Internet Draft
draft-ietf-idn-nameprep-01.txt
January 15, 2001
Expires in six months

Paul Hoffman
IMC & VPNC
Marc Blanchet
ViaGenie

Preparation of Internationalized Host Names

Status of this memo

Abstract

This document describes how to prepare internationalized host names for for use in the DNS. The steps include:
- mapping characters to other characters, such as to change their case
- normalizing the characters
- excluding characters that are prohibited from appearing in internationalized host names

1. Introduction

When expanding today's DNS to include internationalized host names, those new names will be handled in many parts of the DNS. The IDN Working Group's requirements document [IDNReq] describes a framework for domain name handling as well as requirements for the new names. The IDN Working Group's comparison document [IDNComp] gives a framework for how various parts of the IDN solution work together.

A user can enter a domain name into an application program in a myriad of fashions. Depending on the input method, the characters entered in the domain name may or may not be those that are allowed in internationalized host names. Thus, there must be a way to normalized the user's input before the name is resolved in the DNS.

It is a design goal of this document to allow users to enter host names in applications and have the highest chance of getting the name correct. This means that the user should not be limited to only entering exactly the characters that might have been used, but to instead be able to enter characters that unambiguously normalize to characters in the desired host name. At the same time, this process must not introduce any chance that two host names could be represented by two distinct strings of characters that look identical to typical users. It is also a design goal to have all preprocessing of IDN done before going on the wire, so that no transformation is done in the DNS server space. Name preparation can be done in other places, such as in the registration process.

This document describes the steps needed to convert a name part from one that is entered by the user to one that can be used in the DNS.

1.1 Terminology

The key words "MUST", "SHALL", "REQUIRED", "SHOULD", "RECOMMENDED", and "MAY" in this document are to be interpreted as described in RFC 2119 [RFC2119].

Examples in this document use the notation for code points and names from the Unicode Standard [Unicode3] and ISO 10646. For example, the letter "a" may be represented as either "U+0061" or "LATIN SMALL LETTER A". In the lists of prohibited characters, the "U+" is left off to make the lists easier to read.

Note: A glossary of terms used in Unicode and ISO 10646 can be found in [Glossary]. Information on the 10646/Unicode character model can be found in [CharModel].

2. Preparation Overview

The steps for preparing names are:

1) Input from the application service interface -- This can be done in many ways and is not specified in this document

2) Map -- For each character in the input, check if it has a mapping and, if so, replace it with its mapping. The mappings are a combination of folding uppercase characters to lowercase and hyphen mapping. This is described in Section 4.

3) Normalize -- Normalize the characters. This is described in Section 5.

4) Look for prohibited output -- Check for any characters that are not allowed in the output. If any are found, return an error to the application service interface. This is described in Section 6.

5) Resolution of the prepared name -- This must be specified in a different IDN document.

The above steps MUST be performed in the order given in order to comply with this specification.

The steps in this document have associated tables in the document. The tables are derived from outside sources, and the derivation is briefly described in the document. Although a great deal of effort has gone into preparing the tables, there is a chance that the tables do not correctly reflect the outside sources. Regardless of whether or not the tables differ from the sources, implementations MUST use the tables in this document for their processing. That is, if there is an error in the tables, the tables must still be used. Future versions of this document may include corrections and additions to the tables.

3. Mapping

Each character in the input stream is checked against the mapping table. The mapping table can be found in Appendix E of this document. That table includes all the steps described in the subsections below.

The mappings can be one-to-none, one-to-one, or one-to-many. That is, some characters may be eliminated or replaced by more than one character, and the output of this step might be shorter or longer than the input.

Design note: Characters that are not wanted in internationalized name parts can either be mapped to nothing in the mapping step, or cause an error in the prohibition step. The general guideline used to pick between the two outcomes was that removing alphabetic, non-protocol characters be done in the mapping step, but all other removals be done in the prohibition step. This allows for simple linguistic errors on the part of an input mechanism to be caught in the mapping step, but to not hide serious errors such as entering protocol characters or invisible characters from the user.

3.1 Case mapping

For each character in the input, if there is a lowercase mapping for that character, the input character is changed to the mapped lowercase character(s). The entries in the mapping table are derived from [UTR21].

Design note: this step could have been "change all lowercase characters into uppercase characters". However, the upper-to-lower folding was chosen because most users of the Internet today enter host names in lowercase.

3.2 Additional folding mappings

There are some characters that do not have mappings in [UTR21] but still need processing. These characters include a few Greek characters and many symbols that contain Latin characters. The list of characters to

add to the mapping table were determined by the following algorithm:

```
b = Normalize(Fold(a));
c = Normalize(Fold(b));
if c is not the same as b, add a mapping for "a to c".
```

Because Normalize(CaseFold(c)) always equals c, the table is stable from that point on.

3.3 Mapped out

The following characters are simply deleted from the input (that is, they are mapped to nothing) because their presence or absence should not make two domain names different.

Some characters are only useful in line-based text, and are otherwise invisible and ignored.

00AD	SOFT HYPHEN
1806	**MONGOLIAN TODO SOFT HYPHEN**
200B	ZERO WIDTH SPACE
FEFF	ZERO WIDTH NO-BREAK SPACE

Variation selectors and cursive connectors select different glyphs, but do not bear semantics.

180B	MONGOLIAN FREE VARIATION SELECTOR ONE
180C	MONGOLIAN FREE VARIATION SELECTOR TWO
180D	MONGOLIAN FREE VARIATION SELECTOR THREE
200C	ZERO WIDTH NON-JOINER
200D	ZERO WIDTH JOINER

4. Normalizaiton

The output of the mapping step is normalized using form KC, as described in [UTR15]. Using form KC instead of form C causes many characters that are identical or near-identical to be converted into a single character. Note that this specification refers to a specific vesion of [UTR15]. If a later version of [UTR15] changes the algorithm used for normalizing, that later version MUST NOT be used with this specification. Note that it is likely that this specification will be revised if UTR15 is changed, but until that happens, only the specified version of [UTR15] must be used.

5. Prohibited Output

Before the text can be emitted, it must be checked for prohibited characters. There is a variety of prohibited characters, as described in this section.

One of the goals of IDN is to allow the widest possible set of host names as long as those host names do not cause other problems, such as conflict with other standards. Specifically, experience with current DNS names have shown that there is a desire for host names that include personal names, company names, and spoken phrases. A goal of this section is to prohibit as few characters that might be used in these contexts as possible.

Note that every character listed in this section MUST NOT be transmitted on the DNS service interface. If a DNS server receives a request containing a prohibited character, then the DNS server MUST NOT resolve that name.

Some characters listed in one section would also appear in other sections. Each character is only listed once.

The collected list of prohibited characters can be found in Appendix F of this document. The list in Appendix F MUST be used by implementations of this specification. If there are any discrepancies between the list in Appendix F and subsections below, the list Appendix F always takes precedence.

5.1 Currently-prohibited ASCII characters

Some of the ASCII characters that are currently prohibited in host names by [STD13] are also used in protocol elements such as URIs. The other characters in the range U+0000 to U+007F that are not currently allowed are also prohibited in host name parts to reserve them for future use in protocol elements.

0000-002C
002E-002F
003A-0040
005B-0060
007B-007F

5.2 Space characters

Space characters would make visual transcription of URLs nearly impossible and could lead to user entry errors in many ways.

