IDN Table Review Tool

IDN Program
November 2023

Availability of LGR Toolset

- IDN Table Review function of the LGR Tool:

  THE IDN TABLE REVIEW FUNCTION OF THE LGR TOOL COMPARES IDN TABLES WITH REFERENCE LABEL GENERATION RULESETS. THE PURPOSE OF THIS REPORT IS TO ASSIST THE USER IN IDENTIFYING POTENTIAL ISSUES EXIST IN IDN TABLES. THIS IDN TABLE REVIEW TOOL REPORT IS FOR INFORMATION ONLY. IT IS NOT A WARRANTY OR GUARANTEE OF ICANN IDN TABLE REVIEW PROCESS.

- LGR Toolset is available with the following disclaimer:

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- Online deployment
  - Visit https://lgrtool.icann.org/
- Open source package(s) release with BSD license
  - Released at github: lgr-core, lgr-django, munidata, picu
- For queries or feedback
  - Email to IDNProgram@icann.org
- For further details, visit the LGR Toolset webpage or www.icann.org/idn

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IDN Table Review Tool

Background

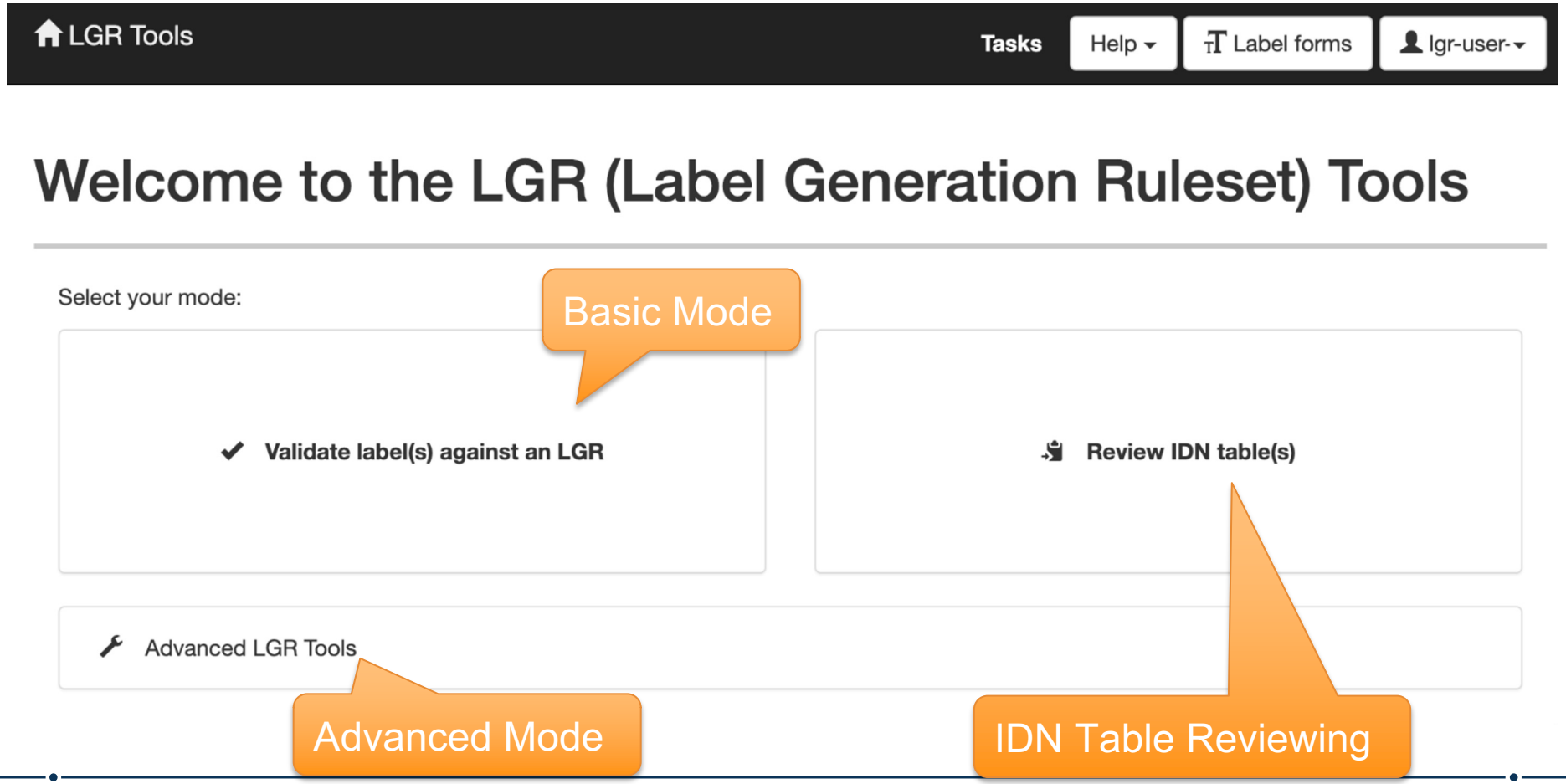
- A generic top-level domain (gTLD) registry operator that intends to offer registrations in different languages and scripts must:
  - Define an IDN table for each language and script.
  - Get it approved by ICANN during:
    - IDN RSEP Service.
    - Registry System Testing (RST) for Registry Service Provider (RSP) Change.
    - RST for Pre-Delegation Testing (PDT).
- ICANN reviews the IDN table(s) for security and stability considerations.

IDN Table Review Tool

- The IDN Table Review Tool was developed to:
  - Increase efficiency in reviewing IDN tables.
  - Promote consistency and transparency of reviews.
- The tool is available online for ICANN org and registry operators.
  - Input: IDN table and relevant reference LGR
    - Select preloaded reference LGR
    - Self-uploaded reference LGR
  - Output: IDN table review report in HTML format.
- The review analysis report is consistent for all types of users
- Comparison is done with
  - either the selected reference LGR
  - or the self-uploaded reference LGR

Landing Page of the LGR tool

- A user guide with more information is published on the LGR Tool webpage.
- Go to link - **Use the Label Generation Rules Tool**

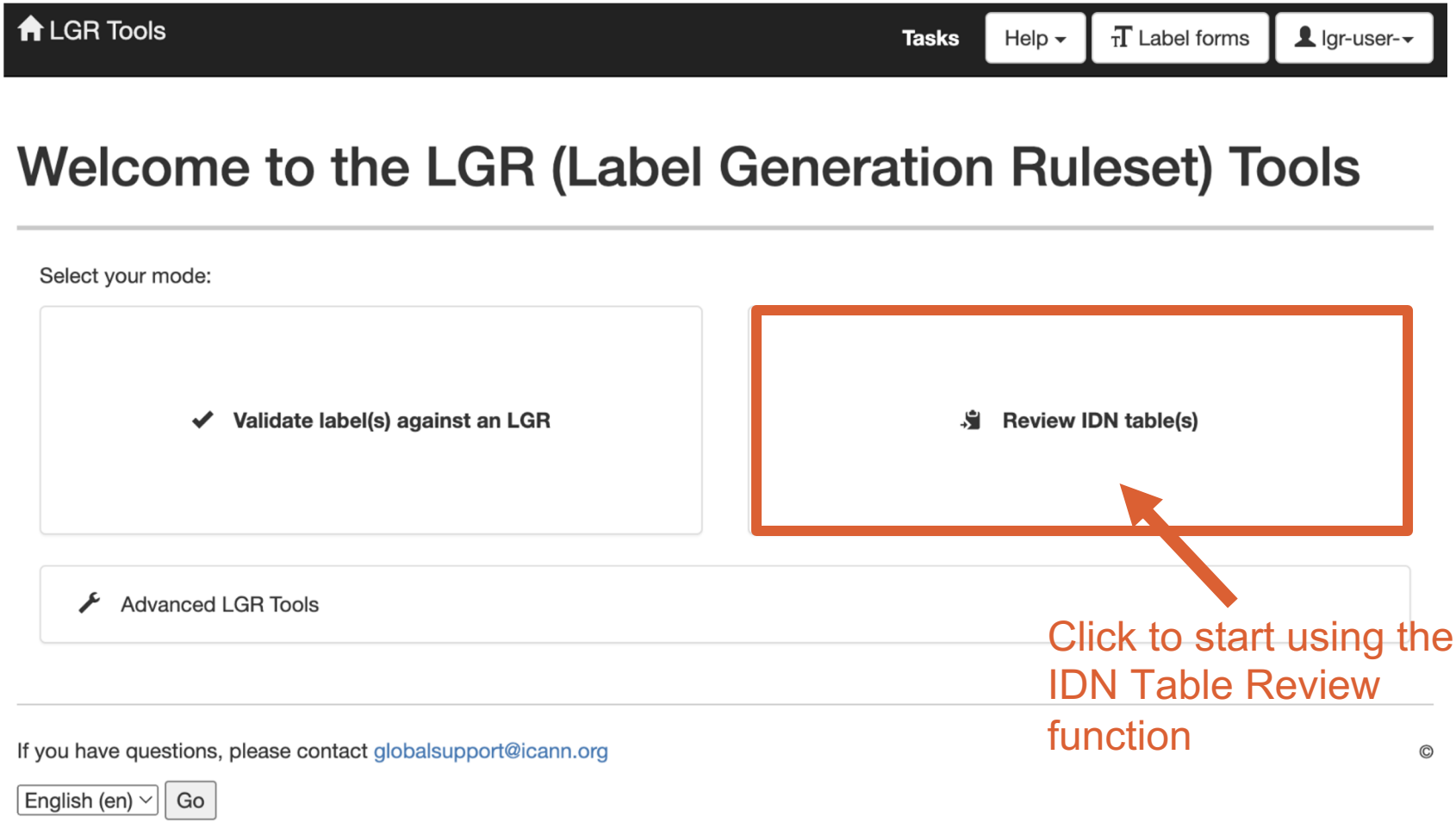


How to Use the IDN Table Review Tool

- Step 1: **Upload** the *IDN table(s)*.
- Step 2: **Select** or **Upload** the *reference LGR* for comparison.
- Step 3: **Review** the output: *HTML report*

