upmendexで作る多言語索引
Multilingual index processing by upmendex

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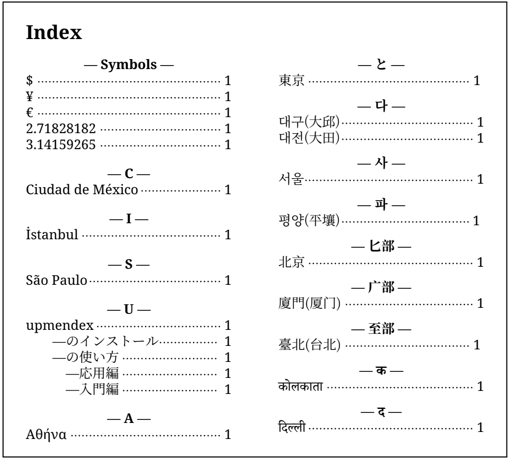
2026年2月15日

Overview

- Feature of **upmendex**
  — Multilingual index processor
- Localization
  - Latin, Cyrillic, Greek
  - CJK (Chinese, Japanese, Korean)
  - Brahmic (Devanagari, Thai, ···)
  - Arabic, Hebrew
- Multilingual environment
- Benchmark



Index

— Symbols —
$ 1
¥ 1
€ 1
2.71828182 1
3.14159265 1

— C —
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— I —
İstanbul 1

— S —
São Paulo 1

— U —
upmendex 1
  —のインストール 1
  —の使い方 1
    —応用編 1
    —入門編 1

— A —
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— と —
東京 1

— 다 —
대구(大邱) 1
대전(大田) 1

— 사 —
서울 1

— 파 —
평양(平壤) 1

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北京 1

— 广部 —
廈門(厦门) 1

— 至部 —
臺北(台北) 1

— क —
कोलकाता 1

— द —
दिल्ली 1

Feature of upmendex (Ver. 1.22)

- Index processor
  - Upper compatible with **MakeIndex**/**Mendex**
  - Work with upLaTeX/LuaLaTeX/XeLaTeX
- Localization
  - Support 72 Languages / 22 Scripts
    - Latin (incl. non-English), Cyrillic, Greek
    - CJK (Chinese, Japanese, Korean)
    - Brahmic (Devanagari, Bengali, Thai, ···)
    - Arabic, Hebrew
    - Symbol, Number
- Multilingualization
  - Unicode, UTF-8
  - ICU[†] (Collation, Case Conversion, Category Property)
  - Environment for babel/polyglossia

[†] ICU: International Components for Unicode

Language, Script, Locale

Language	Script / Index	ICU locale
English	Latin	root
Spanish	Latin	es
German	Latin	de
Turkish	Latin	tr
…		
Russian	Cyrillic	ru
Ukrainian	Cyrillic	uk
…		
Greek	Greek	el
Chinese	Hanzi / Pinyin	zh
	Hanzi / Stroke	zh-u-co-stroke
	Hanzi / Radical-Stroke	zh-u-co-unihan
	Hanzi / Zhuyin	zh-u-co-zhuyin
Japanese	Kana & Hanzi / Kana	ja
Korean	Hangul	ko

Language	Script / Index	ICU locale
Hindi	Devanagari	hi
Marathi	Devanagari	mr
Bengali	Bengali	bn
…		
Thai	Thai	th
Persian	Arabic	fa
Arabic	Arabic	ar
…		
Hebrew	Hebrew	he
Yiddish	Hebrew	yi
Common	Symbol Number	

upmendex supports 72 languages, 22 scripts & 110 locales.

Latin, Cyrillic, Greek

- Sorting (Collation) | ソート順
- Diacritical mark | ダイアクリティカルマーク
- Digraph/Trigraph | ダイグラフ/トライグラフ

German, Phonebook Sort Order

Collation Rule locale: de-u-co-phonebk

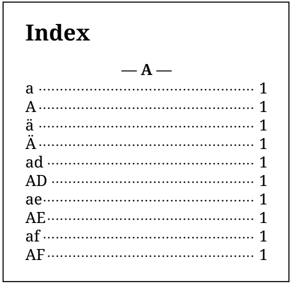
```
&AE<<ä<<<Ä
&OE<<ö<<<Ö
&UE<<ü<<<Ü
...
```

Style File *.ist locale: de-u-co-phonebk

```
icu_locale "de-u-co-phonebk"
```

German Inputs in *.tex

```
ad\index{ad}.
ae\index{ae}.
AE\index{AE}.
ä\index{ä}.
Ä\index{Ä}.
af\index{af}.
...
```

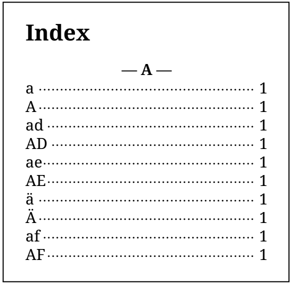


Index

— **A** —

a 1
A 1
ä 1
Ä 1
ad 1
AD 1
ae 1
AE 1
af 1
AF 1

default



Index

— **A** —

a 1
A 1
ad 1
AD 1
ae 1
AE 1
ä 1
Ä 1
af 1
AF 1

phonebook sort order

Lithuanian, Sort Order of Y

Collation Rule locale: lt

```
&I<<į<<<Į<<y<<<Y
...
```

Lithuanian Inputs in *.tex

```
i\index{i}.
I\index{I}.
į\index{į}.
Į\index{Į}.
y\index{y}.
Y\index{Y}.
...
```