0020 **SPACE**
00A0 NO-BREAK SPACE
2000 **EN QUAD**
2001 **EM QUAD**
2002 **EN SPACE**
2003 **EM SPACE**
2004 **THREE-PER-EM SPACE**
2005 **FOUR-PER-EM SPACE**
2006 **SIX-PER-EM SPACE**
2007 **FIGURE SPACE**
2008 **PUNCTUATION SPACE**

2009 **THIN SPACE**
200A HAIR SPACE
202F NARROW NO-BREAK SPACE
3000 **IDEOGRAPHIC SPACE**
1680 **OGHAM SPACE MARK**
200B ZERO WIDTH SPACE

5.3 Control characters

Control characters cannot be seen and can cause unpredictable results when displayed.

0000-001F [CONTROL CHARACTERS]
007F DELETE
0080-009F [CONTROL CHARACTERS]
2028 **LINE SEPARATOR**
2029 **PARAGRAPH SEPARATORS**

5.4 Private use and replacement characters

Because private-use characters do not have defined meanings, they are prohibited. The private-use characters are:

E000-F8FF [PRIVATE USE, PLANE 0]
F0000-FFFFD [PRIVATE USE, PLANE 15]
100000-10FFFD [PRIVATE USE, PLANE 16]

The replacement character (U+FFFD) has no known semantic definition in a name, and is often used in renderers to say "there would be some character here, but it cannot be rendered". For example, on a computer with no Asian fonts, a name with three katakana characters might be rendered with three replacement characters.

FFFD REPLACEMENT CHARACTER

5.5 Non-character codepoints

Non-character code points are code points that have been assigned in ISO 10646 but are not characters. Because they are already assigned, they are guaranteed not to later change into characters.

FFFE-FFFF [NONCHARACTER CODE POINTS]
1FFFE-1FFFF [NONCHARACTER CODE POINTS]
2FFFE-2FFFF [NONCHARACTER CODE POINTS]
3FFFE-3FFFF [NONCHARACTER CODE POINTS]
4FFFE-4FFFF [NONCHARACTER CODE POINTS]
5FFFE-5FFFF [NONCHARACTER CODE POINTS]
6FFFE-6FFFF [NONCHARACTER CODE POINTS]
7FFFE-7FFFF [NONCHARACTER CODE POINTS]
8FFFE-8FFFF [NONCHARACTER CODE POINTS]
9FFFE-9FFFF [NONCHARACTER CODE POINTS]
AFFFE-AFFFF [NONCHARACTER CODE POINTS]

```
BFFFE-BFFFF [NONCHARACTER CODE POINTS]
CFFFE-CFFFF [NONCHARACTER CODE POINTS]
DFFFE-DFFFF [NONCHARACTER CODE POINTS]
EFFFE-EFFFF [NONCHARACTER CODE POINTS]
FFFFE-FFFFF [NONCHARACTER CODE POINTS]
10FFFE-10FFFF  [NONCHARACTER CODE POINTS]
```

5.6 Surrogate codes

The following are permanently reserved for use as surrogate code values in the UTF-16 encoding, will never be assigned to characters and are therefore prohibited:

```
D800-DFFF   [SURROGATE CODES]
```

5.7 Inappropriate for plain text

The following characters should not appear in regular text.

```
FFF9        INTERLINEAR ANNOTATION ANCHOR
FFFA        INTERLINEAR ANNOTATION SEPARATOR
FFFB        INTERLINEAR ANNOTATION TERMINATOR
FFFC        OBJECT REPLACEMENT CHARACTER
```

5.8 Inappropriate for domain names

The ideographic description characters allow different sequences of characters to be rendered the same way, which makes them inappropriate for host names that must have a single canonical order.

```
2FF0-2FFF   IDEOGRAPHIC DESCRIPTION CHARACTERS
```

5.9 Change display properties

The following characters, some of which are deprecated in ISO 10646, can cause changes in display or the order in which characters appear when rendered.

```
200E        LEFT-TO-RIGHT MARK
200F        RIGHT-TO-LEFT MARK
202A        LEFT-TO-RIGHT EMBEDDING
202B        RIGHT-TO-LEFT EMBEDDING
202C        POP DIRECTIONAL FORMATTING
202D        LEFT-TO-RIGHT OVERRIDE
202E        RIGHT-TO-LEFT OVERRIDE
206A        INHIBIT SYMMETRIC SWAPPING
206B        ACTIVATE SYMMETRIC SWAPPING
206C        INHIBIT ARABIC FORM SHAPING
206D        ACTIVATE ARABIC FORM SHAPING
206E        NATIONAL DIGIT SHAPES
206F        NOMINAL DIGIT SHAPES
```

6. Unassigned Characters

All characters not yet assigned in [ISO10646] are called "unassigned characters". Authoritative name servers MUST NOT have internationalized name parts that contain any unassigned characters. DNS requests MAY contain name parts that contain unassigned characters. Note that this is the only part of this document where the requirements for queries differs from the requirements for names in DNS zones.

Using two different policies for where unassigned characters can appear in the DNS prevents the need for versioning the IDNprotocol [IDNrev]. This is very useful since it makes the overall processing simpler and do not impose a "protocol" to handle versioning. It is expected that ISO **10646 will be updated fairly frequently; recently, it has happened** approximately once a year. Each time a new version of ISO 10646 appears, a new version of this document can be created. Some end users will want to use the new characters as soon as they are defined.

The list of unassigned characters can be found in Appendix G of this document. The list in Appendix G MUST be used by implementations of this specification. If there are any discrepancies between the list in Appendix G and the ISO 10646 specification, the list Appendix G always takes precedence.

Due to the way that versioning is handled in this section, host names that are embedded in structures that cannot be changed (such as the signed parts of digital certificates) MUST NOT have internationalized name parts that contain any unassigned characters.

6.1 Categories of characters

Each character in ISO 10646 can be categorized by how it acts in the process described in earlier sections of this document:

AO Characters that may be in the output

MN Characters that cannot be in the output because they are mapped to nothing or never appear as output from normalization

D Characters that cannot be in the output because they are disallowed in the prohibition step

U Unassigned characters

A subsequent version of this document that references a newer version of ISO 10646 with new characters will inherently have some characters move from category U to either D, MN, or AO. For backwards compatibility, no future version of this document will move characters from any other category. That is, no current AO, MN, or D characters will ever change to a different category.

Authoritative name servers MUST NOT contain any name that has characters outside of AO for the latest version of this document. That is, they are forbidden to contain any IDN names containing characters from the MN, D, or U categories.

Applications creating name queries MUST treat U code points as if they were AO when preparing the name parts according to this document. Those applications MAY optionally have a preprocess that provide stricter checks: treating unassigned characters in the input as errors, or warning the user about the fact that the character is unassigned in the version of this document that the software is based on; such a choice is a local matter for the software.

Non-authoritative DNS servers MAY reject names that contain characters that are in categories MN or D for the version of this document that they implement, but MUST NOT reject names because they contain name parts with characters from category U.

6.2 Reasons for difference between authoritative servers and requests

Different software using different versions of this document need to interoperate with maximal compatibility. The scheme described in this section (authoritative name servers MUST NOT use unassigned characters, requests MAY include unassigned characters) allows that compatibility without introducing any known security or interoperability issues.