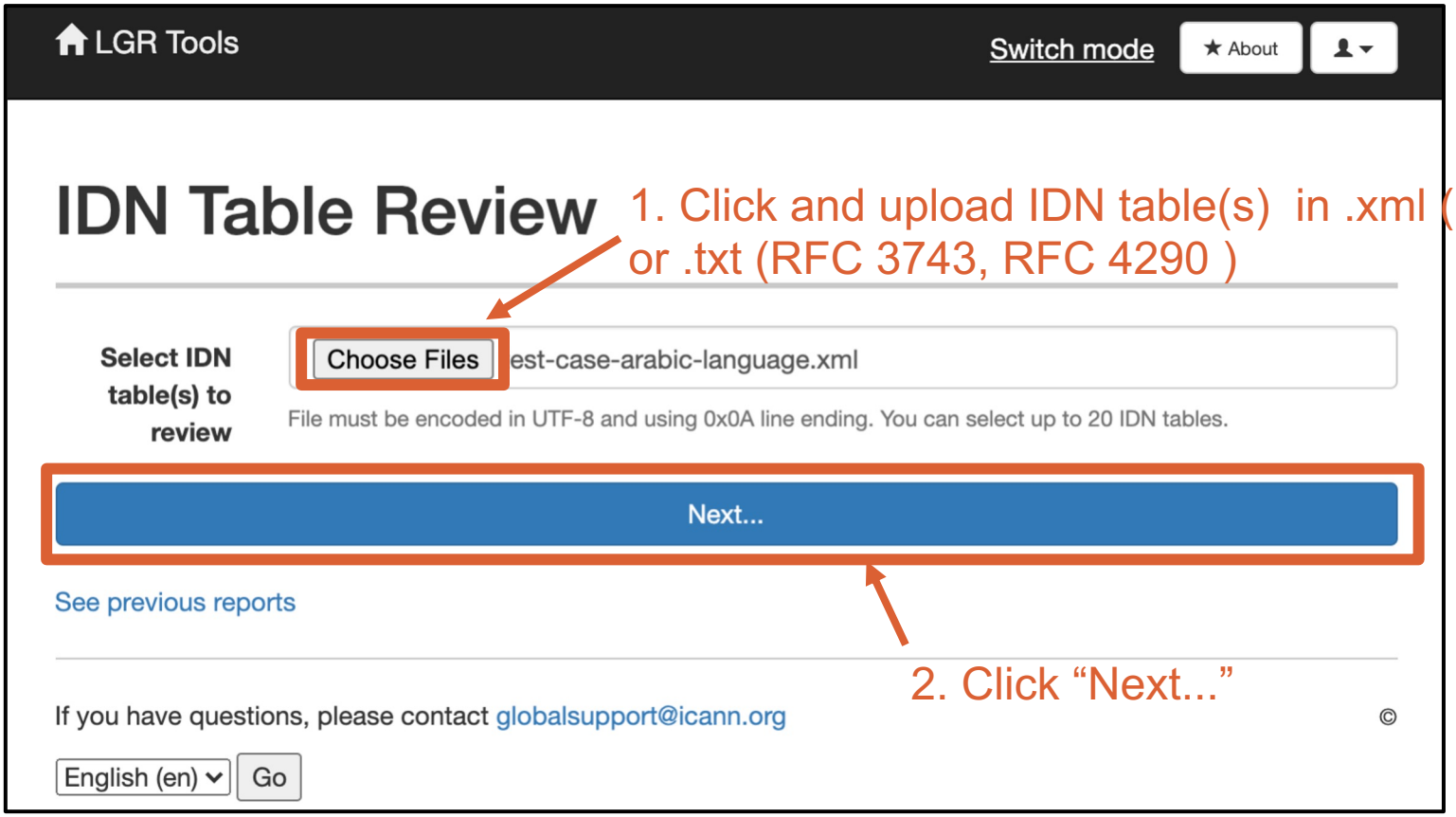
Step 1: Upload the IDN Table(s)

Step 1-1: Click the “Review IDN table(s)” menu.



Step 1: Upload the IDN Table(s)

Step 1-2: Click “Choose Files” and select the IDN table(s) for review (the tool can review up to 20 IDN tables at a time), then click ”Next…”



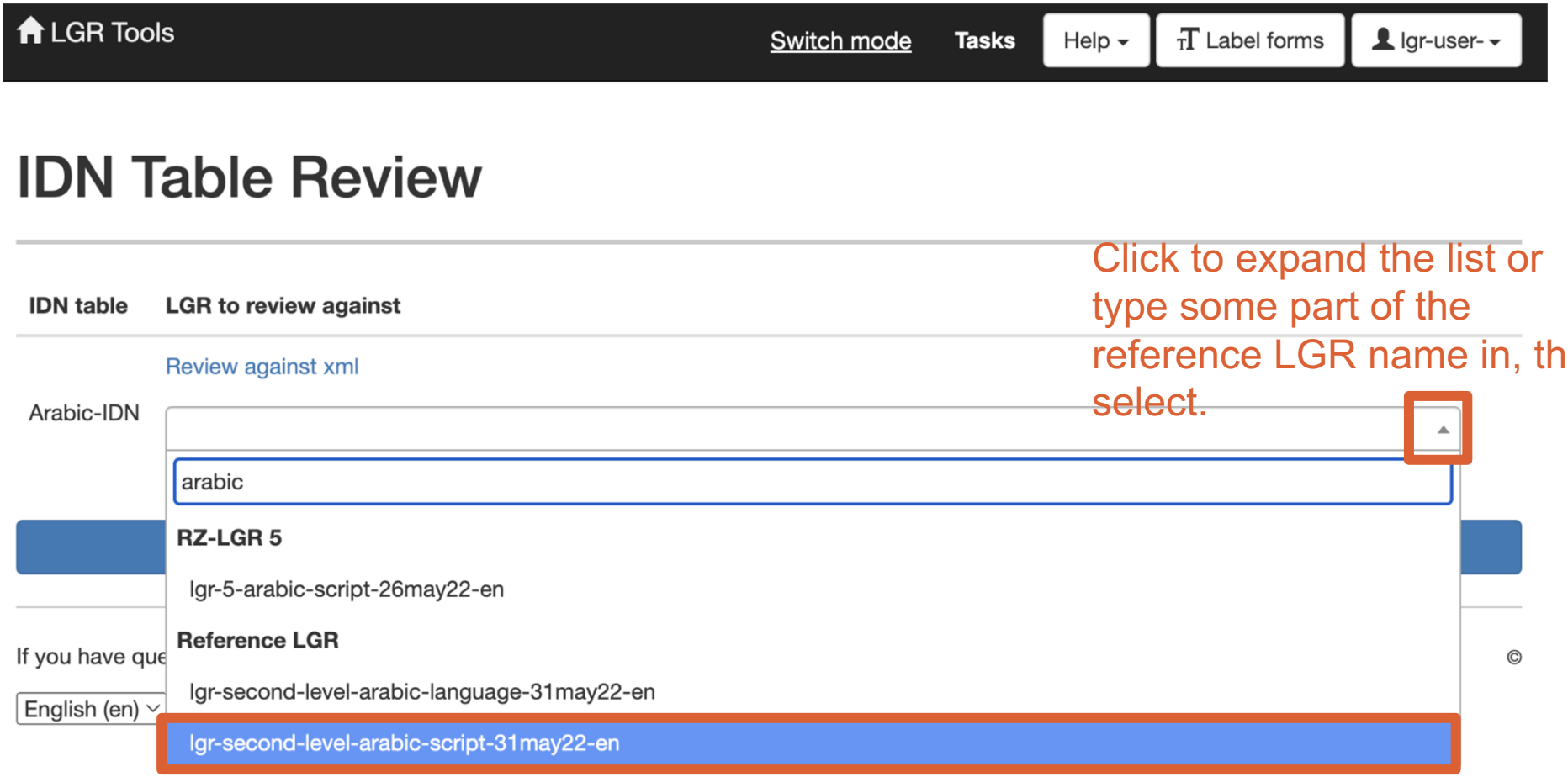
Step 2: Select or upload the Reference LGR

- There are three options for this step
- User should go with **one** out of these three options
  - Step 2.a: Select the Reference LGR *(preloaded)*
    - The LGR can be selected from the dropdown menu
  - Step 2.b: Select RFC Core Requirement *(preloaded)*
    - The RFC Core Requirements can be selected from the dropdown menu
  - Step 2.c: Upload the Reference LGR

    (user upload xml file in RFC 7940 format*)*
    - The relevant reference LGR in the xml format can be uploaded

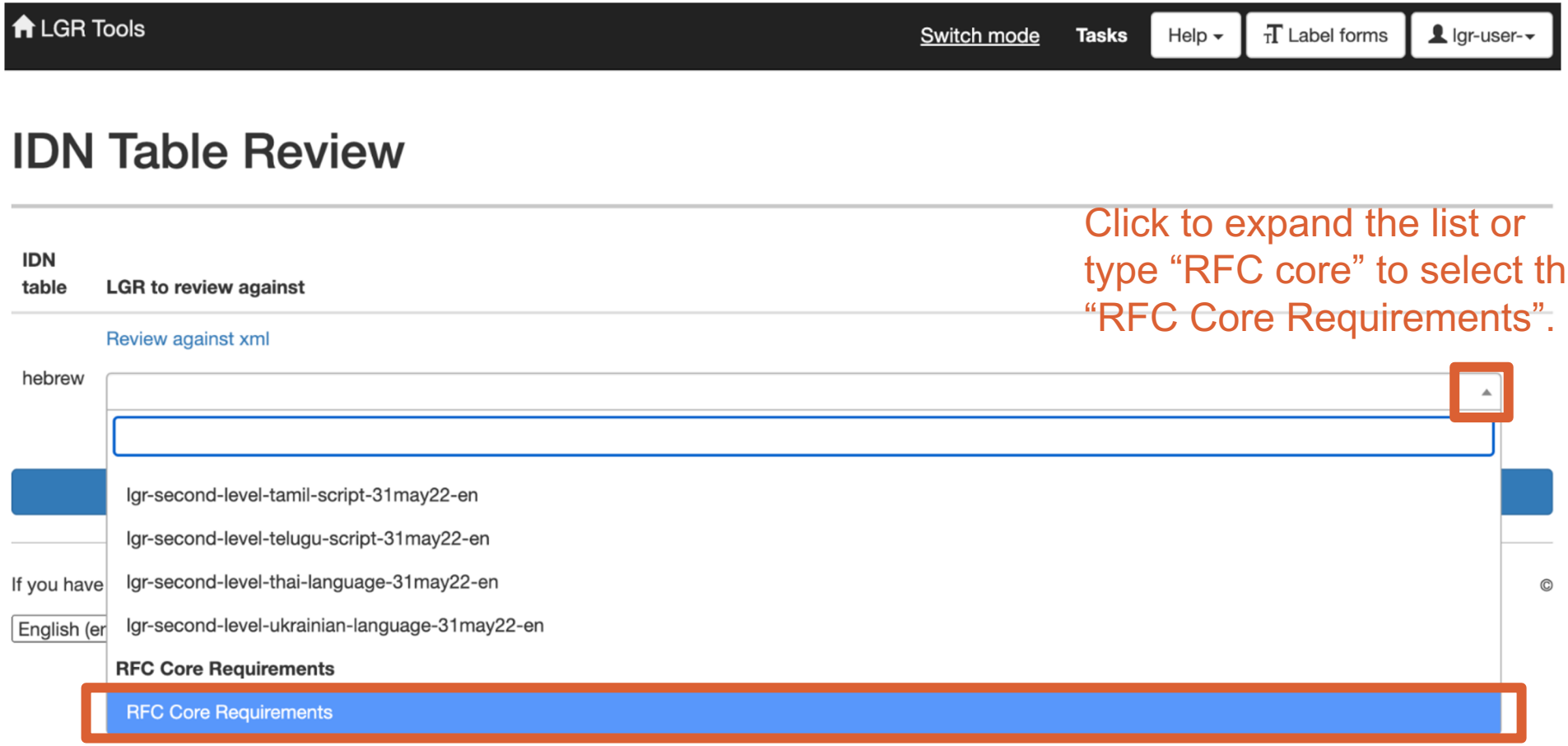
Step 2.a: Select the Reference LGR (preloaded)

Step 2.a: For each IDN table uploaded, select the relevant reference LGR from the dropdown list.