Rodyklė

— H —

h 1
H 1

— I —

i 1
I 1
į 1
Į 1
y 1
Y 1

— J —

j 1
J 1

— X —

x 1

— Z —

z 1

Slovak, Diacritical Mark

Collation Rule locale: sk

```
&O<ô<<<Ô
. . .
```

Collation Rule locale: sk-u-co-search

```
&L<ĺ<<<Ĺ<ľ<<<Ľ
&O<ó<<<Ó<ô<<<Ô
. . .
```

Slovak Inputs in *.tex

```
l\index{l}.
ĺ\index{ĺ}.
ľ\index{ľ}.
o\index{o}.
ó\index{ó}.
ô\index{ô}.
```

Index

— **L** —

l 1
ĺ 1
ľ 1

— **O** —

o 1
ó 1

— **Ô** —

ô 1

default

Index

— **L** —

l 1

— **Ĺ** —

ĺ 1

— **Ľ** —

ľ 1

— **O** —

o 1

— **Ó** —

ó 1

— **Ô** —

ô 1

General-Purpose Search

Turkish, Dotless / Dotted I

language	upper	lower
Turkish	İ	i
	I	ı
English	I	i

Collation Rule locale: tr

```
&[before 1]i<ı<<<I
&i<<<İ
...
```

Turkish Inputs in *.tex

```
h\index{h}.
H\index{H}.
i\index{i}.
ı\index{ı}.
I\index{I}.
İ\index{İ}.
j\index{j}.
J\index{J}.
...
```

Dizin

— H —
h 1
H 1

— I —
ı 1
I 1

— İ —
i 1
İ 1

— J —
j 1
J 1

Turkish

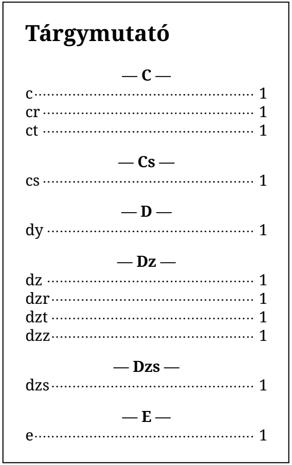
Hungarian, Digraphs and Trigraph

Collation Rule locale: hu

```
&C<cs<<<Cs<<<CS
&D<dz<<<Dz<<<DZ
&DZ<dzs<<<Dzs<<<DZS
. . .
```

Hungarian Inputs in *.tex

```
cr\index{cr}.
cs\index{cs}.
ct\index{ct}.
dy\index{dy}.
dz\index{dz}.
dzr\index{dzr}.
dzs\index{dzs}.
dzt\index{dzt}.
e\index{e}.
. . .
```



Tárgymutató

— C —
c 1
cr 1
ct 1

— Cs —
cs 1

— D —
dy 1

— Dz —
dz 1
dzr 1
dzt 1
dzz 1

— Dzs —
dzs 1

— E —
e 1

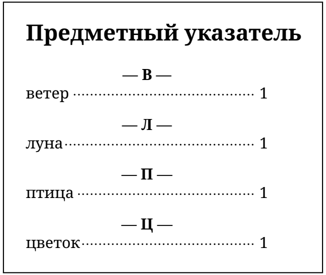
Cyrillic & Greek

Russian Inputs in *.tex

```
цветок\index{цветок}.
птица\index{птица}.
ветер\index{ветер}.
луна\index{луна}.
```

Greek Inputs in *.tex

```
λουλούδι\index{λουλούδι}.
πουλί\index{πουλί}.
άνεμος\index{άνεμος}.
φεγγάρι\index{φεγγάρι}.
```



Предметный указатель

— В —

ветер 1

— Л —

луна 1

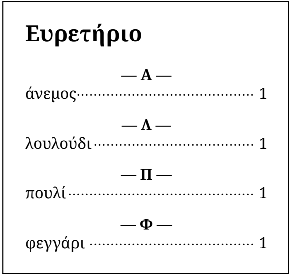
— П —

птица 1

— Ц —

цветок 1

Russian, Cyrillic



Ευρετήριο

— Α —

άνεμος 1

— Λ —

λουλούδι 1

— Π —

πουλί 1

— Φ —

φεγγάρι 1

Greek

CJK (Chinese, Japanese, Korean)

- Chinese: 4 kinds of sort order | 中国語: 4種のソート順
- Japanese: Reading, Extended Kana | 日本語: 読み、仮名拡張
- Korean: composed/decomposed | 韓国語: 完成型・組合型

