETTER PHI → LATIN SMALL LETTER PHI

03D5 ; ( ϕ → ϕ ) GREEK PHI SYMBOL → LATIN SMALL LETTER PHI

03BA ; ( κ → κ ) GREEK SMALL LETTER KAPPA → LATIN SMALL LETTER KRA

03F0 ; ( χ → κ ) GREEK KAPPA SYMBOL → LATIN SMALL LETTER KRA

1D26 ; ( ϱ → ϱ ) GREEK LETTER SMALL CAPITAL GAMMA → LATIN SMALL LETTER R

1D216 ; ( ϱ → R ) GREEK VOCAL NOTATION SYMBOL-23 → LATIN CAPITAL LETTER R

2129 ; ( ϱ → ϱ ) TURNED GREEK SMALL LETTER IOTA → LATIN SMALL LETTER REVERSED R WITH FISHHOOK

03B2 ; ( β → β ) GREEK SMALL LETTER BETA → LATIN SMALL LETTER SHARP S

03D0 ; ( β → β ) GREEK BETA SYMBOL → LATIN SMALL LETTER SHARP S

03A3 ; ( Σ → Σ ) GREEK CAPITAL LETTER SIGMA → LATIN CAPITAL LETTER ESH

03A4 ; ( Τ → Τ ) GREEK CAPITAL LETTER TAU → LATIN CAPITAL LETTER T

03C4 ; ( τ → τ ) GREEK SMALL LETTER TAU → LATIN LETTER SMALL CAPITAL T

03C5 ; ( υ → υ ) GREEK SMALL LETTER UPSILON → LATIN SMALL LETTER U

03BD ; ( ν → ν ) GREEK SMALL LETTER NU → LATIN SMALL LETTER V

1D20D ; ( ϱ → V ) GREEK VOCAL NOTATION SYMBOL-14 → LATIN CAPITAL LETTER V

1D27 ; ( ϱ → Λ ) GREEK LETTER SMALL CAPITAL LAMDA → LATIN SMALL LETTER TURNED V

039B ; ( Λ → Λ ) GREEK CAPITAL LETTER LAMDA → LATIN CAPITAL LETTER TURNED V

03A7 ; ( Χ → Χ ) GREEK CAPITAL LETTER CHI → LATIN CAPITAL LETTER X

03B3 ; ( γ → γ ) GREEK SMALL LETTER GAMMA → LATIN SMALL LETTER Y

03A5 ; ( Υ → Υ ) GREEK CAPITAL LETTER UPSILON → LATIN CAPITAL LETTER Y

03D2 ; ( Υ → Υ ) GREEK UPSILON WITH HOOK SYMBOL → LATIN CAPITAL LETTER Y

0396 ; ( Ζ → Ζ ) GREEK CAPITAL LETTER ZETA → LATIN CAPITAL LETTER Z

03F8 ; ( ϑ → ϑ ) GREEK SMALL LETTER SHO → LATIN SMALL LETTER THORN

03F7 ; ( ϑ → ϑ ) GREEK CAPITAL LETTER SHO → LATIN CAPITAL LETTER THORN

03C7 ; ( ϱ → χ ) LATIN SMALL LETTER CHI → GREEK SMALL LETTER CHI

03C9 ; ( ϱ → ω ) LATIN SMALL LETTER OMEGA → GREEK SMALL LETTER OMEGA

## 20 References

- [AltId] Unicode Standard Annex. [http://www.unicode.org/reports/tr31/tr31-11.html#Alternative\\_Identifier\\_Syntax](http://www.unicode.org/reports/tr31/tr31-11.html#Alternative_Identifier_Syntax)
- [DefId] Unicode Standard Annex. [http://www.unicode.org/reports/tr31/tr31-11.html#Default\\_Identifier\\_Syntax](http://www.unicode.org/reports/tr31/tr31-11.html#Default_Identifier_Syntax)
- [ISO 15924 Codes] TR24 Unicode Script Property Values and ISO 15924 Codes. [https://www.unicode.org/reports/tr24/#Relation\\_To\\_ISO15924](https://www.unicode.org/reports/tr24/#Relation_To_ISO15924)

- [libu8ident] Reini Urban. 2020. unicode security guidelines for identifiers <https://github.com/rurban/libu8ident/>
- [N3146] Clark Nelson. 2010. Recommendations for extended identifier characters for C and C++. <https://wg21.link/n3146>
- [P1949] Steve Downey et al. 2021. C++ Identifier Syntax using Unicode Standard Annex 31 <http://www.open-std.org/jtc1/sc22/wg21/docs/papers/2021/p1949r7.html>
- [TR15] Ken Whistler. Unicode Normalization Forms. <http://www.unicode.org/reports/tr15>
- [TR24] Ken Whistler. Unicode Script Property. <https://www.unicode.org/reports/tr24/#Common>
- [TR24#5.1] Handling Characters with the Common Script Property <https://www.unicode.org/reports/tr24/#Common>
- [TR24#5.2] Handling Combining Marks [https://www.unicode.org/reports/tr24/#Nonspacing\\_Marks](https://www.unicode.org/reports/tr24/#Nonspacing_Marks)
- [TR31] Mark Davis. Unicode Identifier and Pattern Syntax. <http://www.unicode.org/reports/tr31>
- [TR31#2.1] Combining Marks [https://www.unicode.org/reports/tr31/#Combining\\_Marks](https://www.unicode.org/reports/tr31/#Combining_Marks)
- [TR31#2.2] Modifier Letters [https://www.unicode.org/reports/tr31/#Modifier\\_Letters](https://www.unicode.org/reports/tr31/#Modifier_Letters)
- [TR31#Table 4] Table Candidate Characters for Exclusion from Identifiers [https://www.unicode.org/reports/tr31/#Table\\_Candidate\\_Characters\\_for\\_Exclusion\\_from\\_Identifiers](https://www.unicode.org/reports/tr31/#Table_Candidate_Characters_for_Exclusion_from_Identifiers)
- [TR31#Table 7] Limited Use Scripts [http://www.unicode.org/reports/tr31/#Table\\_Limited\\_Use\\_Scripts](http://www.unicode.org/reports/tr31/#Table_Limited_Use_Scripts)
- [TR36] Mark Davis and Michel Suignard. Unicode Security Considerations. <http://www.unicode.org/reports/tr36>
- [TR39] Mark Davis and Michel Suignard. Unicode Security Mechanisms. <http://www.unicode.org/reports/tr36>
- [TR39#Table 1] Identifier Status and Type Table 1 [https://www.unicode.org/reports/tr39/#Identifier\\_Status\\_and\\_Type](https://www.unicode.org/reports/tr39/#Identifier_Status_and_Type)
- [TR39#5.2] Mixed-Scripts Restriction-Level Detection [https://www.unicode.org/reports/tr39/#Restriction\\_Level\\_Detection](https://www.unicode.org/reports/tr39/#Restriction_Level_Detection)
- [TR39#5.4] Optional Detection [https://www.unicode.org/reports/tr39/#Optional\\_Detection](https://www.unicode.org/reports/tr39/#Optional_Detection)

- [TR44] Ken Whistler and Laurențiu Iancu. Unicode Character Database. <http://www.unicode.org/reports/tr44>
- [TR46] Mark Davis and Michel Suignard. Unicode IDNA Compatibility Processing. <http://www.unicode.org/reports/tr46>