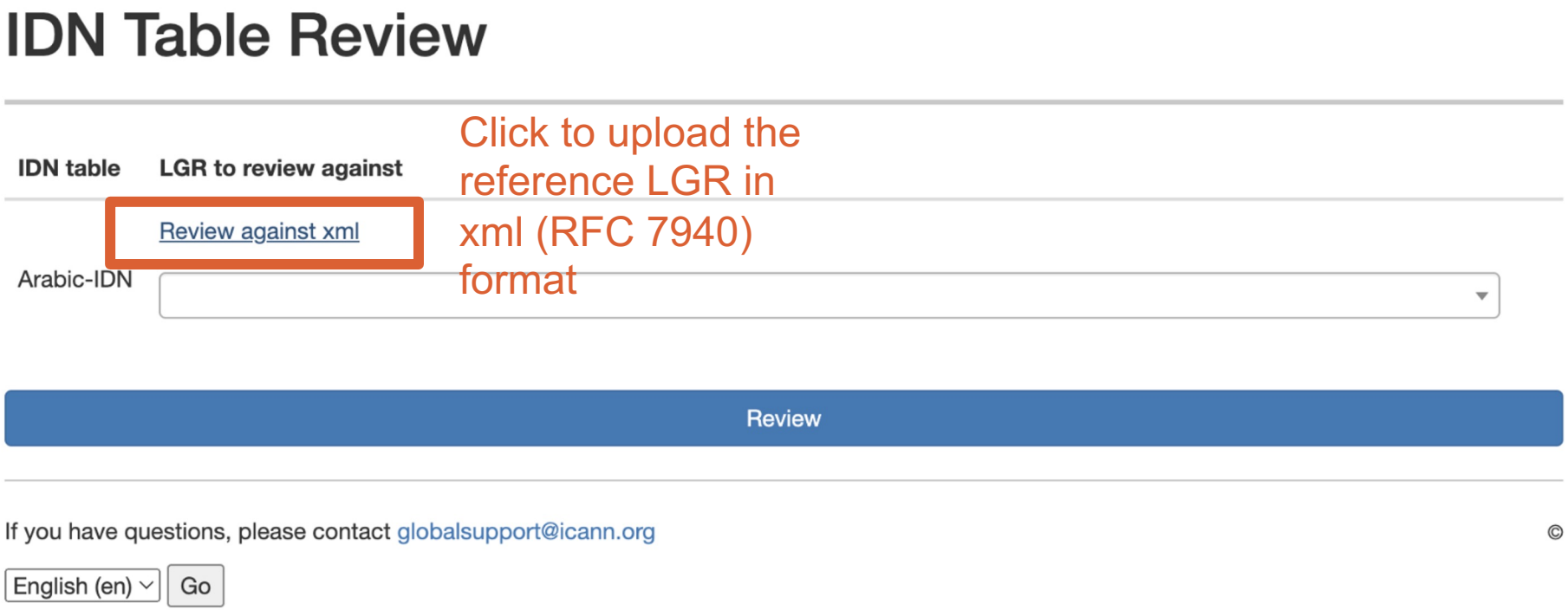
Step 2.b: Select RFC Core Requirement (preloaded)

Step 2.b: For each IDN table uploaded, to be checked against RFC requirements, select at the bottom of the list



Step 2.c: Upload the Reference LGR (Self uploaded)

Step 2.c: For each IDN table uploaded, upload the relevant reference LGR in the xml (RFC 7940) format



Click to upload the reference LGR in xml (RFC 7940) format

Step 3: Review the output

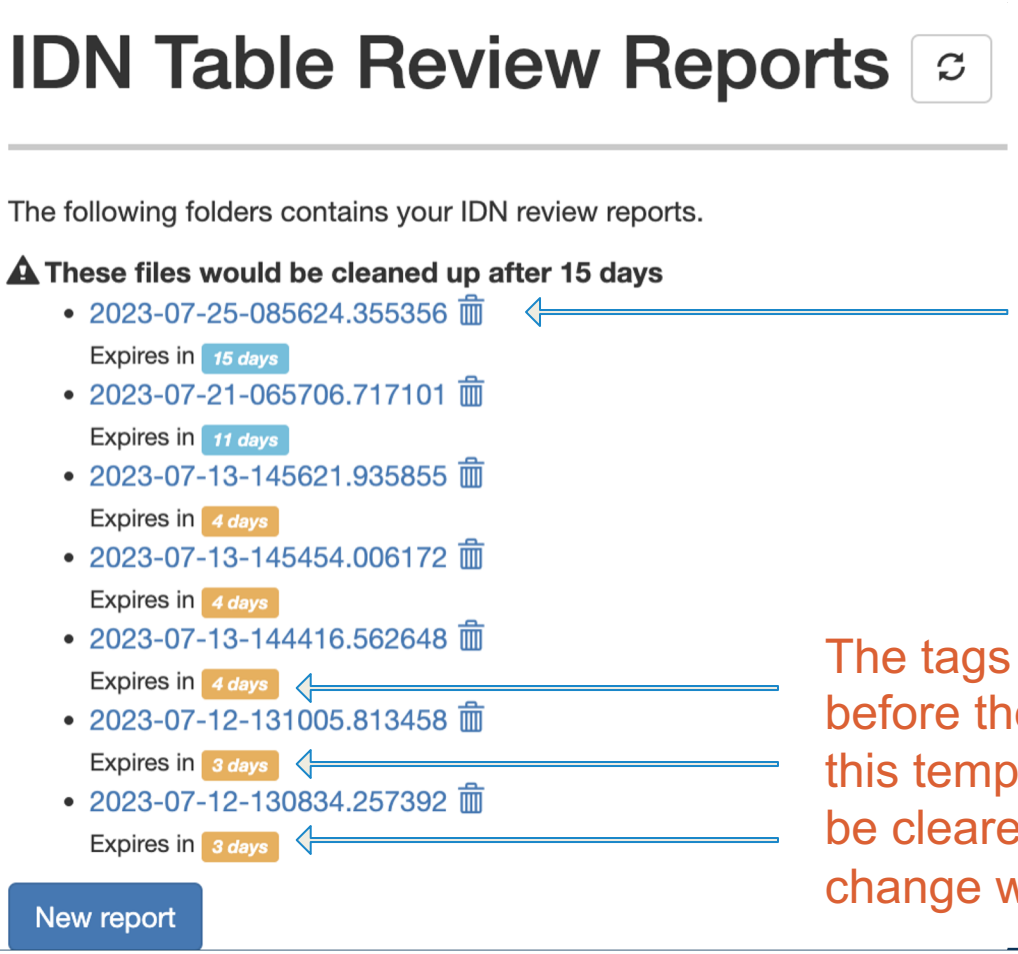
Step 3-1: Click ‘Review’ after selecting or uploading the reference LGR

- This step is the same for all options 2.a, 2.b or 2.c

Step 3: Review Report

Step 3-2: the output will be HTML report(s)

- can be viewed online or downloaded to the user's local machine.



The newest report will be at the top of the list. You are encouraged to download the files for your record. Server storage is temporary only

The tags show the remaining time before the report files are deleted from this temporary storage. These files will be cleared after 15 days (this time may change without notice)

Step 3: Review the HTML Output Report

- The IDN Table Review Tool generates a report in HTML format for each uploaded IDN table.
- Each report includes:
  - Report Header: details of the IDN table and the reference LGR.
  - Overall Summary: a quick summary of results.
  - Detail Analysis for Each Section:
    - Language Tag
    - Repertoire
    - Variant Sets
    - Classes
    - WLE Rules
    - Actions

Structure of HTML Output Report

IDN Table Review Report

Table of Contents

1 Summary
2 Language Tag
3 Repertoire
4 Variant Sets
5 Classes
6 Whole label evaluation rules
7 Actions

Date: Oct. 20, 2022

Please refer to the LGR (IDN Table) Review Tool disclaimer on this page

This document presents the review report for IDN Table:
lgr-second-level-arabic-script-31may22-en Version: 3
with the Reference LGR:
lgr-5-arabic-script-26may22-en Version: 5

Overall Summary

#	Comparing Item	Overall Result	Result	Summarized Remarks	Remark occurrence
1	Language Tag	MATCH	MATCH	Exact match	1
2	Repertoire	MANUAL CHECK	MANUAL CHECK	The code point only exists in the IDN Table but not in the reference LGR	31
			MATCH	Matches code point (including tags, context rule)	127
			NOTE	Rules not required in Reference LGR	1
3	Variant Sets	REVIEW	MANUAL CHECK	Variant set only exists in the IDN Table	60
			REVIEW	Variant type in the IDN Table is less conservative compared to the Ref. LGR	15
			MATCH	Exact match (including type, conditional variant rule)	177
4	Classes	MANUAL CHECK	MANUAL CHECK	Mismatch class with only additional code points.	3
			MANUAL CHECK	Mismatch class (class does not exist in ref. LGR; check for different class names)	5
5	Whole label evaluation rules	MANUAL CHECK	MANUAL CHECK	Mismatch (WLE rule only exists in IDN Table)	5
			MATCH	Exact Match (matched names and content)	13
			MANUAL CHECK	Mismatch (WLE rule only exists in Ref. LGR)	4
6	Actions	MANUAL CHECK	MANUAL CHECK	Mismatch (additional action)	5
			MATCH	Exact Match (action name and content are the same)	17
			MANUAL CHECK	Mismatch (missing action)	4

Language Tag

#	IDN Table language tag	Ref. LGR language tag	Result	Remark
1	und-Arab	und-Arab	MATCH	Exact match

Repertoire

#	Code Point	Glyph	Name	IDN Table	Ref. LGR	Result	Remark
1	U+002D	-	HYPHEN-MINUS	✓	×	MANUAL CHECK	The code point only exists in the IDN Table but not in the reference LGR
						MANUAL	The code point only exists in the IDN Table but not in

Report Header

Overall Summary

Detail Analysis

Report Header

- Report Header includes:
  - Table of contents
  - Date of comparison
  - IDN table name and version, if available
  - Reference LGR name and version

IDN Table Review Report

Table of Contents

1 Summary

2 Language Tag

3 Repertoire

4 Variant Sets

5 Classes

6 Whole label evaluation rules

7 Actions

Date: Oct. 20, 2022

Please refer to the LGR (IDN Table) Review Tool disclaimer on this page

This document presents the review report for IDN Table:
lgr-second-level-arabic-script-31may22-en Version: 3
with the Reference LGR:
lgr-5-arabic-script-26may22-en Version: 5

Overall Summary

- Overall Summary includes:
  - The result for each section.
    - Result categories: MATCH, SUBSET, NOTE, MANUAL CHECK, REVIEW.
  - Remarks and their occurrences.