Chinese, Han Ideograph Sort Order

Style File *.ist locale: zh-u-co-unihan

```
%icu_locale "zh"
%icu_locale "zh-u-co-stroke"
icu_locale "zh-u-co-unihan"
%icu_locale "zh-u-co-zhuyin"
hanzi_head  "一部;丨部;丶部;丿部;乙部;亅部;二部;亠部;
...
```

Chinese Inputs in *.tex

```
花\index{花 (8, 艸, huā, ㄏㄨㄚ)}
鳥\index{鳥 (11, 鳥, niǎo, ㄋㄧㄠˇ)}
風\index{風 (9, 風, fēng, ㄈㄥ)}
月\index{月 (4, 月, yuè, ㄩㄝˋ)}
```

sort order		locale
Pinyin	拼音	zh
Stroke	筆畫數	zh-u-co-stroke
Radical-Stroke	部首筆畫數	zh-u-co-unihan
Zhuyin (Bopomofo)	注音符號	zh-u-co-zhuyin

Chinese, Han Ideograph Sort Order

Pinyin Sort Order 拼音 locale: zh

```
\centerline{\bfseries --- F ---}\par\nobreak
  \item 風 (9, 風, fēng, ㄈㄥ)\leaders\hbox{ }\hfill 1

  \indexspace

\centerline{\bfseries --- H ---}\par\nobreak
  \item 花 (8, 艸, huā, ㄏㄨㄚ)\leaders\hbox{ }\hfill 1
```

Radical-Stroke Sort Order 部首筆畫數 zh-u-co-unihan

```
\centerline{\bfseries --- 月部 ---}\par\nobreak
  \item 月 (4, 月, yuè, ㄩㄝˋ)\leaders\hbox{ }\hfill 1

  \indexspace

\centerline{\bfseries --- 艸部 ---}\par\nobreak
  \item 花 (8, 艸, huā, ㄏㄨㄚ)\leaders\hbox{ }\hfill 1
```

Stroke Sort Order 筆畫數 zh-u-co-stroke

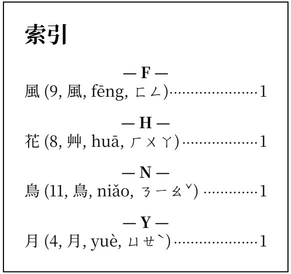
```
\centerline{\bfseries --- 四畫 ---}\par\nobreak
  \item 月 (4, 月, yuè, ㄩㄝˋ)\leaders\hbox{ }\hfill 1

  \indexspace

\centerline{\bfseries --- 八畫 ---}\par\nobreak
  \item 花 (8, 艸, huā, ㄏㄨㄚ)\leaders\hbox{ }\hfill 1
```

Zhuyin (Bopomofo) Sort Order 注音符號 zh-u-co-zhuyin

```
\centerline{\bfseries --- ㄈ ---}\par\nobreak
  \item 風 (9, 風, fēng, ㄈㄥ)\leaders\hbox{ }\hfill 1

  \indexspace

\centerline{\bfseries --- ㄋ ---}\par\nobreak
  \item 鳥 (11, 鳥, niǎo, ㄋㄧㄠˇ)\leaders\hbox{ }\hfill
```

upmendex Output *.ind

Chinese, Han Ideograph Sort Order



索引

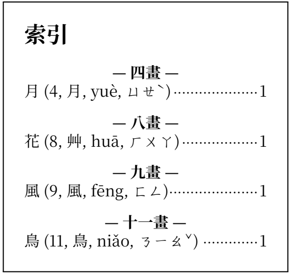
— F —
風 (9, 風, fēng, ㄈㄥ)……1

— H —
花 (8, 艸, huā, ㄏㄨㄚ)……1

— N —
鳥 (11, 鳥, niǎo, ㄋㄧㄠˇ)……1

— Y —
月 (4, 月, yuè, ㄩㄝˋ)……1

拼音
pinyin



索引

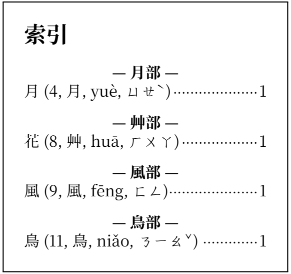
— 四畫 —
月 (4, 月, yuè, ㄩㄝˋ)……1

— 八畫 —
花 (8, 艸, huā, ㄏㄨㄚ)……1

— 九畫 —
風 (9, 風, fēng, ㄈㄥ)……1

— 十一畫 —
鳥 (11, 鳥, niǎo, ㄋㄧㄠˇ)……1

筆畫數
stroke



索引

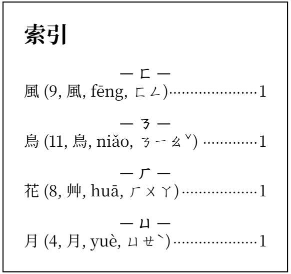
— 月部 —
月 (4, 月, yuè, ㄩㄝˋ)……1

— 艸部 —
花 (8, 艸, huā, ㄏㄨㄚ)……1

— 風部 —
風 (9, 風, fēng, ㄈㄥ)……1

— 鳥部 —
鳥 (11, 鳥, niǎo, ㄋㄧㄠˇ)……1

部首筆畫數
radical-stroke



索引

— ㄈ —
風 (9, 風, fēng, ㄈㄥ)……1

— ㄋ —
鳥 (11, 鳥, niǎo, ㄋㄧㄠˇ)……1

— ㄏ —
花 (8, 艸, huā, ㄏㄨㄚ)……1

— ㄩ —
月 (4, 月, yuè, ㄩㄝˋ)……1

注音符號
zhuyin (bopomofo)