The list below shows what happens if a request contains a character from category U that is allowed in a newer version of this document. The request either resolves to the domain name that was intended, or resolves to no domain at all. In this list, the request comes from an application using version "oldVersion" of this document, the authoritative name server is using version "newVersion" of this document, and the character X was in category U on oldVersion, and has changed category to AO, MN, or D. There are 3 possible scenarios:

1. **X becomes AO -- In newVersion, X is in category AO. Because the** application passed X through, it gets back correct data from the authoritative name server. There is one exceptional case, where X is a combining mark.

The order of combining marks is normalized, so if another combining mark Y has a lower combining class than X then XY will be put in the canonical order YX. (Unassigned characters are never reordered, so this doesn't happen in oldVersion). If the request contains YX, the request will get correct data from the authoritative name server. However, no domain name can be registered with XY, so a request with XY will get a "no such host" error.

2. **X becomes MN -- In newVersion, X is normalized to character "nX" and** therefore X is now put in category MN. This cannot exist in any domain

name, so any request containing X will get back a "no such host" error. Note, however, if the request had contained the letter nX, it would have gotten back correct data.

3. X becomes D -- In newVersion, X is in category MN. This cannot exist in any domain name, so any request containing X will get back a "no such host" error.

In none of the cases does the request get data for a host name other than the one it actually wanted.

The processing in this document is always stable. If a string S is the result of processing on newVersion, then it will remain the same when processed on oldVersion.

There is always a way for the application to get the correct data from the authoritative name server. For example, suppose that <ALPHA> was unassigned in oldVersion, and that it is assigned in newVersion, but case-folded to <alpha>. As long as the application supplies strings containing <alpha> instead of <ALPHA>, the correct data will be returned. Because the processing is stable, a different application running newVersion can pass a processed host name to the application running oldVersion. It will only contain <alpha>, and will return the correct results from the authoritative name server.

6.3 Versions of applications and authoritative name servers

Another way to see that this versioning system works is to compare what happens when an application uses a newer or older version of this document.

Newer application -- Suppose that a application or intermediary DNS server is using version newVersion and the authoritative name server is using version oldVersion. This case is simple: there will be no names on the server that cannot be accessed by the application because the resolver uses a superset of the code points accepted by the server.

Newer server -- Suppose that an application or intermediary DNS server is using oldVersion and the authoritative name server is using newVersion. Because the application passed through any unassigned characters, the user can access names on the server that use characters in newVersion. No names on the site can have characters that are unassigned in newVersion, since that is illegal. In this case, the application has to enter the unassigned characters in the correct order, and has to use unassigned characters that would make it through both the mapping and the normalization steps.

7. Security Considerations

Much of the security of the Internet relies on the DNS. Thus, any change to the characteristics of the DNS can change the security of much of the

Internet.

Host names are used by users to connect to Internet servers. The security of the Internet would be compromised if a user entering a single internationalized name could be connected to different servers based on different interpretations of the internationalized host name.

Current applications may assume that the characters allowed in host names will always be the same as they are in [STD13]. This document vastly increases the number of characters available in host names. Every program that uses "special" characters in conjunction with host names may be vulnerable to attack based on the new characters allowed by this specification.

8. References

[CharModel] Unicode Technical Report;17, Character Model. <http://www.unicode.org/unicode/reports/tr17/>.

[Glossary] Unicode Glossary, <http://www.unicode.org/glossary/>.

[IDNComp] Paul Hoffman, "Comparison of Internationalized Domain Name Proposals", draft-ietf-idn-compare

[IDNReq] James Seng, "Requirements of Internationalized Domain Names", draft-ietf-idn-requirement

[IDNRev] Marc Blanchet, "Handling versions of internationalized domain names protocols", draft-ietf-idn-version

[ISO10646] ISO/IEC 10646-1:2000. International Standard -- Information technology -- Universal Multiple-Octet Coded Character Set (UCS) -- Part 1: Architecture and Basic Multilingual Plane.

[Normalize] Character Normalization in IETF Protocols, draft-duerst-i18n-norm-03

[RFC2119] Scott Bradner, "Key words for use in RFCs to Indicate Requirement Levels", March 1997, RFC 2119.

[RFC2396] Tim Berners-Lee, et. al., "Uniform Resource Identifiers (URI): Generic Syntax", August 1998, RFC 2396.

[RFC2732] Robert Hinden, et. al., Format for Literal IPv6 Addresses in URL's, December 1999, RFC 2732.

[STD13] Paul Mockapetris, "Domain names - implementation and specification", November 1987, STD 13 (RFC 1034 and 1035).

[Unicode3] The Unicode Consortium, "The Unicode Standard -- Version 3.0", ISBN 0-201-61633-5. Described at

<http://www.unicode.org/unicode/standard/versions/Unicode3.0.html>.

[UTR15] Mark Davis and Martin Duerst. Unicode Normalization Forms. Unicode Technical Report;15. <http://www.unicode.org/unicode/reports/tr15/>.

[UTR21] Mark Davis. Case Mappings. Unicode Technical Report;21. <http://www.unicode.org/unicode/reports/tr21/>.

A. Acknowledgements

Many people from the IETF IDN Working Group and the Unicode Technical Committee contributed ideas that went into the first draft of this document. Mark Davis and Patrik Faltstrom were particularly helpful in some of the ideas, such as the versioning description.

The IDN namprep design team made many useful changes to the first draft. That team and its advisors include:

Asmus Freytag
Cathy Wissink
Francois Yergeau
James Seng
Marc Blanchet
Mark Davis
Martin Duerst
Patrik Faltstrom
Paul Hoffman

Additional significant improvements were proposed by:

Jonathan Rosenne

B. Differences Between -00 and -01 Drafts

Throughout: Changed "canonicalize" to "normalize". Removed the normative references to ISO 10646.

1.1: Clarified the second paragraph and added the third.

1.2: Removed the IDN summary because we have diverged from the comparison draft significantly.

1.3: Removed the open issues list.

2: Removed the references to the parts of IDNComp.

2.1: Removed the section on where preparation happens.

2.2: Reversed the order of the middle three steps.

3, 4, and 5: Changed the order to match the new ordering.

4: Added the description of the design goals for one-to-none vs. prohibition. Changed the table on which case mapping is based. Pretty much changed the whole section.

5: Removed many characters. Two reasons were to remove the ones that now get corrected by NFKC, and removed the ones that "looked like" other forbidden characters.

5.2: Added and removed various characters.

5.3: Added higher-plane private use characters.

5.5: Added non-character code points.

5.6: Changed "surrogate characters" to "surrogate codes" and corrected the description of why they are prohibited.

6: Replaced future IANA description with new versioning proposal.

7: Added third paragraph.

8: Added [CharModel] and [Glossary]. Updated the non-normative reference for ISO 10646.

A: Added names of commenters.

C: Removed the IANA Considerations because we are not sure we will we have any.

E, F, G: Added the long appendicies at the end of the document.

C. IANA Considerations

[[[We probably won't have any.]]]