Overall Summary

#	Comparing Item	Overall Result	Result	Summarized Remarks	Remark occurrence
1	Language Tag	MATCH	MATCH	Exact match	1
2	Repertoire	MANUAL CHECK	MANUAL CHECK	The code point only exists in the IDN Table but not in the reference LGR	31
			MATCH	Matches code point (including tags, context rule)	127
			NOTE	Rules not required in Reference LGR	1
3	Variant Sets	REVIEW	MANUAL CHECK	Variant set only exists in the IDN Table	60
			REVIEW	Variant type in the IDN Table is less conservative compared to the Ref. LGR	15
			MATCH	Exact match (including type, conditional variant rule)	177
4	Classes	MANUAL CHECK	MANUAL CHECK	Mismatch class with only additional code points.	3
			MANUAL CHECK	Mismatch class (class does not exist in ref. LGR; check for different class names)	5
5	Whole label evaluation rules	MANUAL CHECK	MANUAL CHECK	Mismatch (WLE rule only exists in IDN Table)	5
			MATCH	Exact Match (matched names and content)	13
			MANUAL CHECK	Mismatch (WLE rule only exists in Ref. LGR)	4
6	Actions	MANUAL CHECK	MANUAL CHECK	Mismatch (additional action)	5
			MATCH	Exact Match (action name and content are the same)	17
			MANUAL CHECK	Mismatch (missing action)	4

Output Result Interpretation

Result	Interpretation
MATCH	Data in IDN table exactly matches the data in the reference LGR.
SUBSET	Data in IDN table matches the data in the reference LGR and does not create security issue; e.g., IDN table code point repertoire is a subset of reference LGR code point repertoire.
NOTE	Data in the IDN table is more conservative than data in the reference LGR; e.g., IDN table applies some additional rules on the code points while reference LGR does not.
MANUAL CHECK	The tool finds a deviation from the reference LGR but cannot decide whether the deviation causes any security or stability issues. Such cases require further manual review to confirm; e.g., IDN table includes an extra code point.
REVIEW	The tool finds a deviation from the reference LGR which may potentially cause security or stability issues; e.g., IDN table omits a variant mapping present in the reference LGR.

Modifying an IDN Table Based on Detailed Analysis

- For “MANUAL CHECK” cases: the IDN table owner should make sure that the deviation does not create any security issues; supporting information should be included in the description section of the IDN table.
- For “REVIEW” cases: the IDN table owner should consider if additional mechanisms should be added to address potential security issues.

Conclusion

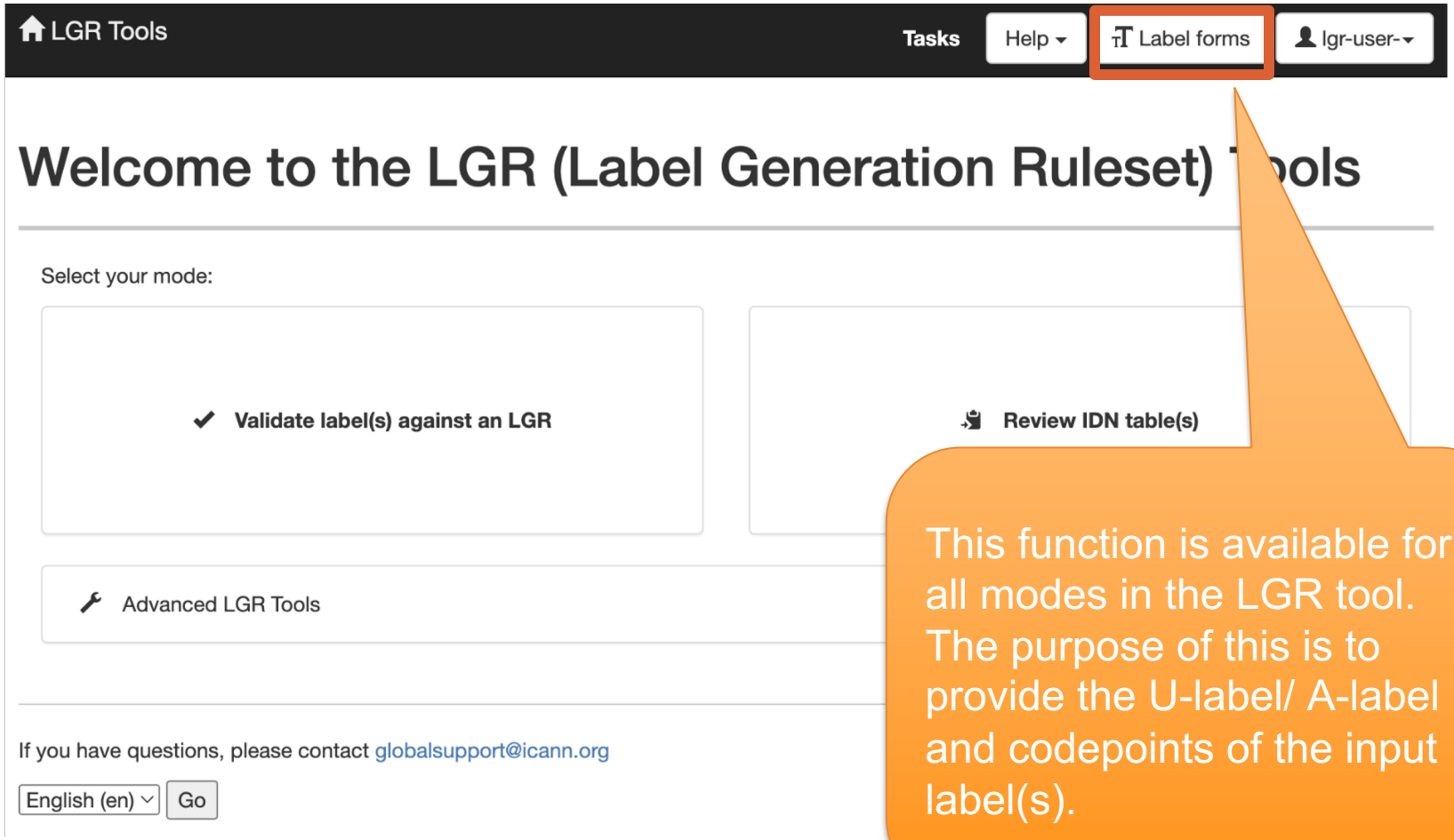
- Link to the IDN Table Review Tool webpage: https://www.icann.org/resources/pages/lgr-toolset-2015-06-21-en
- Link to reference LGRs: https://www.icann.org/resources/pages/second-level-lgr-2015-06-21-en
- This is currently a pilot release, and you are invited to use the tool and share feedback with us, which will lead to further improvements. Please contact IDNProgram@icann.org to report any bugs.
- Please remember: The IDN table review function of the LGR tool compares IDN tables with reference label generation rulesets. The purpose of this report is to assist the user in identifying potential issues that exist in IDN tables. The IDN Table Review Tool report is for information only – it is not a warranty or guarantee of an ICANN IDN table review process.