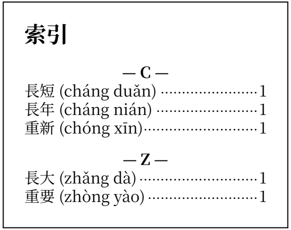
Chinese, Polyphone (多音字)

Input with Polyphone in *.tex

```
重新\index{重新 (chóng xīn)}
重要\index{重要 (zhòng yào)}
長年\index{長年 (cháng nián)}
長短\index{長短 (cháng duǎn)}
長大\index{長大 (zhǎng dà)}
```

Style File *.ist

```
icu_locale "zh"
%icu_locale "zh-u-co-zhuyin"
icu_rules  "&常<<長年<<長短 &崇<<重新"
```

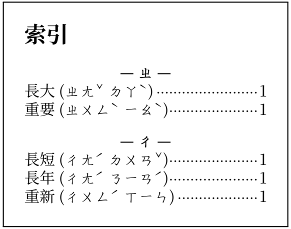


索引

— C —
長短 (cháng duǎn) 1
長年 (cháng nián) 1
重新 (chóng xīn) 1

— Z —
長大 (zhǎng dà) 1
重要 (zhòng yào) 1

拼音
pinyin



索引

— ㄓ —
長大 (ㄓㄤˇ ㄉㄚˋ) 1
重要 (ㄓㄨㄥˋ ㄧㄠˋ) 1

— ㄔ —
長短 (ㄔㄤˊ ㄉㄨㄢˇ) 1
長年 (ㄔㄤˊ ㄋㄧㄢˊ) 1
重新 (ㄔㄨㄥˊ ㄒㄧㄣ) 1

注音符號
zhuyin (bopomofo)

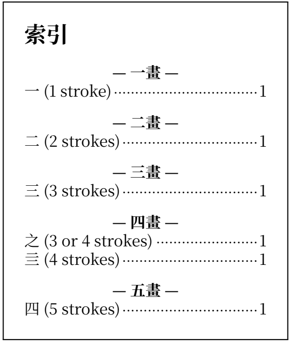
Chinese, Customize Strokes

Inputs in *.tex

```
一\index{一 (1 stroke)}
二\index{二 (2 strokes)}
三\index{三 (3 strokes)}
之\index{之 (3 or 4 strokes)}
亖\index{亖 (4 strokes)}
四\index{四 (5 strokes)}
```

Style File *.ist

```
icu_locale "zh-u-co-stroke"
icu_rules  "&'\uFDD0\u2803'<之"
```



索引

— 一畫 —
一 (1 stroke) 1

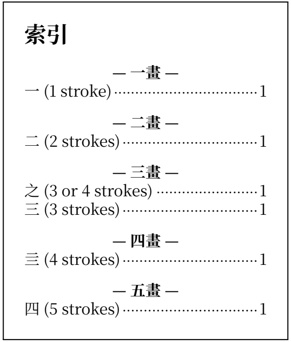
— 二畫 —
二 (2 strokes) 1

— 三畫 —
三 (3 strokes) 1

— 四畫 —
之 (3 or 4 strokes) 1
亖 (4 strokes) 1

— 五畫 —
四 (5 strokes) 1

Default



索引

— 一畫 —
一 (1 stroke) 1

— 二畫 —
二 (2 strokes) 1

— 三畫 —
之 (3 or 4 strokes) 1
三 (3 strokes) 1

— 四畫 —
亖 (4 strokes) 1

— 五畫 —
四 (5 strokes) 1

Customized

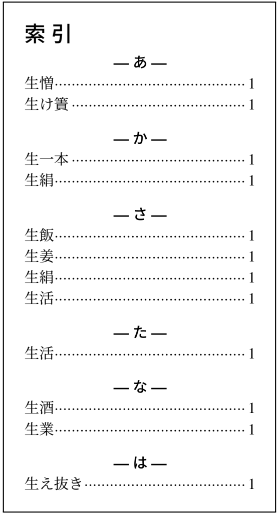
Japanese, Sort by Reading (Yomi)

Japanese Inputs with Reading (Yomi) in *.tex

```
\newcommand{\YomiTag}[1]{\relax}

%%  \index{reading@index_word}
生酒\index{なまざけ@生酒}。
生一本\index{きいっぽん@生一本}。
生け簀\index{いけす@生け簀}。
生絹\index{きぎぬ@生絹\YomiTag{きぎぬ}}%
    \index{すずし@生絹\YomiTag{すずし}}。
生飯\index{さば@生飯}。
生姜\index{しょうが@生姜}。
生活\index{せいかつ@生活\YomiTag{せいかつ}}
    \index{たつき@生活\YomiTag{たつき}}。
...
```

Japanese words consist of Hanzi (ideographs) & Kana (syllabaries), sorted by reading (yomi), indexed by Kana.