D. Author Contact Information

Paul Hoffman
Internet Mail Consortium and VPN Consortium
127 Segre Place
Santa Cruz, CA 95060 USA
paul.hoffman@imc.org and paul.hoffman@vpnc.org

Marc Blanchet
Viagenie inc.
2875 boul. Laurier, bur. 300
Ste-Foy, Quebec, Canada, G1V 2M2

Marc.Blanchet@viagenie.qc.ca

E. Mapping Table

The following is the mapping table from Section 3. The table has three columns:
- the character that is mapped from
- the zero or more characters that it is mapped to
- the reason for the mapping

The columns are separated by semicolons. Note that the second column may be empty, or it may have one character, or it may have more than one character, with each character separated by a space.

```
0041; 0061; Case map
0042; 0062; Case map
0043; 0063; Case map
0044; 0064; Case map
0045; 0065; Case map
0046; 0066; Case map
0047; 0067; Case map
0048; 0068; Case map
0049; 0069; Case map
004A; 006A; Case map
004B; 006B; Case map
004C; 006C; Case map
004D; 006D; Case map
004E; 006E; Case map
004F; 006F; Case map
0050; 0070; Case map
0051; 0071; Case map
0052; 0072; Case map
0053; 0073; Case map
0054; 0074; Case map
0055; 0075; Case map
0056; 0076; Case map
0057; 0077; Case map
0058; 0078; Case map
0059; 0079; Case map
005A; 007A; Case map
00AD; ; Map out
00B5; 03BC; Case map
00C0; 00E0; Case map
00C1; 00E1; Case map
00C2; 00E2; Case map
00C3; 00E3; Case map
00C4; 00E4; Case map
00C5; 00E5; Case map
00C6; 00E6; Case map
00C7; 00E7; Case map
00C8; 00E8; Case map
```

00C9; 00E9; Case map
00CA; 00EA; Case map
00CB; 00EB; Case map
00CC; 00EC; Case map
00CD; 00ED; Case map
00CE; 00EE; Case map
00CF; 00EF; Case map
00D0; 00F0; Case map
00D1; 00F1; Case map
00D2; 00F2; Case map
00D3; 00F3; Case map
00D4; 00F4; Case map
00D5; 00F5; Case map
00D6; 00F6; Case map
00D8; 00F8; Case map
00D9; 00F9; Case map
00DA; 00FA; Case map
00DB; 00FB; Case map
00DC; 00FC; Case map
00DD; 00FD; Case map
00DE; 00FE; Case map
00DF; 0073 0073; Case map
0100; 0101; Case map
0102; 0103; Case map
0104; 0105; Case map
0106; 0107; Case map
0108; 0109; Case map
010A; 010B; Case map
010C; 010D; Case map
010E; 010F; Case map
0110; 0111; Case map
0112; 0113; Case map
0114; 0115; Case map
0116; 0117; Case map
0118; 0119; Case map
011A; 011B; Case map
011C; 011D; Case map
011E; 011F; Case map
0120; 0121; Case map
0122; 0123; Case map
0124; 0125; Case map
0126; 0127; Case map
0128; 0129; Case map
012A; 012B; Case map
012C; 012D; Case map
012E; 012F; Case map
0130; 0069; Case map
0131; 0069; Case map
0132; 0133; Case map
0134; 0135; Case map
0136; 0137; Case map

0139; 013A; Case map
013B; 013C; Case map
013D; 013E; Case map
013F; 0140; Case map
0141; 0142; Case map
0143; 0144; Case map
0145; 0146; Case map
0147; 0148; Case map
0149; 02BC 006E; Case map
014A; 014B; Case map
014C; 014D; Case map
014E; 014F; Case map
0150; 0151; Case map
0152; 0153; Case map
0154; 0155; Case map
0156; 0157; Case map
0158; 0159; Case map
015A; 015B; Case map
015C; 015D; Case map
015E; 015F; Case map
0160; 0161; Case map
0162; 0163; Case map
0164; 0165; Case map
0166; 0167; Case map
0168; 0169; Case map
016A; 016B; Case map
016C; 016D; Case map
016E; 016F; Case map
0170; 0171; Case map
0172; 0173; Case map
0174; 0175; Case map
0176; 0177; Case map
0178; 00FF; Case map
0179; 017A; Case map
017B; 017C; Case map
017D; 017E; Case map
017F; 0073; Case map
0181; 0253; Case map
0182; 0183; Case map
0184; 0185; Case map
0186; 0254; Case map
0187; 0188; Case map
0189; 0256; Case map
018A; 0257; Case map
018B; 018C; Case map
018E; 01DD; Case map
018F; 0259; Case map
0190; 025B; Case map
0191; 0192; Case map
0193; 0260; Case map
0194; 0263; Case map

0196; 0269; Case map
0197; 0268; Case map
0198; 0199; Case map
019C; 026F; Case map
019D; 0272; Case map
019F; 0275; Case map
01A0; 01A1; Case map
01A2; 01A3; Case map
01A4; 01A5; Case map
01A6; 0280; Case map
01A7; 01A8; Case map
01A9; 0283; Case map
01AC; 01AD; Case map
01AE; 0288; Case map
01AF; 01B0; Case map
01B1; 028A; Case map
01B2; 028B; Case map
01B3; 01B4; Case map
01B5; 01B6; Case map
01B7; 0292; Case map
01B8; 01B9; Case map
01BC; 01BD; Case map
01C4; 01C6; Case map
01C5; 01C6; Case map
01C7; 01C9; Case map
01C8; 01C9; Case map
01CA; 01CC; Case map
01CB; 01CC; Case map
01CD; 01CE; Case map
01CF; 01D0; Case map
01D1; 01D2; Case map
01D3; 01D4; Case map
01D5; 01D6; Case map
01D7; 01D8; Case map
01D9; 01DA; Case map
01DB; 01DC; Case map
01DE; 01DF; Case map
01E0; 01E1; Case map
01E2; 01E3; Case map
01E4; 01E5; Case map
01E6; 01E7; Case map
01E8; 01E9; Case map
01EA; 01EB; Case map
01EC; 01ED; Case map
01EE; 01EF; Case map
01F0; 006A 030C; Case map
01F1; 01F3; Case map
01F2; 01F3; Case map
01F4; 01F5; Case map
01F6; 0195; Case map
01F7; 01BF; Case map

01F8; 01F9; Case map
01FA; 01FB; Case map
01FC; 01FD; Case map
01FE; 01FF; Case map
0200; 0201; Case map
0202; 0203; Case map
0204; 0205; Case map
0206; 0207; Case map
0208; 0209; Case map
020A; 020B; Case map
020C; 020D; Case map
020E; 020F; Case map
0210; 0211; Case map
0212; 0213; Case map
0214; 0215; Case map
0216; 0217; Case map
0218; 0219; Case map
021A; 021B; Case map
021C; 021D; Case map
021E; 021F; Case map
0222; 0223; Case map
0224; 0225; Case map
0226; 0227; Case map
0228; 0229; Case map
022A; 022B; Case map
022C; 022D; Case map
022E; 022F; Case map
0230; 0231; Case map
0232; 0233; Case map
0345; 03B9; Case map
037A; 0020 03B9; Additional folding
0386; 03AC; Case map
0388; 03AD; Case map
0389; 03AE; Case map
038A; 03AF; Case map
038C; 03CC; Case map
038E; 03CD; Case map
038F; 03CE; Case map
0390; 03B9 0308 0301; Case map
0391; 03B1; Case map
0392; 03B2; Case map
0393; 03B3; Case map
0394; 03B4; Case map
0395; 03B5; Case map
0396; 03B6; Case map
0397; 03B7; Case map
0398; 03B8; Case map
0399; 03B9; Case map
039A; 03BA; Case map
039B; 03BB; Case map
039C; 03BC; Case map