Label forms

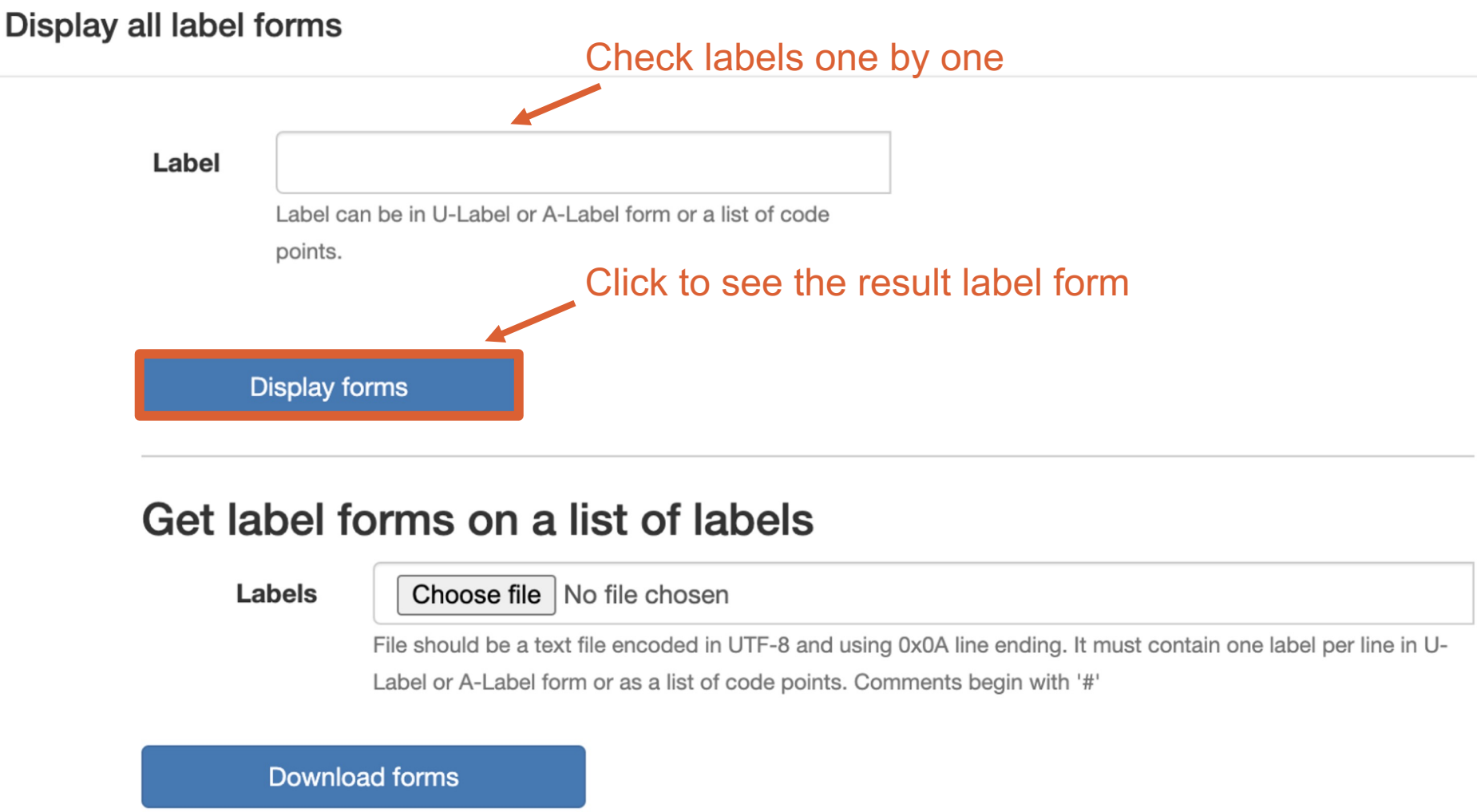
A label, U label against IDNA2008

Label Forms

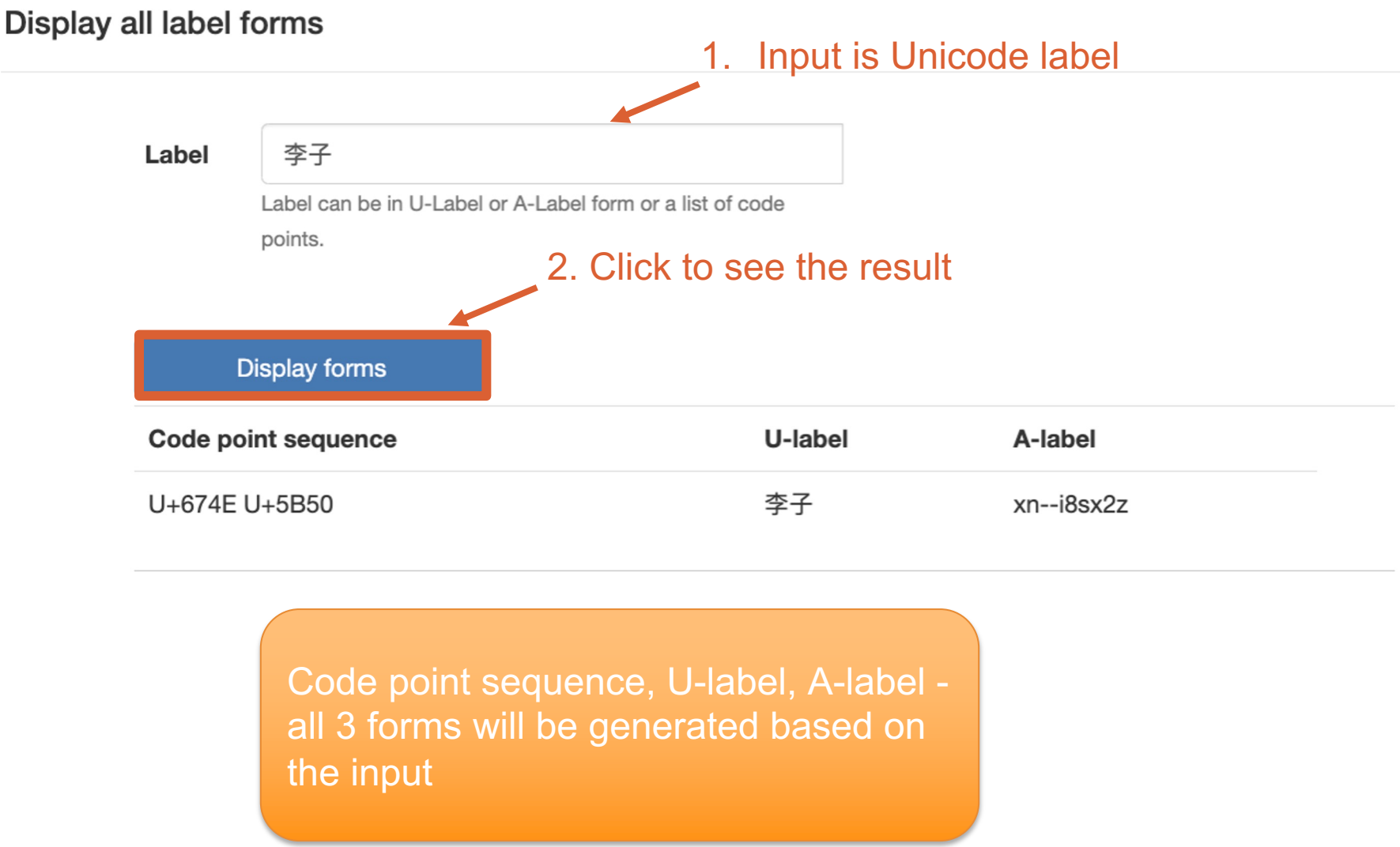
- Type in a label or upload a list of labels



Label Forms

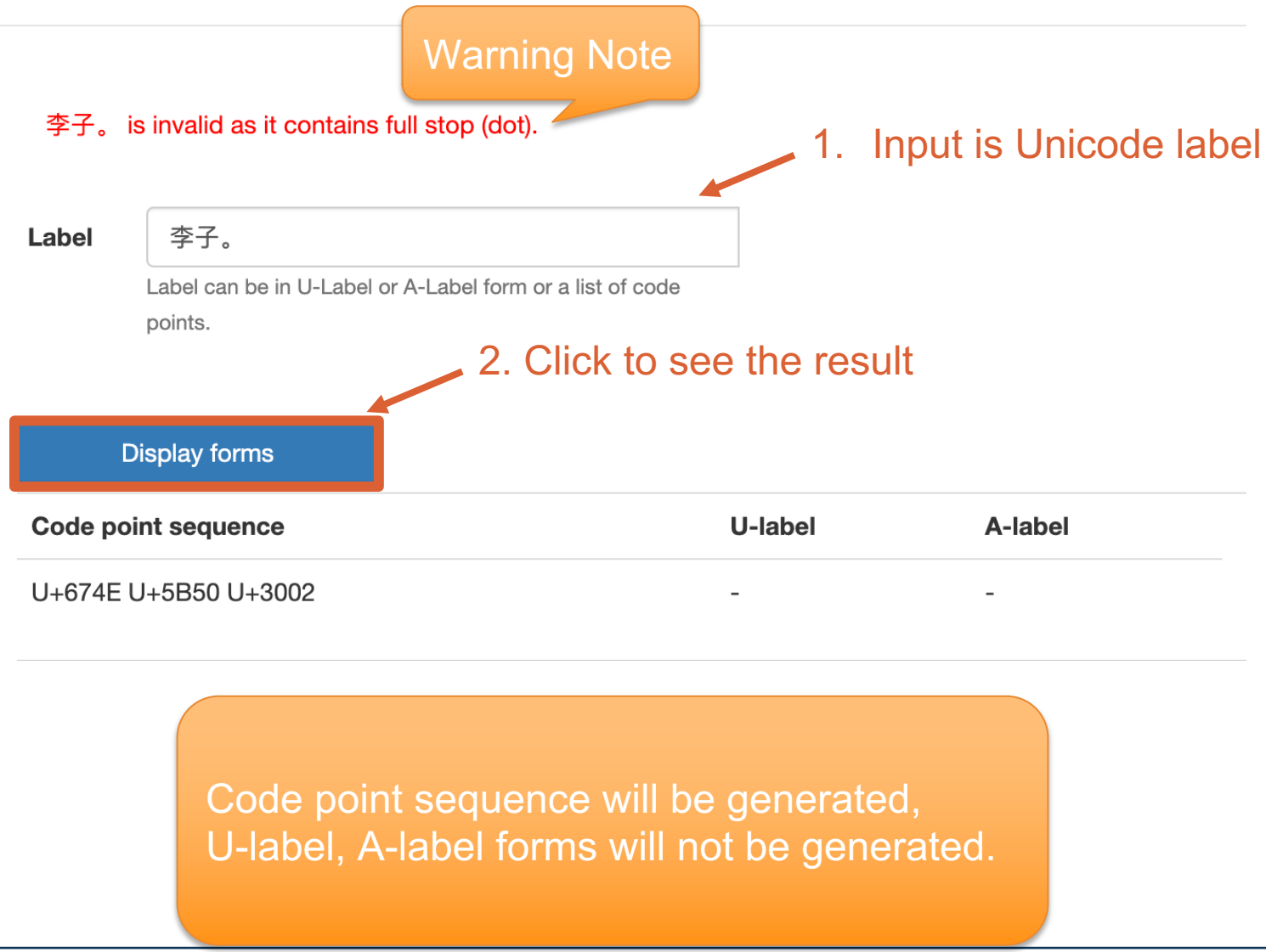

Display all label forms
Check labels one by one
Label
Label can be in U-Label or A-Label form or a list of code points.
Click to see the result label form
Display forms
Get label forms on a list of labels
Labels
Choose file
No file chosen
File should be a text file encoded in UTF-8 and using 0x0A line ending. It must contain one label per line in U-Label or A-Label form or as a list of code points. Comments begin with '#'
Download forms

Label Forms - Input One Label (Example 1 - valid)