This feature is implemented by **ASCII mendex**.



索 引

— あ —

生憎 1
生け簀 1

— か —

生一本 1
生絹 1

— さ —

生飯 1
生姜 1
生絹 1
生活 1

— た —

生活 1

— な —

生酒 1
生業 1

— は —

生え抜き 1

Japanese, Reading & Dictionary

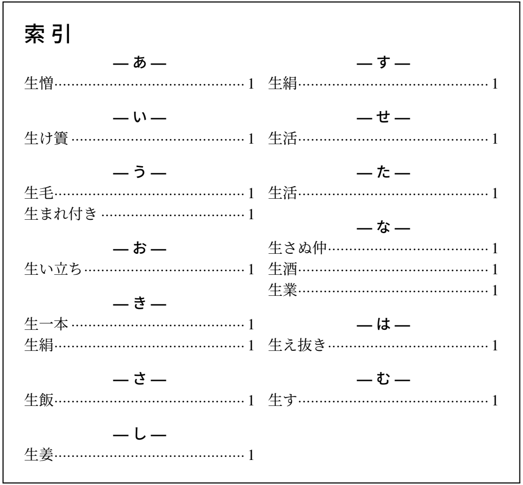
Japanese Inputs in *.tex

```
生酒\index{生酒}。
生一本\index{生一本}。
生け簀\index{生け簀}。
生絹\index{生絹}%
    \index{すずし@生絹\YomiTag{すずし}}。
生え抜き\index{生え抜き}。
...
```

Dictionary *.dic

```
index_word  reading
生酒        なまざけ
生一本      きいっぽん
生け簀      いけす
生絹        きぎぬ
生え抜き    はえぬき
...
```

Implemented by **ASCII mendex**.



索 引

— あ —
生憎 1

— い —
生け簀 1

— う —
生毛 1
生まれ付き 1

— お —
生い立ち 1

— き —
生一本 1
生絹 1

— さ —
生飯 1

— し —
生姜 1

— す —
生絹 1

— せ —
生活 1

— た —
生活 1

— な —
生さぬ仲 1
生酒 1
生業 1

— は —
生え抜き 1

— む —
生す 1

Japanese, Hentaigana

Inputs with Hentaigana in *.tex

```
きそば\index{きそば}
うなぎ\index{うなぎ}
しるこ\index{しるこ}
すし\index{すし}
天ぷら\index{天ぷら}
...
```

Dictionary for Hentaigana *.dic

index_word	reading
き	き
そ	そ
は	は
な	な
し	し
こ	こ
...	

お品書き

— う —
うどん 1
うどん 1
うなぎ 1
うなぎ 1

— き —
きそば 1
きそば 1

— し —
しるこ 1
しるこ 1

— す —
すし 1
すし 1

— せ —
せんべい 1
せんべい 1

— た —
だんご 1
だんご 1

— て —
てんぷら 1
天ぷら 1

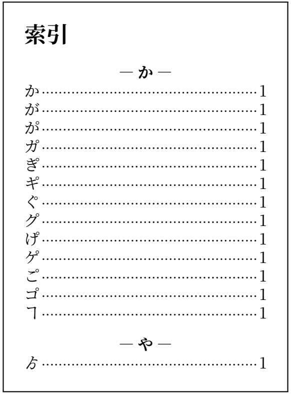
Extended Kana in JIS X 0213

Extended Kana Inputs in *.tex

```
か゚\index{か゚}. % NGA
き゚\index{き゚}. % NGI
く゚\index{く゚}. % NGU
...
ゟ\index{ゟ}. % Hiragana Digraph Yori
ヿ\index{ヿ}. % Katakana Digraph Koto
```

Aynu itak Inputs in *.tex

```
ㇰ\index{ㇰ}
ㇱ\index{ㇱ}
ㇲ\index{ㇲ}
ㇷ゚\index{ㇷ゚}
セ゚\index{セ゚}
ツ゚\index{ツ゚}
ト゚\index{ト゚}
...
```



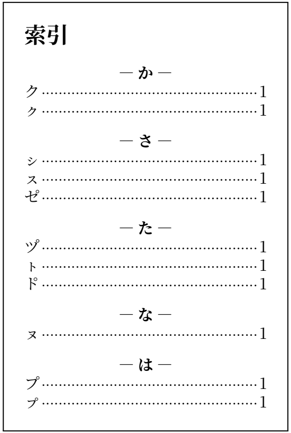
索引

— か —

か …… 1
が …… 1
か゚ …… 1
カ゚ …… 1
き゚ …… 1
キ゚ …… 1
く゚ …… 1
ク゚ …… 1
け゚ …… 1
ケ゚ …… 1
こ゚ …… 1
コ゚ …… 1
ヿ …… 1