039D; 03BD; Case map
039E; 03BE; Case map
039F; 03BF; Case map
03A0; 03C0; Case map
03A1; 03C1; Case map
03A3; 03C2; Case map
03A4; 03C4; Case map
03A5; 03C5; Case map
03A6; 03C6; Case map
03A7; 03C7; Case map
03A8; 03C8; Case map
03A9; 03C9; Case map
03AA; 03CA; Case map
03AB; 03CB; Case map
03B0; 03C5 0308 0301; Case map
03C2; 03C2; Case map
03C3; 03C2; Case map
03D0; 03B2; Case map
03D1; 03B8; Case map
03D2; 03C5; Additional folding
03D3; 03CD; Additional folding
03D4; 03CB; Additional folding
03D5; 03C6; Case map
03D6; 03C0; Case map
03DA; 03DB; Case map
03DC; 03DD; Case map
03DE; 03DF; Case map
03E0; 03E1; Case map
03E2; 03E3; Case map
03E4; 03E5; Case map
03E6; 03E7; Case map
03E8; 03E9; Case map
03EA; 03EB; Case map
03EC; 03ED; Case map
03EE; 03EF; Case map
03F0; 03BA; Case map
03F1; 03C1; Case map
03F2; 03C2; Case map
0400; 0450; Case map
0401; 0451; Case map
0402; 0452; Case map
0403; 0453; Case map
0404; 0454; Case map
0405; 0455; Case map
0406; 0456; Case map
0407; 0457; Case map
0408; 0458; Case map
0409; 0459; Case map
040A; 045A; Case map
040B; 045B; Case map
040C; 045C; Case map

040D; 045D; Case map
040E; 045E; Case map
040F; 045F; Case map
0410; 0430; Case map
0411; 0431; Case map
0412; 0432; Case map
0413; 0433; Case map
0414; 0434; Case map
0415; 0435; Case map
0416; 0436; Case map
0417; 0437; Case map
0418; 0438; Case map
0419; 0439; Case map
041A; 043A; Case map
041B; 043B; Case map
041C; 043C; Case map
041D; 043D; Case map
041E; 043E; Case map
041F; 043F; Case map
0420; 0440; Case map
0421; 0441; Case map
0422; 0442; Case map
0423; 0443; Case map
0424; 0444; Case map
0425; 0445; Case map
0426; 0446; Case map
0427; 0447; Case map
0428; 0448; Case map
0429; 0449; Case map
042A; 044A; Case map
042B; 044B; Case map
042C; 044C; Case map
042D; 044D; Case map
042E; 044E; Case map
042F; 044F; Case map
0460; 0461; Case map
0462; 0463; Case map
0464; 0465; Case map
0466; 0467; Case map
0468; 0469; Case map
046A; 046B; Case map
046C; 046D; Case map
046E; 046F; Case map
0470; 0471; Case map
0472; 0473; Case map
0474; 0475; Case map
0476; 0477; Case map
0478; 0479; Case map
047A; 047B; Case map
047C; 047D; Case map
047E; 047F; Case map

0480; 0481; Case map
048C; 048D; Case map
048E; 048F; Case map
0490; 0491; Case map
0492; 0493; Case map
0494; 0495; Case map
0496; 0497; Case map
0498; 0499; Case map
049A; 049B; Case map
049C; 049D; Case map
049E; 049F; Case map
04A0; 04A1; Case map
04A2; 04A3; Case map
04A4; 04A5; Case map
04A6; 04A7; Case map
04A8; 04A9; Case map
04AA; 04AB; Case map
04AC; 04AD; Case map
04AE; 04AF; Case map
04B0; 04B1; Case map
04B2; 04B3; Case map
04B4; 04B5; Case map
04B6; 04B7; Case map
04B8; 04B9; Case map
04BA; 04BB; Case map
04BC; 04BD; Case map
04BE; 04BF; Case map
04C1; 04C2; Case map
04C3; 04C4; Case map
04C7; 04C8; Case map
04CB; 04CC; Case map
04D0; 04D1; Case map
04D2; 04D3; Case map
04D4; 04D5; Case map
04D6; 04D7; Case map
04D8; 04D9; Case map
04DA; 04DB; Case map
04DC; 04DD; Case map
04DE; 04DF; Case map
04E0; 04E1; Case map
04E2; 04E3; Case map
04E4; 04E5; Case map
04E6; 04E7; Case map
04E8; 04E9; Case map
04EA; 04EB; Case map
04EC; 04ED; Case map
04EE; 04EF; Case map
04F0; 04F1; Case map
04F2; 04F3; Case map
04F4; 04F5; Case map
04F8; 04F9; Case map

0531; 0561; Case map
0532; 0562; Case map
0533; 0563; Case map
0534; 0564; Case map
0535; 0565; Case map
0536; 0566; Case map
0537; 0567; Case map
0538; 0568; Case map
0539; 0569; Case map
053A; 056A; Case map
053B; 056B; Case map
053C; 056C; Case map
053D; 056D; Case map
053E; 056E; Case map
053F; 056F; Case map
0540; 0570; Case map
0541; 0571; Case map
0542; 0572; Case map
0543; 0573; Case map
0544; 0574; Case map
0545; 0575; Case map
0546; 0576; Case map
0547; 0577; Case map
0548; 0578; Case map
0549; 0579; Case map
054A; 057A; Case map
054B; 057B; Case map
054C; 057C; Case map
054D; 057D; Case map
054E; 057E; Case map
054F; 057F; Case map
0550; 0580; Case map
0551; 0581; Case map
0552; 0582; Case map
0553; 0583; Case map
0554; 0584; Case map
0555; 0585; Case map
0556; 0586; Case map
0587; 0565 0582; Case map
1806; ; Map out
180B; ; Map out
180C; ; Map out
180D; ; Map out
1E00; 1E01; Case map
1E02; 1E03; Case map
1E04; 1E05; Case map
1E06; 1E07; Case map
1E08; 1E09; Case map
1E0A; 1E0B; Case map
1E0C; 1E0D; Case map
1E0E; 1E0F; Case map

1E10; 1E11; Case map
1E12; 1E13; Case map
1E14; 1E15; Case map
1E16; 1E17; Case map
1E18; 1E19; Case map
1E1A; 1E1B; Case map
1E1C; 1E1D; Case map
1E1E; 1E1F; Case map
1E20; 1E21; Case map
1E22; 1E23; Case map
1E24; 1E25; Case map
1E26; 1E27; Case map
1E28; 1E29; Case map
1E2A; 1E2B; Case map
1E2C; 1E2D; Case map
1E2E; 1E2F; Case map
1E30; 1E31; Case map
1E32; 1E33; Case map
1E34; 1E35; Case map
1E36; 1E37; Case map
1E38; 1E39; Case map
1E3A; 1E3B; Case map
1E3C; 1E3D; Case map
1E3E; 1E3F; Case map
1E40; 1E41; Case map
1E42; 1E43; Case map
1E44; 1E45; Case map
1E46; 1E47; Case map
1E48; 1E49; Case map
1E4A; 1E4B; Case map
1E4C; 1E4D; Case map
1E4E; 1E4F; Case map
1E50; 1E51; Case map
1E52; 1E53; Case map
1E54; 1E55; Case map
1E56; 1E57; Case map
1E58; 1E59; Case map
1E5A; 1E5B; Case map
1E5C; 1E5D; Case map
1E5E; 1E5F; Case map
1E60; 1E61; Case map
1E62; 1E63; Case map
1E64; 1E65; Case map
1E66; 1E67; Case map
1E68; 1E69; Case map
1E6A; 1E6B; Case map
1E6C; 1E6D; Case map
1E6E; 1E6F; Case map
1E70; 1E71; Case map
1E72; 1E73; Case map
1E74; 1E75; Case map