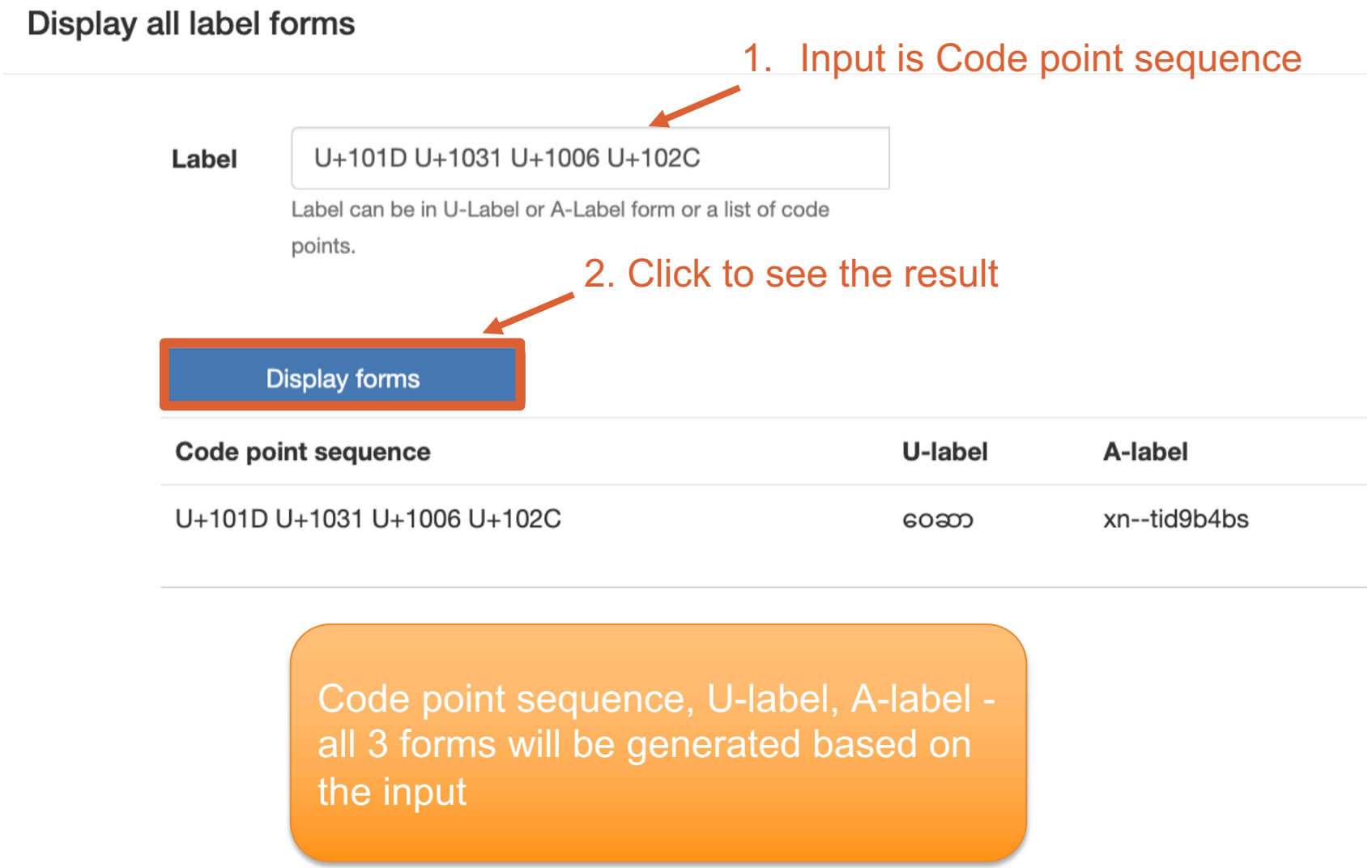
Code point sequence, U-label, A-label - all 3 forms will be generated based on the input

Label Forms - Input One Label (Example 1 - invalid)



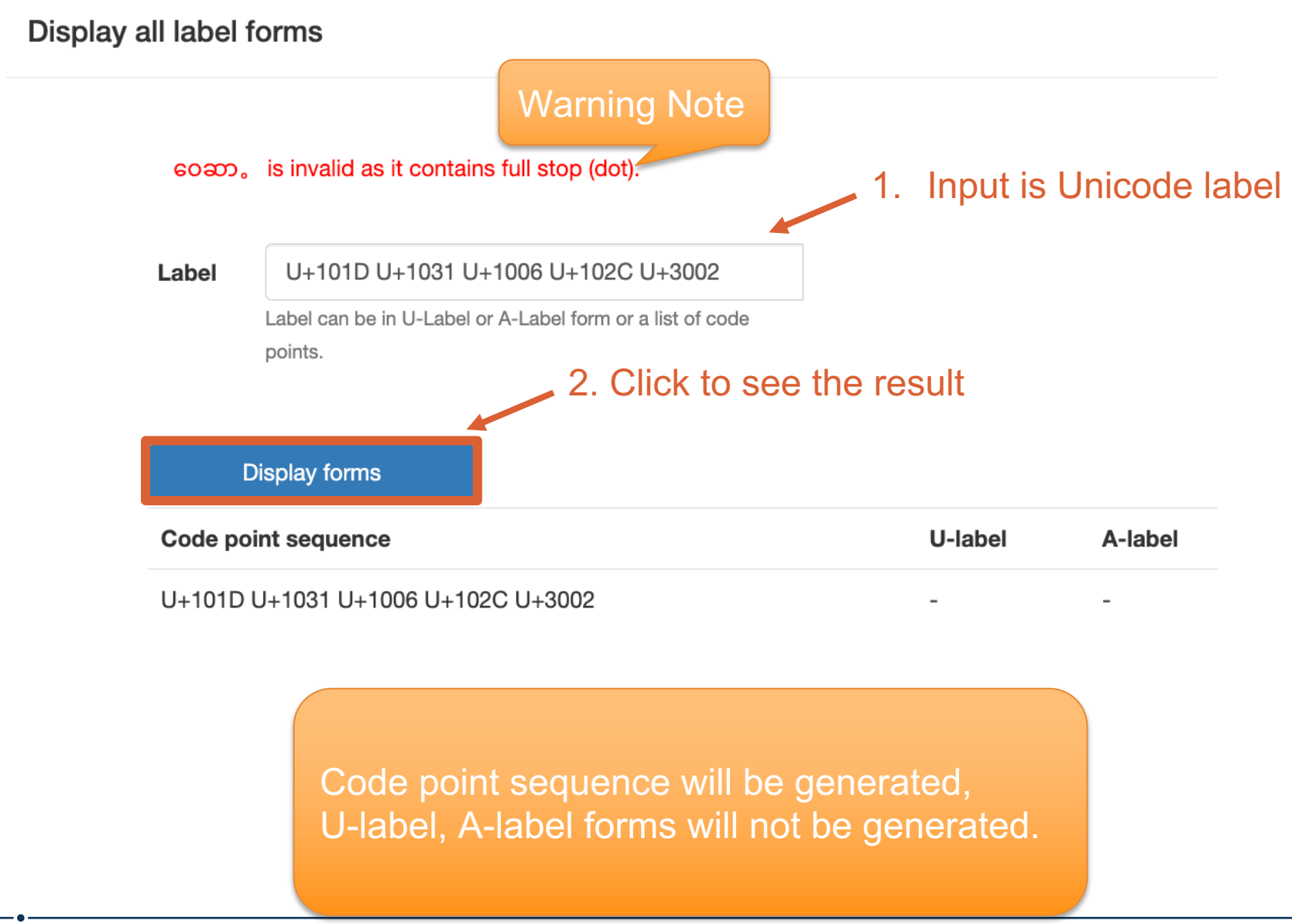
Code point sequence will be generated,
U-label, A-label forms will not be generated.

Label Forms - Input One Label (Example 2 - valid)



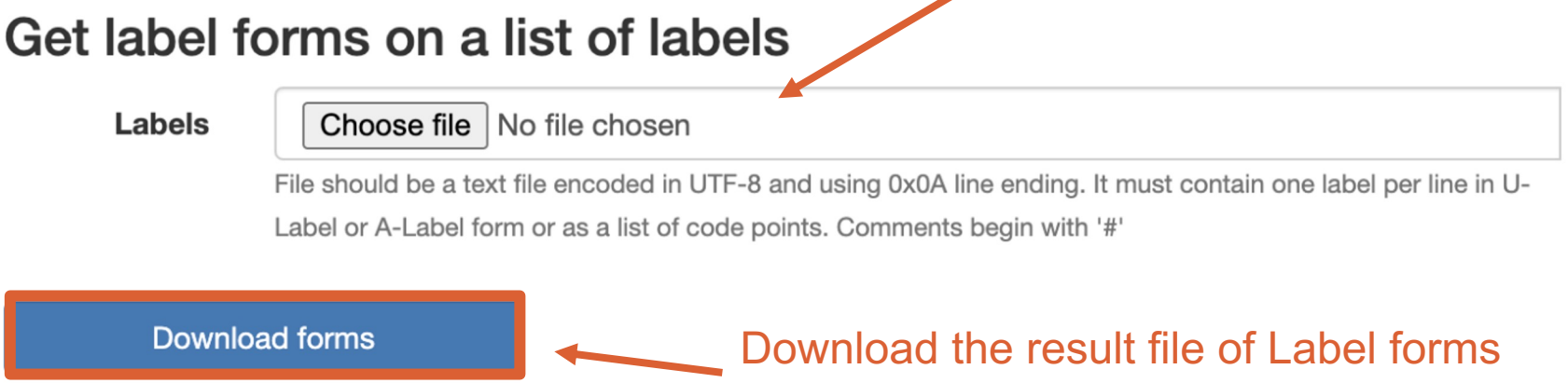
Code point sequence, U-label, A-label - all 3 forms will be generated based on the input

Label Forms - Input One Label (Example 2 - invalid)



Label Forms - Input a List of Labels (Example 3)

Upload file to check the list of labels (in txt format)



Download the result file of Label forms (in csv format)

Label Forms - Input a List of Labels (Example 3 - Input)

example3.txt

Downloads/example3.txt

```
#Code points – valid
U+1005 U+102D U+1014 U+103A
#Code points – invalid
U+1005 U+102D U+1014 U+103A U+002D
#Unicode – valid
ရတနာ
#Unicode – invalid
ရတ--နာ
#Punycode – valid
xn--ridd1ji0d
#Punycode – invalid
xn--vi8hua2f
```

- Input file format is .txt.
- Input can be one label per line.
- Each label can be in
  - Code point sequence
  - Unicode
  - Punycode
- The lines beginning with '#' are comments and will not be processed.