— や —

ゟ …… 1



索引

— か —

ク …… 1
ㇰ …… 1

— さ —

ㇱ …… 1
ㇲ …… 1
セ゚ …… 1

— た —

ツ゚ …… 1
ㇳ …… 1
ト゚ …… 1

— な —

ㇴ …… 1

— は —

プ …… 1
ㇷ゚ …… 1

Japanese, Archaic Kana

Archaic Kana Inputs in *.tex

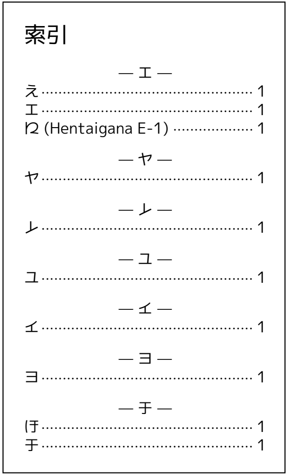
```
𛀁\index{𛀁}. % Hiragana Archaic YE
             %  or Hentaigana E-1
𛄟\index{𛄟}. % Hiragana WU
𛄠\index{𛄠}. % Katakana YI
𛄡\index{𛄡}. % Katakana YE
𛄢\index{𛄢}. % Katakana WU
...
```

Dictionary: “𛀁” is Hentaigana E-1

𛀁 え

Style: “𛀁” is Hiragana Archaic YE

```
icu_rules "&ゆ<𛀁<<<𛄡<よ"
```



索引

— エ —

え 1
エ 1
𛀁 (Hentaigana E-1) 1

— ヤ —

ヤ 1

— 𛄠 —

𛄠 1

— ユ —

ユ 1

— 𛄡 —

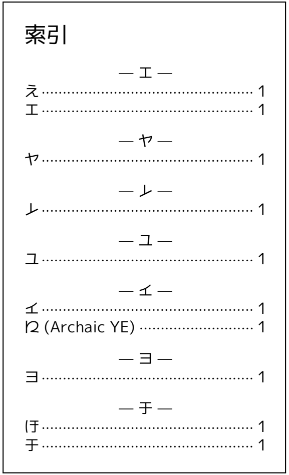
𛄡 1

— ヨ —

ヨ 1

— 𛄢 —

𛄟 1
𛄢 1



索引

— エ —

え 1
エ 1

— ヤ —

ヤ 1

— 𛄠 —

𛄠 1

— ユ —

ユ 1

— 𛄡 —

𛄡 1
𛀁 (Archaic YE) 1

— ヨ —

ヨ 1

— 𛄢 —

𛄟 1
𛄢 1

Korean, Modarn / Archaic Hangul

ideograph
한자

日

modarn
현대 한글

일

U+C77C

archaic, composed / decomposed
옛 한글, 완성형 / 조합형 (完成型 / 組合型)

·ᅀᅵᇙ = ᅀ + ᅵ + ᇙ + 〮

ᅀ	ᅵ	ᇙ	〮
U+1140 첫소리 初聲	U+1175 가운뎃소리 中聲	U+11D9 끝소리 終聲	U+302E 방점 傍點

	Unicode block	style		upmendex	upLaTeX	XeLaTeX
modarn	Hangul Syllables	composed	완성형	✓	✓	✓
ex. 일	Hangul Jamo	decompopsed	조합형	✓	N.A.	✓
archaic	Private Use Area	composed	완성형	via dictionary	✓	✓
ex. ·ᅀᅵᇙ	Hangul Jamo	decomposed	조합형	✓	N.A.	✓

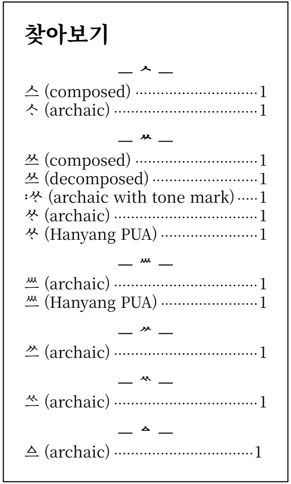
Korean Hangul

Hangul Inputs in *.tex

```
쓰\index{쓰 (composed)}.
쓰\index{쓰 (decomposed)}.

ᄊᆞ\index{ᄊᆞ (archaic)}.
ᄊᆞ〯\index{ᄊᆞ〯 (archaic with tone mark)}.
ᄊᆞ\index{ᄊᆞ (Hanyang PUA)}.
...
```

Dictionary for PUA code *.dic

```
Hanyang PUA code   decomposed
ᄊᆞ                 ᄊᆞ
ᄊᆡ                 ᄊᆡ
...
```



찾아보기

Complex Text Layout

- Brahmic scripts:
  Devanagari, Bengali, Gurmukhi, Gujarati, Oriya, Tamil, Telugu, Kannada, Malayalam, Sinhala, Thai, Lao
- Arabic, Hebrew: R-to-L typeset
- Symbol, Number

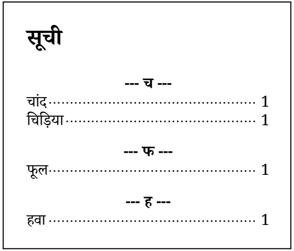
Devanagari & Thai (experimental)