1E76; 1E77; Case map
1E78; 1E79; Case map
1E7A; 1E7B; Case map
1E7C; 1E7D; Case map
1E7E; 1E7F; Case map
1E80; 1E81; Case map
1E82; 1E83; Case map
1E84; 1E85; Case map
1E86; 1E87; Case map
1E88; 1E89; Case map
1E8A; 1E8B; Case map
1E8C; 1E8D; Case map
1E8E; 1E8F; Case map
1E90; 1E91; Case map
1E92; 1E93; Case map
1E94; 1E95; Case map
1E96; 0068 0331; Case map
1E97; 0074 0308; Case map
1E98; 0077 030A; Case map
1E99; 0079 030A; Case map
1E9A; 0061 02BE; Case map
1E9B; 1E61; Case map
1EA0; 1EA1; Case map
1EA2; 1EA3; Case map
1EA4; 1EA5; Case map
1EA6; 1EA7; Case map
1EA8; 1EA9; Case map
1EAA; 1EAB; Case map
1EAC; 1EAD; Case map
1EAE; 1EAF; Case map
1EB0; 1EB1; Case map
1EB2; 1EB3; Case map
1EB4; 1EB5; Case map
1EB6; 1EB7; Case map
1EB8; 1EB9; Case map
1EBA; 1EBB; Case map
1EBC; 1EBD; Case map
1EBE; 1EBF; Case map
1EC0; 1EC1; Case map
1EC2; 1EC3; Case map
1EC4; 1EC5; Case map
1EC6; 1EC7; Case map
1EC8; 1EC9; Case map
1ECA; 1ECB; Case map
1ECC; 1ECD; Case map
1ECE; 1ECF; Case map
1ED0; 1ED1; Case map
1ED2; 1ED3; Case map
1ED4; 1ED5; Case map
1ED6; 1ED7; Case map
1ED8; 1ED9; Case map

1EDA; 1EDB; Case map
1EDC; 1EDD; Case map
1EDE; 1EDF; Case map
1EE0; 1EE1; Case map
1EE2; 1EE3; Case map
1EE4; 1EE5; Case map
1EE6; 1EE7; Case map
1EE8; 1EE9; Case map
1EEA; 1EEB; Case map
1EEC; 1EED; Case map
1EEE; 1EEF; Case map
1EF0; 1EF1; Case map
1EF2; 1EF3; Case map
1EF4; 1EF5; Case map
1EF6; 1EF7; Case map
1EF8; 1EF9; Case map
1F08; 1F00; Case map
1F09; 1F01; Case map
1F0A; 1F02; Case map
1F0B; 1F03; Case map
1F0C; 1F04; Case map
1F0D; 1F05; Case map
1F0E; 1F06; Case map
1F0F; 1F07; Case map
1F18; 1F10; Case map
1F19; 1F11; Case map
1F1A; 1F12; Case map
1F1B; 1F13; Case map
1F1C; 1F14; Case map
1F1D; 1F15; Case map
1F28; 1F20; Case map
1F29; 1F21; Case map
1F2A; 1F22; Case map
1F2B; 1F23; Case map
1F2C; 1F24; Case map
1F2D; 1F25; Case map
1F2E; 1F26; Case map
1F2F; 1F27; Case map
1F38; 1F30; Case map
1F39; 1F31; Case map
1F3A; 1F32; Case map
1F3B; 1F33; Case map
1F3C; 1F34; Case map
1F3D; 1F35; Case map
1F3E; 1F36; Case map
1F3F; 1F37; Case map
1F48; 1F40; Case map
1F49; 1F41; Case map
1F4A; 1F42; Case map
1F4B; 1F43; Case map
1F4C; 1F44; Case map

1F4D; 1F45; Case map
1F50; 03C5 0313; Case map
1F52; 03C5 0313 0300; Case map
1F54; 03C5 0313 0301; Case map
1F56; 03C5 0313 0342; Case map
1F59; 1F51; Case map
1F5B; 1F53; Case map
1F5D; 1F55; Case map
1F5F; 1F57; Case map
1F68; 1F60; Case map
1F69; 1F61; Case map
1F6A; 1F62; Case map
1F6B; 1F63; Case map
1F6C; 1F64; Case map
1F6D; 1F65; Case map
1F6E; 1F66; Case map
1F6F; 1F67; Case map
1F80; 1F00 03B9; Case map
1F81; 1F01 03B9; Case map
1F82; 1F02 03B9; Case map
1F83; 1F03 03B9; Case map
1F84; 1F04 03B9; Case map
1F85; 1F05 03B9; Case map
1F86; 1F06 03B9; Case map
1F87; 1F07 03B9; Case map
1F88; 1F00 03B9; Case map
1F89; 1F01 03B9; Case map
1F8A; 1F02 03B9; Case map
1F8B; 1F03 03B9; Case map
1F8C; 1F04 03B9; Case map
1F8D; 1F05 03B9; Case map
1F8E; 1F06 03B9; Case map
1F8F; 1F07 03B9; Case map
1F90; 1F20 03B9; Case map
1F91; 1F21 03B9; Case map
1F92; 1F22 03B9; Case map
1F93; 1F23 03B9; Case map
1F94; 1F24 03B9; Case map
1F95; 1F25 03B9; Case map
1F96; 1F26 03B9; Case map
1F97; 1F27 03B9; Case map
1F98; 1F20 03B9; Case map
1F99; 1F21 03B9; Case map
1F9A; 1F22 03B9; Case map
1F9B; 1F23 03B9; Case map
1F9C; 1F24 03B9; Case map
1F9D; 1F25 03B9; Case map
1F9E; 1F26 03B9; Case map
1F9F; 1F27 03B9; Case map
1FA0; 1F60 03B9; Case map
1FA1; 1F61 03B9; Case map

1FA2; 1F62 03B9; Case map
1FA3; 1F63 03B9; Case map
1FA4; 1F64 03B9; Case map
1FA5; 1F65 03B9; Case map
1FA6; 1F66 03B9; Case map
1FA7; 1F67 03B9; Case map
1FA8; 1F60 03B9; Case map
1FA9; 1F61 03B9; Case map
1FAA; 1F62 03B9; Case map
1FAB; 1F63 03B9; Case map
1FAC; 1F64 03B9; Case map
1FAD; 1F65 03B9; Case map
1FAE; 1F66 03B9; Case map
1FAF; 1F67 03B9; Case map
1FB2; 1F70 03B9; Case map
1FB3; 03B1 03B9; Case map
1FB4; 03AC 03B9; Case map
1FB6; 03B1 0342; Case map
1FB7; 03B1 0342 03B9; Case map
1FB8; 1FB0; Case map
1FB9; 1FB1; Case map
1FBA; 1F70; Case map
1FBB; 1F71; Case map
1FBC; 03B1 03B9; Case map
1FBE; 03B9; Case map
1FC2; 1F74 03B9; Case map
1FC3; 03B7 03B9; Case map
1FC4; 03AE 03B9; Case map
1FC6; 03B7 0342; Case map
1FC7; 03B7 0342 03B9; Case map
1FC8; 1F72; Case map
1FC9; 1F73; Case map
1FCA; 1F74; Case map
1FCB; 1F75; Case map
1FCC; 03B7 03B9; Case map
1FD2; 03B9 0308 0300; Case map
1FD3; 03B9 0308 0301; Case map
1FD6; 03B9 0342; Case map
1FD7; 03B9 0308 0342; Case map
1FD8; 1FD0; Case map
1FD9; 1FD1; Case map
1FDA; 1F76; Case map
1FDB; 1F77; Case map
1FE2; 03C5 0308 0300; Case map
1FE3; 03C5 0308 0301; Case map
1FE4; 03C1 0313; Case map
1FE6; 03C5 0342; Case map
1FE7; 03C5 0308 0342; Case map
1FE8; 1FE0; Case map
1FE9; 1FE1; Case map
1FEA; 1F7A; Case map