Label Forms - Input a List of Labels (Example 3 - Output)

Input	Code point sequence	U-label	A-label	Note
U+1005 U+102D U+1014 U+103A	U+1005 U+102D U+1014 U+103A	စိန်	xn--sid4a9d7b	-
U+1005 U+102D U+1014 U+103A U+002D	U+1005 U+102D U+1014 U+103A U+002D	-	-	စိန်- is invalid due to hyphen restrictions in the RFC5891 as it ends with a hyphen-minus.
ရတနာ	U+101B U+1010 U+1014 U+102C	ရတနာ	xn--3idit4e	-
ရတ--နာ	U+101B U+1010 U+002D U+002D U+1014 U+102C	-	-	ရတ--နာ is invalid due to hyphen restrictions in the RFC5891 as it contains hyphen-minus in the third and fourth positions.
xn--ridd1ji0d	U+1006 U+102D U+102F U+1004 U+103A	ဆိုင်	xn--ridd1ji0d	-
xn--vi8hua2f	U+D83C U+DF55 U+D83C U+DF5F U+D83C U+DF79	-	-	'utf-8' codec can't encode characters in position 55-60: surrogates not allowed

- Output csv: *U-label* and *A-label* forms will be generated when
  - Input is Code point sequence and valid
  - Input is U-label and valid
  - Input is A-label and valid

Label Forms - Input a List of Labels (Example 3 - Output)

Input	Code point sequence	U-label	A-label	Note
U+1005 U+102D U+1014 U+103A	U+1005 U+102D U+1014 U+103A	စိန်	xn--sid4a9d7b	-
U+1005 U+102D U+1014 U+103A U+002D	U+1005 U+102D U+1014 U+103A U+002D	-	-	စိန်- is invalid due to hyphen restrictions in the RFC5891 as it ends with a hyphen-minus.
ရတနာ	U+101B U+1010 U+1014 U+102C	ရတနာ	xn--3idit4e	-
ရတ--နာ	U+101B U+1010 U+002D U+002D U+1014 U+102C	-	-	ရတ--နာ is invalid due to hyphen restrictions in the RFC5891 as it contains hyphen-minus in the third and fourth positions.
xn--ridd1ji0d	U+1006 U+102D U+102F U+1004 U+103A	ဆိုင်	xn--ridd1ji0d	-
xn--vi8hua2f	U+D83C U+DF55 U+D83C U+DF5F U+D83C U+DF79	-	-	'utf-8' codec can't encode characters in position 55-60: surrogates not allowed

- Output csv: Notes will be generated, (with no A-label or U-label) when
  - Input is Code point sequence and IDNA2008-non-compliant
  - Input is U-label and IDNA2008-non-compliant
  - Input is A-label and IDNA2008-non-compliant

Appendix A:

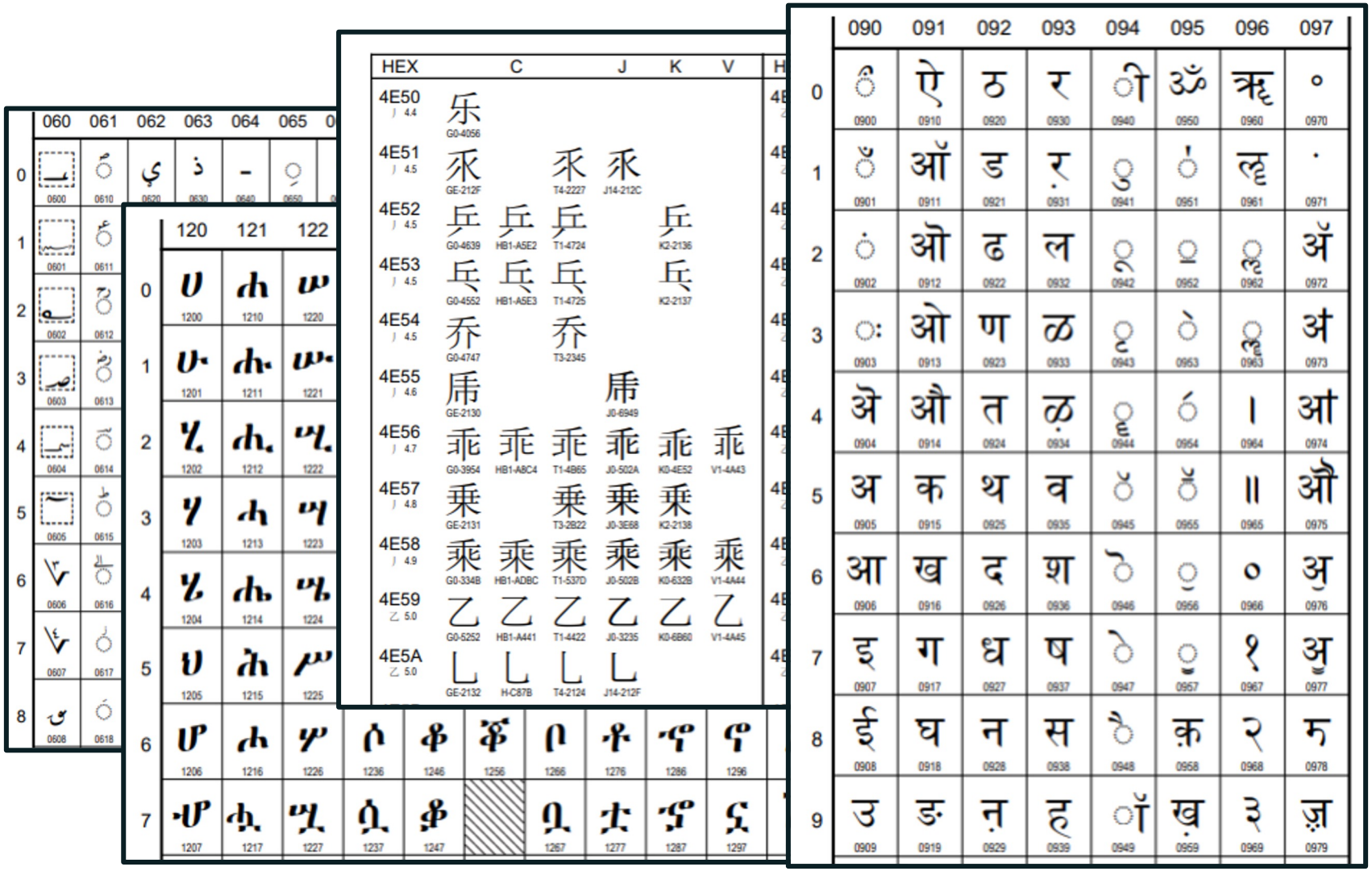
Introduction to IDN Tables

What is an IDN Table?

- IDN tables define the labels that can be registered for a particular language or script under a top-level domain (TLD).
  - IDN tables help manage the security, stability, and usability of IDNs.
- IDN tables include Unicode code points, variants, and linguistic and technical rules to determine appropriate and secure domain labels.
  - Repertoire: {U+0061 - U+007A, U+0030 - U+0039, U+002D}; a-z, 0-9, -.
  - Variants: U+0629 (ة) and U+06C3 (ۃ) are variants in Arabic script.
  - Rules:
    - Linguistic: A tone mark follows the main consonant in the Lao script.
    - Technical: The Unicode string MUST NOT contain a hyphen in the third- and fourth-character positions as per RFC 5891.
- IDN tables can be defined in multiple formats:
  - Latest machine-readable XML format specified in RFC 7940.
    - RFC 7940 refers to IDN tables as Label Generation Rules (LGRs).
  - Previously, text-based formats in RFC 3743 and RFC 4290 were also used.

Repertoire

- Repertoire is a subset of possible code points based on IDNA2008.

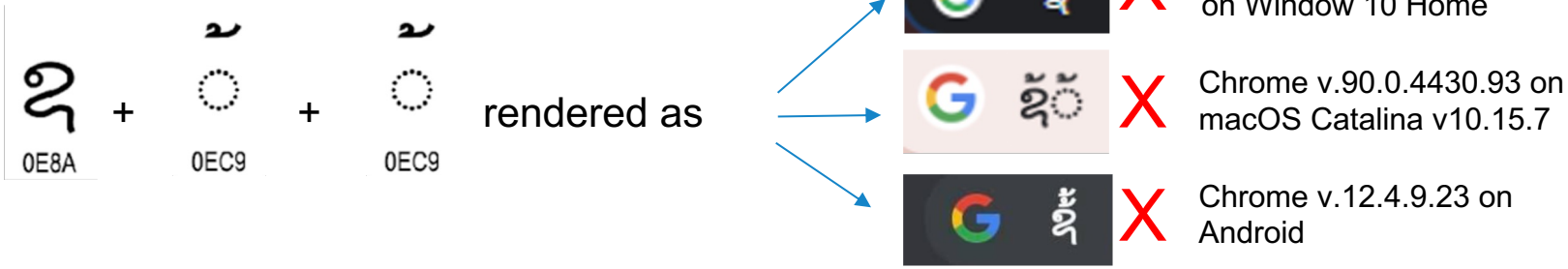


Variant Labels

- Variant labels are generated by code point (or sequence of code points) that could be substituted for a code point (or sequence of code points) that is considered the “same” in some measure by a given community of Internet users. They can be defined for **Security** and/or **Usability**

Rules

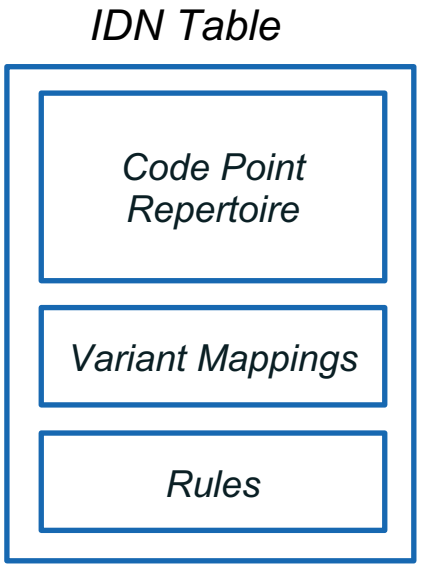
- Linguistic: A tone mark follows the main consonant in the Lao script.



- Technical: The Unicode string MUST NOT contain a hyphen in the third- and fourth-character positions as per RFC 5891.
  - niña-café ✓
  - ni--ñacafé X

Format of an IDN Table

- IDN tables include a Repertoire, Variant Mappings, and Rules.



- IDN tables can be defined in multiple formats:
  - Latest machine-readable XML format specified in RFC 7940.
    - RFC 7940 refers to IDN tables as Label Generation Rules (LGRs).
  - Previously, text-based formats in RFC 3743 and RFC 4290 were also used.