Hindi Inputs in *.tex

```
फूल \index{ फूल }
चिड़िया \index{ चिड़िया }
हवा \index{ हवा }
चांद \index{ चांद }
...
```

Thai Inputs in *.tex

```
ดอกไม้ \index{ ดอกไม้ }
นก \index{ นก }
ลม \index{ ลม }
ดวงจันทร์ \index{ ดวงจันทร์ }
...
```



सूची

--- च ---

चांद 1
चिड़िया 1

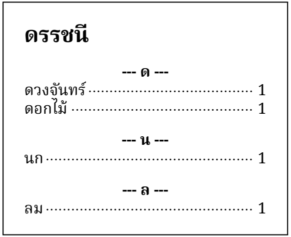
--- फ ---

फूल 1

--- ह ---

हवा 1

Hindi, Devanagari



ดรรชนี

--- ด ---

ดวงจันทร์ 1
ดอกไม้ 1

--- น ---

นก 1

--- ล ---

ลม 1

Thai

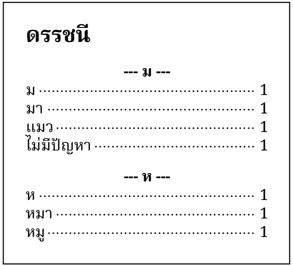
Typeset by XeLaTeX

Thai/Lao Prevowels Reordering (experimental)

Thai Inputs in *.tex

```
หมา \index{หมา}
หมู \index{หมู}
แมว \index{แมว}
ไม่มีปัญหา \index{ไม่มีปัญหา}
มา \index{มา}
ห \index{ห}
ม \index{ม}
```

A sequence of a Thai vowel เ แ โ ใ ไ or a Lao vowel ເ ແ ໂ ໃ ໄ followed by a Thai consonant ก ข ค ฆ ง ... or a Lao consonant ກ ຂ ຄ ງ ... is placed after the consonant for collation purposes.



ดรรชนี

--- ม ---

ม	1
มา	1
แมว	1
ไม่มีปัญหา	1

--- ห ---

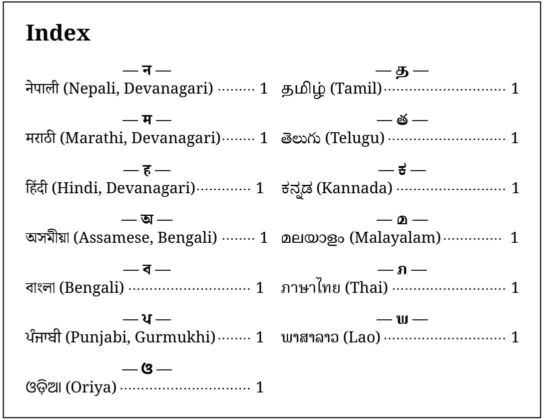
ห	1
หมา	1
หมู	1

Brahmic Scripts (experimental)

Multiscript Inputs in *.tex

```
\begin{hindi}
हिंदी \index{हिंदी (Hindi, Devanagari)}
मराठी \index{मराठी (Marathi, Devanagari)}
नेपाली \index{नेपाली (Nepali, Devanagari)}
\end{hindi}
...
\begin{bengali}
বাংলা \index{বাংলা (Bengali)}
অসমীয়া \index{অসমীয়া (Assamese, Bengali)}
\end{bengali}
...
```

Supports 12 Brahmic scripts,
15 languages.



Index

— न —
नेपाली (Nepali, Devanagari) 1

— म —
मराठी (Marathi, Devanagari) 1

— ह —
हिंदी (Hindi, Devanagari) 1

— অ —
অসমীয়া (Assamese, Bengali) 1

— ব —
বাংলা (Bengali) 1

— ਪ —
ਪੰਜਾਬੀ (Punjabi, Gurmukhi) 1

— ଓ —
ଓଡ଼ିଆ (Oriya) 1

— த —
தமிழ் (Tamil) 1

— తె —
తెలుగు (Telugu) 1

— ಕ —
ಕನ್ನಡ (Kannada) 1

— മ —
മലയാളം (Malayalam) 1

— ภ —
ภาษาไทย (Thai) 1

— ພ —
ພາສາລາວ (Lao) 1

with XeLaTeX & polyglossia

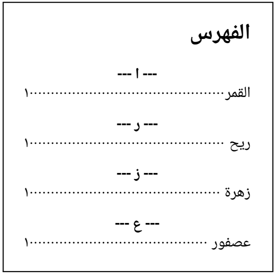
Arabic & Hebrew (experimental)

Arabic Inputs in *.tex

```
زهرة \index{زهرة}
عصفور \index{عصفور}
ريح \index{ريح}
القمر \index{القمر}
...
```

Hebrew Inputs in *.tex

```
פֶּרַח \index{פֶּרַח}
ציפור \index{ציפור}
רוּחַ \index{רוּחַ}
ירח \index{ירח}
...
```



الفهرس

--- ا ---

القمر ١

--- ر ---

ريح ١

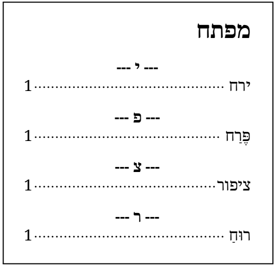
--- ز ---

زهرة ١

--- ع ---

عصفور ١

Arabic



מפתח

--- י ---

ירח 1

--- פ ---

פֶּרַח 1

--- צ ---

ציפור 1

--- ר ---

רוּחַ 1

Hebrew

R-to-L typeset by XeLaTeX.
upmendex processes only indexing.