1FEB; 1F7B; Case map
1FEC; 1FE5; Case map
1FF2; 1F7C 03B9; Case map
1FF3; 03C9 03B9; Case map
1FF4; 03CE 03B9; Case map
1FF6; 03C9 0342; Case map
1FF7; 03C9 0342 03B9; Case map
1FF8; 1F78; Case map
1FF9; 1F79; Case map
1FFA; 1F7C; Case map
1FFB; 1F7D; Case map
1FFC; 03C9 03B9; Case map
200B; ; Map out
200C; ; Map out
200D; ; Map out
20A8; 0072 0073; Additional folding
2102; 0063; Additional folding
2103; 00B0 0063; Additional folding
2107; 025B; Additional folding
2109; 00B0 0066; Additional folding
210B; 0068; Additional folding
210C; 0068; Additional folding
210D; 0068; Additional folding
2110; 0069; Additional folding
2111; 0069; Additional folding
2112; 006C; Additional folding
2115; 006E; Additional folding
2116; 006E 006F; Additional folding
2119; 0070; Additional folding
211A; 0071; Additional folding
211B; 0072; Additional folding
211C; 0072; Additional folding
211D; 0072; Additional folding
2120; 0073 006D; Additional folding
2121; 0074 0065 006C; Additional folding
2122; 0074 006D; Additional folding
2124; 007A; Additional folding
2126; 03C9; Case map
2128; 007A; Additional folding
212A; 006B; Case map
212B; 00E5; Case map
212C; 0062; Additional folding
212D; 0063; Additional folding
2130; 0065; Additional folding
2131; 0066; Additional folding
2133; 006D; Additional folding
2160; 2170; Case map
2161; 2171; Case map
2162; 2172; Case map
2163; 2173; Case map
2164; 2174; Case map

2165; 2175; Case map
2166; 2176; Case map
2167; 2177; Case map
2168; 2178; Case map
2169; 2179; Case map
216A; 217A; Case map
216B; 217B; Case map
216C; 217C; Case map
216D; 217D; Case map
216E; 217E; Case map
216F; 217F; Case map
24B6; 24D0; Case map
24B7; 24D1; Case map
24B8; 24D2; Case map
24B9; 24D3; Case map
24BA; 24D4; Case map
24BB; 24D5; Case map
24BC; 24D6; Case map
24BD; 24D7; Case map
24BE; 24D8; Case map
24BF; 24D9; Case map
24C0; 24DA; Case map
24C1; 24DB; Case map
24C2; 24DC; Case map
24C3; 24DD; Case map
24C4; 24DE; Case map
24C5; 24DF; Case map
24C6; 24E0; Case map
24C7; 24E1; Case map
24C8; 24E2; Case map
24C9; 24E3; Case map
24CA; 24E4; Case map
24CB; 24E5; Case map
24CC; 24E6; Case map
24CD; 24E7; Case map
24CE; 24E8; Case map
24CF; 24E9; Case map
3371; 0068 0070 0061; Additional folding
3373; 0061 0075; Additional folding
3375; 006F 0076; Additional folding
3380; 0070 0061; Additional folding
3381; 006E 0061; Additional folding
3382; 03BC 0061; Additional folding
3383; 006D 0061; Additional folding
3384; 006B 0061; Additional folding
3385; 006B 0062; Additional folding
3386; 006D 0062; Additional folding
3387; 0067 0062; Additional folding
338A; 0070 0066; Additional folding
338B; 006E 0066; Additional folding
338C; 03BC 0066; Additional folding

```
3390; 0068 007A; Additional folding
3391; 006B 0068 007A; Additional folding
3392; 006D 0068 007A; Additional folding
3393; 0067 0068 007A; Additional folding
3394; 0074 0068 007A; Additional folding
33A9; 0070 0061; Additional folding
33AA; 006B 0070 0061; Additional folding
33AB; 006D 0070 0061; Additional folding
33AC; 0067 0070 0061; Additional folding
33B4; 0070 0076; Additional folding
33B5; 006E 0076; Additional folding
33B6; 03BC 0076; Additional folding
33B7; 006D 0076; Additional folding
33B8; 006B 0076; Additional folding
33B9; 006D 0076; Additional folding
33BA; 0070 0077; Additional folding
33BB; 006E 0077; Additional folding
33BC; 03BC 0077; Additional folding
33BD; 006D 0077; Additional folding
33BE; 006B 0077; Additional folding
33BF; 006D 0077; Additional folding
33C0; 006B 03C9; Additional folding
33C1; 006D 03C9; Additional folding
33C3; 0062 0071; Additional folding
33C6; 0063 2215 006B 0067; Additional folding
33C7; 0063 006F 002E; Additional folding
33C8; 0064 0062; Additional folding
33C9; 0067 0079; Additional folding
33CB; 0068 0070; Additional folding
33CD; 006B 006B; Additional folding
33CE; 006B 006D; Additional folding
33D7; 0070 0068; Additional folding
33D9; 0070 0070 006D; Additional folding
33DA; 0070 0072; Additional folding
33DC; 0073 0076; Additional folding
33DD; 0077 0062; Additional folding
FB00; 0066 0066; Case map
FB01; 0066 0069; Case map
FB02; 0066 006C; Case map
FB03; 0066 0066 0069; Case map
FB04; 0066 0066 006C; Case map
FB05; 0073 0074; Case map
FB06; 0073 0074; Case map
FB13; 0574 0576; Case map
FB14; 0574 0565; Case map
FB15; 0574 056B; Case map
FB16; 057E 0576; Case map
FB17; 0574 056D; Case map
FEFF; ; Map out
FF21; FF41; Case map
FF22; FF42; Case map
```

FF23; FF43; Case map
FF24; FF44; Case map
FF25; FF45; Case map
FF26; FF46; Case map
FF27; FF47; Case map
FF28; FF48; Case map
FF29; FF49; Case map
FF2A; FF4A; Case map
FF2B; FF4B; Case map
FF2C; FF4C; Case map
FF2D; FF4D; Case map
FF2E; FF4E; Case map
FF2F; FF4F; Case map
FF30; FF50; Case map
FF31; FF51; Case map
FF32; FF52; Case map
FF33; FF53; Case map
FF34; FF54; Case map
FF35; FF55; Case map
FF36; FF56; Case map
FF37; FF57; Case map
FF38; FF58; Case map
FF39; FF59; Case map
FF3A; FF5A; Case map

F. Prohibited Character List

0000-002C
002E-002F
003A-0040
005B-0060
007B-007F
0080-009F
00A0
1680
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
200A
200B
200E
200F
2028

2029
202A
202B
202C
202D
202E
202F
206A
206B
206C
206D
206E
206F
2FF0-2FFF
3000
D800-DFFF
E000-F8FF
FFF9
FFFA
FFFB
FFFC
FFFD
FFFE-FFFF
1FFFE-1FFFF
2FFFE-2FFFF
3FFFE-3FFFF
4FFFE-4FFFF
5FFFE-5FFFF
6FFFE-6FFFF
7FFFE-7FFFF
8FFFE-8FFFF
9FFFE-9FFFF
AFFFE-AFFFF
BFFFE-BFFFF
CFFFE-CFFFF
DFFFE-DFFFF
EFFFE-EFFFF
F0000-FFFFD
FFFFE-FFFFF
100000-10FFFD
10FFFE-10FFFF

NOTE WELL: Software that follows this specification that will be used to check names before they are put in authoritative name servers MUST add all unassigned characters to the list of characters that are prohibited. See Section 6 for more details.