IDN Table Example in XML Format (RFC 7940)

```
<lgr xmlns="urn:ietf:params:xml:ns:lgr-1.0">
  <meta>
    <version comment="Second Level Reference LGR">3</version>
    <date>2020-08-24</date>
    <language>und-Khmr</language>
    <unicode-version>13.0.0</unicode-version>
    <description type="text/html">
    ...
    </description>
    <references>
    ...
    </references>
  </meta>
  <data>
    <char cp="002D" not-when="h
    <char cp="0030" tag="Common
      <var cp="17E0" type="bloc
    </char>
    <char cp="0031" tag="Common
      <var cp="17E1" type="bloc
    </char>
    <char cp="0032" tag="Common
      <var cp="17E2" type="bloc
    </char>
    <char cp="0033" tag="Common
      <var cp="17E3" type="bloc
    </char>
    <char cp="0034" tag="Common-digit sc:Zyyy" ref="0" comment="DIGIT FOUR; ⊛">
      <var cp="17E4" type="blocked" comment="Khmer digit variant"/>
    </char>
    <char cp="0035" tag="Common-digit sc:Zyyy" ref="0" comment="DIGIT FIVE; ⊛">
      <var cp="17E5" type="blocked" comment="Khmer digit variant"/>
    </char>
    <char cp="0036" tag="Common-digit sc:Zyyy" ref="0" comment="DIGIT SIX; ⊛">
      <var cp="17E6" type="blocked" comment="Khmer digit variant"/>
    </char>
    <char cp="0037" tag="Common-digit sc:Zyyy" ref="0" comment="DIGIT SEVEN; ⊛">
      <var cp="17E7" type="blocked" comment="Khmer digit variant"/>
    </char>
```

```
<rule name="follows-consonant-robat-shifter" comment="WLE Rule 5: makes
sure that dependent vowel follows a consonant or a shifter or a robat">
  <look-behind>
    <choice>
      <class by-ref="shifter"/>
      <class by-ref="consonant"/>
      <class by-ref="robat"/>
    </choice>
  </look-behind>
  <anchor/>
</rule>
```

```
    <char cp="0038" tag="Common-digit sc:Zyyy" ref="0" comment="DIGIT EIGHT; ⊛">
      <var cp="17E8" type="blocked" comment="Khmer digit variant"/>
    </char>
    <char cp="0039" tag="Common-digit sc:Zyyy" ref="0" comment="DIGIT NINE; ⊛">
      <var cp="17E9" type="blocked" comment="Khmer digit variant"/>
    </char>
    <char cp="1780" tag="consonant sc:Khmr series-three" ref="3 203 205" comment="Khmer"/
    <char cp="1781" tag="consonant sc:Khmr" ref="3 203" comment="Khmer"/>
    <char cp="1782" tag="consonant sc:Khmr" ref="3 203" comment="Khmer"/>
    <char cp="1783" tag="consonant sc:Khmr" ref="3 203" comment="Khmer"/>
    <char cp="1784" tag="consonant sc:Khmr series-three series-two" ref="3 203 205 210" c
    <char cp="1796" tag="consonant sc:Khmr" ref="3 203" comment="Khmer"/>
    <char cp="1797" tag="consonant sc:Khmr" ref="3 203" comment="Khmer"/>
    <char cp="1798" tag="consonant sc:Khmr series-two" ref="3 203 210" comment="Khmer"/>
    <char cp="1799" tag="consonant sc:Khmr series-two" ref="3 203 210" comment="Khmer"/>
    <char cp="179A" tag="consonant sc:Khmr series-two" ref="3 203 210" comment="Khmer"/>
    <char cp="179B" tag="consonant sc:Khmr series-three" ref="3 203 205" comment="Khmer"/
    <char cp="179C" tag="consonant sc:Khmr series-two" ref="3 203 210" comment="Khmer"/>
    <char cp="179F" tag="consonant sc:Khmr series-one series-three" ref="3 203 205 210" c
    <char cp="17A0" tag="consonant sc:Khmr series-one" ref="3 203 210" comment="Khmer"/>
    <char cp="17A1" tag="base-only consonant sc:Khmr" ref="3 203" comment="Khmer"/>
    <char cp="17A2" tag="consonant sc:Khmr series-one" ref="3 203 210" comment="Khmer"/>
    <char cp="17A5" tag="independent-vowel sc:Khmr" ref="3 206" comment="Khmer"/>
    <char cp="17A6" tag="independent-vowel sc:Khmr" ref="3 206" comment="Khmer"/>
```

IDN Table Example in Text Format (RFC 4290)

```
# Info ##########################################################
#
# Registry:    Verisign Inc.
# Contact:     Registry Customer Service
# Email:       info@verisign-grs.com
# Phone:       +1-703-925-6999
# Script:      Khmer (khmr)
# Version:     2.5
# Date:        March 21st, 2017
# Unicode:     6.0.0
#
################################################################


# Applicable Rules ########################################
#
# Code points: U+002D (HYPHEN-MINUS)
# Reference:   RFC 5891 4.2.3.1
# Rules:       Cannot begin or end a label
#              Cannot occupy 3rd and 4th position
#
# Code points: U+17B6..U+17D3, U+17DD (COMBINING MARKS)
# Reference:   RFC 5891 4.2.3.2
# Rules:       Cannot begin a label
#
# Code points: U+17D7 (MODIFIER LETTERS)
# Reference:   Predelegation Tester Request
# Rules:       Cannot begin a label
#
################################################################


# Points ########################################################
U+002D  # Common        HYPHEN-MINUS
U+0030  # Common        DIGIT ZERO
U+0031  # Common        DIGIT ONE
U+0032  # Common        DIGIT TWO
U+0033  # Common        DIGIT THREE
U+0034  # Common        DIGIT FOUR
U+0035  # Common        DIGIT FIVE
U+0036  # Common        DIGIT SIX
U+0037  # Common        DIGIT SEVEN
U+0038  # Common        DIGIT EIGHT
U+0039  # Common        DIGIT NINE
U+1780  # Khmer KHMER LETTER KA
U+1781  # Khmer KHMER LETTER KHA
U+1782  # Khmer KHMER LETTER KO
U+1783  # Khmer KHMER LETTER KHO
U+1784  # Khmer KHMER LETTER NGO
U+1785  # Khmer KHMER LETTER CA
U+1786  # Khmer KHMER LETTER CHA
U+1787  # Khmer KHMER LETTER CO
U+1788  # Khmer KHMER LETTER CHO
U+1789  # Khmer KHMER LETTER NYO
U+178A  # Khmer KHMER LETTER DA
U+178B  # Khmer KHMER LETTER TTHA
U+178C  # Khmer KHMER LETTER DO
U+178D  # Khmer KHMER LETTER TTHO
U+178E  # Khmer KHMER LETTER NNO
U+178F  # Khmer KHMER LETTER TA
U+1790  # Khmer KHMER LETTER THA
U+1791  # Khmer KHMER LETTER TO
U+1792  # Khmer KHMER LETTER THO
U+1793  # Khmer KHMER LETTER NO
U+1794  # Khmer KHMER LETTER BA
U+1795  # Khmer KHMER LETTER PHA
U+1796  # Khmer KHMER LETTER PO
U+1797  # Khmer KHMER LETTER PHO
U+1798  # Khmer KHMER LETTER MO
U+1799  # Khmer KHMER LETTER YO
U+179A  # Khmer KHMER LETTER RO
U+179B  # Khmer KHMER LETTER LO
U+179C  # Khmer KHMER LETTER VO
U+179D  # Khmer KHMER LETTER SHA
U+179E  # Khmer KHMER LETTER SSO
U+179F  # Khmer KHMER LETTER SA
U+17A0  # Khmer KHMER LETTER HA
U+17A1  # Khmer KHMER LETTER LA
U+17A2  # Khmer KHMER LETTER QA
U+17A3  # Khmer KHMER INDEPENDENT VOWEL QAQ
U+17A4  # Khmer KHMER INDEPENDENT VOWEL QAA
U+17A5  # Khmer KHMER INDEPENDENT VOWEL QI
U+17A6  # Khmer KHMER INDEPENDENT VOWEL QII
U+17A7  # Khmer KHMER INDEPENDENT VOWEL QU
U+17A8  # Khmer KHMER INDEPENDENT VOWEL QUK
U+17A9  # Khmer KHMER INDEPENDENT VOWEL QUU
U+17AA  # Khmer KHMER INDEPENDENT VOWEL QUUV
U+17AB  # Khmer KHMER INDEPENDENT VOWEL RY
U+17AC  # Khmer KHMER INDEPENDENT VOWEL RYY
U+17AD  # Khmer KHMER INDEPENDENT VOWEL LY
U+17AE  # Khmer KHMER INDEPENDENT VOWEL LYY
U+17AF  # Khmer KHMER INDEPENDENT VOWEL QE
U+17B0  # Khmer KHMER INDEPENDENT VOWEL QAI
U+17B1  # Khmer KHMER INDEPENDENT VOWEL QOO TYPE ONE
U+17B2  # Khmer KHMER INDEPENDENT VOWEL QOO TYPE TWO
U+17B3  # Khmer KHMER INDEPENDENT VOWEL QAU
U+17B6  # Khmer KHMER VOWEL SIGN AA
U+17B7  # Khmer KHMER VOWEL SIGN I
U+17B8  # Khmer KHMER VOWEL SIGN II
U+17B9  # Khmer KHMER VOWEL SIGN Y
U+17BA  # Khmer KHMER VOWEL SIGN YY
U+17BB  # Khmer KHMER VOWEL SIGN U
U+17BC  # Khmer KHMER VOWEL SIGN UU
U+17BD  # Khmer KHMER VOWEL SIGN UA
U+17BE  # Khmer KHMER VOWEL SIGN OE
U+17BF  # Khmer KHMER VOWEL SIGN YA
U+17C0  # Khmer KHMER VOWEL SIGN IE
U+17C1  # Khmer KHMER VOWEL SIGN E
U+17C2  # Khmer KHMER VOWEL SIGN AE
U+17C3  # Khmer KHMER VOWEL SIGN AI
U+17C4  # Khmer KHMER VOWEL SIGN OO
U+17C5  # Khmer KHMER VOWEL SIGN AU
U+17C6  # Khmer KHMER SIGN NIKAHIT
U+17C7  # Khmer KHMER SIGN REAHMUK
U+17C8  # Khmer KHMER SIGN YUUKALEAPINTU
U+17C9  # Khmer KHMER SIGN MUUSIKATOAN
U+17CA  # Khmer KHMER SIGN TRIISAP
U+17CB  # Khmer KHMER SIGN BANTOC
U+17CC  # Khmer KHMER SIGN ROBAT
U+17CD  # Khmer KHMER SIGN TOANDAKHIAT
```

Appendix B:

Introduction to Reference LGRs

Reference Label Generation Rules (LGRs)

- Reference LGRs are based on the RZ-LGR, and designed for the second level:
  - Formed in consultation with the relevant script community.
  - Follow design principles in RFC 6912 and SSAC's SAC060.
  - Developed in machine-readable RFC 7940 format.
  - Pre-vetted for security and stability considerations.
- Registry operators are encouraged to consult the reference LGRs while they design their own IDN tables. However, strict adherence is not required.
- Reference LGRs are used as a baseline for reviewing IDN tables for generic top-level domain (gTLD) registries.
- Reference LGRs are published at https://www.icann.org/resources/pages/second-level-lgr-2015-06-21-en

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