G. Unassigned Character List

000220-000221

000234-00024F
0002AE-0002AF
0002EF-0002FF
00034F-00035F
000363-000373
000376-000379
00037B-00037D
00037F-000383
00038B
00038D
0003A2
0003CF
0003D8-0003D9
0003F6-0003FF
000487
00048A-00048B
0004C5-0004C6
0004C9-0004CA
0004CD-0004CF
0004F6-0004F7
0004FA-000530
000557-000558
000560
000588
00058B-000590
0005A2
0005BA
0005C5-0005CF
0005EB-0005EF
0005F5-00060B
00060D-00061A
00061C-00061E
000620
00063B-00063F
000656-00065F
00066E-00066F
0006EE-0006EF
0006FF
00070E
00072D-00072F
00074B-00077F
0007B1-000900
000904
00093A-00093B
00094E-00094F
000955-000957
000971-000980
000984
00098D-00098E
000991-000992
0009A9

0009B1
0009B3-0009B5
0009BA-0009BB
0009BD
0009C5-0009C6
0009C9-0009CA
0009CE-0009D6
0009D8-0009DB
0009DE
0009E4-0009E5
0009FB-000A01
000A03-000A04
000A0B-000A0E
000A11-000A12
000A29
000A31
000A34
000A37
000A3A-000A3B
000A3D
000A43-000A46
000A49-000A4A
000A4E-000A58
000A5D
000A5F-000A65
000A75-000A80
000A84
000A8C
000A8E
000A92
000AA9
000AB1
000AB4
000ABA-000ABB
000AC6
000ACA
000ACE-000ACF
000AD1-000ADF
000AE1-000AE5
000AF0-000B00
000B04
000B0D-000B0E
000B11-000B12
000B29
000B31
000B34-000B35
000B3A-000B3B
000B44-000B46
000B49-000B4A
000B4E-000B55
000B58-000B5B

000B5E
000B62-000B65
000B71-000B81
000B84
000B8B-000B8D
000B91
000B96-000B98
000B9B
000B9D
000BA0-000BA2
000BA5-000BA7
000BAB-000BAD
000BB6
000BBA-000BBD
000BC3-000BC5
000BC9
000BCE-000BD6
000BD8-000BE6
000BF3-000C00
000C04
000C0D
000C11
000C29
000C34
000C3A-000C3D
000C45
000C49
000C4E-000C54
000C57-000C5F
000C62-000C65
000C70-000C81
000C84
000C8D
000C91
000CA9
000CB4
000CBA-000CBD
000CC5
000CC9
000CCE-000CD4
000CD7-000CDD
000CDF
000CE2-000CE5
000CF0-000D01
000D04
000D0D
000D11
000D29
000D3A-000D3D
000D44-000D45
000D49

000D4E-000D56
000D58-000D5F
000D62-000D65
000D70-000D81
000D84
000D97-000D99
000DB2
000DBC
000DBE-000DBF
000DC7-000DC9
000DCB-000DCE
000DD5
000DD7
000DE0-000DF1
000DF5-000E00
000E3B-000E3E
000E5C-000E80
000E83
000E85-000E86
000E89
000E8B-000E8C
000E8E-000E93
000E98
000EA0
000EA4
000EA6
000EA8-000EA9
000EAC
000EBA
000EBE-000EBF
000EC5
000EC7
000ECE-000ECF
000EDA-000EDB
000EDE-000EFF
000F48
000F6B-000F70
000F8C-000F8F
000F98
000FBD
000FCD-000FCE
000FD0-000FFF
001022
001028
00102B
001033-001035
00103A-00103F
00105A-00109F
0010C6-0010CF
0010F7-0010FA
0010FC-0010FF

00115A-00115E
0011A3-0011A7
0011FA-0011FF
001207
001247
001249
00124E-00124F
001257
001259
00125E-00125F
001287
001289
00128E-00128F
0012AF
0012B1
0012B6-0012B7
0012BF
0012C1
0012C6-0012C7
0012CF
0012D7
0012EF
00130F
001311
001316-001317
00131F
001347
00135B-001360
00137D-00139F
0013F5-001400
001677-00167F
00169D-00169F
0016F1-00177F
0017DD-0017DF
0017EA-0017FF
00180F
00181A-00181F
001878-00187F
0018AA-001DFF
001E9C-001E9F
001EFA-001EFF
001F16-001F17
001F1E-001F1F
001F46-001F47
001F4E-001F4F
001F58
001F5A
001F5C
001F5E
001F7E-001F7F
001FB5

001FC5
001FD4-001FD5
001FDC
001FF0-001FF1
001FF5
001FFF
002047
00204E-002069
002071-002073
00208F-00209F
0020B0-0020CF
0020E4-0020FF
00213B-002152
002184-00218F
0021F4-0021FF
0022F2-0022FF
00237C
00239B-0023FF
002427-00243F
00244B-00245F
0024EB-0024FF
002596-00259F
0025F8-0025FF
002614-002618
002672-002700
002705
00270A-00270B
002728
00274C
00274E
002753-002755
002757
00275F-002760
002768-002775
002795-002797
0027B0
0027BF-0027FF
002900-002E7F
002E9A
002EF4-002EFF
002FD6-002FEF
002FFC-002FFF
00303B-00303D
003040
003095-003098
00309F-0030A0
0030FF-003104
00312D-003130
00318F
0031B8-0031FF
00321D-00321F

003244-00325F
00327C-00327E
0032B1-0032BF
0032CC-0032CF
0032FF
003377-00337A
0033DE-0033DF
0033FF
004DB6-004DFF
009FA6-009FFF
00A48D-00A48F
00A4A2-00A4A3
00A4B4
00A4C1
00A4C5
00A4C7-00ABFF
00D7A4-00D7FF
00FA2E-00FAFF
00FB07-00FB12
00FB18-00FB1C
00FB37
00FB3D
00FB3F
00FB42
00FB45
00FBB2-00FBD2
00FD40-00FD4F
00FD90-00FD91
00FDC8-00FDCF
00FDFC-00FE1F
00FE24-00FE2F
00FE45-00FE48
00FE53
00FE67
00FE6C-00FE6F
00FE73
00FE75
00FEFD-00FEFE
00FF00
00FF5F-00FF60
00FFBF-00FFC1
00FFC8-00FFC9
00FFD0-00FFD1
00FFD8-00FFD9
00FFDD-00FFDF
00FFE7
00FFEF-00FFF8