Symbol, Number

Script	charType	example	treatment by upmendex
Latin	`Lu, Ll, Lo,` … : letters	ABCabcＡ ａⓐ	directly pass to ICU collator
Greek	`Lu, Ll, Lo,` … : letters	ΑΒΓαβγ	direct
Cyrillic	`Lu, Ll, Lo,` … : letters	АБВабв	direct
Kana	`Lo` : other letter	あいうアｱ㋐㌀	direct
Hangul	`Lo` : other letter	가나다ᄁ㉡㉯㉾	direct
Hanzi	`Lo` : other letter	花鳥風月	lookup dictionary or direct
—	`Lm` : modifier letter	ー゛゜ｰ	direct
Number	`Nd` : dicimal digit number	012０ １ ２	direct
	`No` : other number	^{12}③❹⑤❻⒎⑻⒐	lookup dictionary or direct
Symbol	`Sk` : modifier symbol	¨ ¯ ´ ^ ` ゛ ゜	direct
	`Sm` : math symbol	÷▷♯	lookup dictionary or direct
	`So` : other symbol	⛄〠☎♥⚽⚾	lookup dictionary or direct
	`Sc` : currency symbol	€$＄¢£¥￥₩￦	lookup dictionary or direct
	`Po, Pd, Mn, Me,` … : other punctuation etc.	⁈⁉¡¿†#§ ¶—	direct
—	`Cc` : control character	ESC, BS, DEL	ignore
—	`Cf` : format character	BOM, RLM	dicect
others	`Lo,` etc. (unknown scripts)		lookup dic or direct (option “-f”) or ignore

Characters are classified by Unicode *General Category Values* or “charTypes”

Ref. `https://unicode.org/reports/tr44/#General_Category_Values`

Multilingual Environment with upLaTeX/pxbabel

Block Setting for Scripts in Style File *.ist

```
script_preamble   cyrillic "\n\\fontencoding{T2A}\\selectfont"
script_postamble  cyrillic "\n\\fontencoding{T1}\\selectfont"

script_preamble   hangul   "\n\\begin{otherlanguage}{korean}"
script_postamble  hangul   "\n\\end{otherlanguage}"

script_preamble   hanzi    "\n\\begin{otherlanguage}{tchinese}"
script_postamble  hanzi    "\n\\end{otherlanguage}"
```

upmendex Output *.ind

```
\centerline{\bfseries --- C ---}\par\nobreak
  \item София\leaders\hbox{~}\hfill 1
...
\fontencoding{T1}\selectfont

  \indexspace

\centerline{--- サ ---}\par\nobreak
  \item さいたま\leaders\hbox{~}\hfill {1}
  \item 札幌\leaders\hbox{~}\hfill {1}
...
\begin{otherlanguage}{korean}

  \indexspace

\centerline{\bfseries --- ㅂ ---}\par\nobreak
  \item 부산(釜山)\leaders\hbox{~}\hfill 1
...
\end{otherlanguage}
```

Multilingual Environment with XeLaTeX/polyglossia

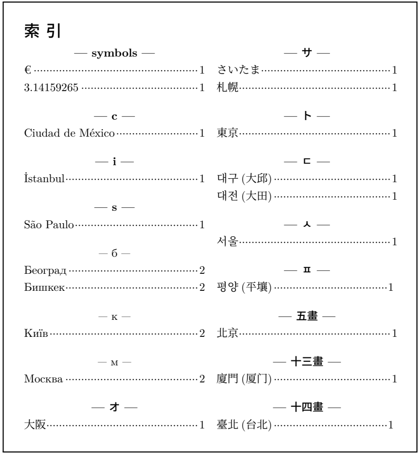
Block Setting for Scripts in Style File *.ist

```
script_preamble   cyrillic "\n\\begin{russian}"
script_postamble  cyrillic "\n\\end{russian}"

script_preamble   kana     "\n\\begin{japanese}"
script_postamble  kana     "\n\\end{japanese}"

script_preamble   hangul   "\n\n\\begin{korean}"
script_postamble  hangul   "\n\\end{korean}"

script_preamble   hebrew   "\n\\begin{hebrew}"
script_postamble  hebrew   "\n\\end{hebrew}"
```

upmendex Output *.ind

```
\centerline{--- さ ---}\par\nobreak
  \item さいたま\leaders\hbox{~}\hfill {1}
...
\end{japanese}

\begin{korean}

  \indexspace

\centerline{--- ㄷ ---}\par\nobreak
  \item 대구(大邱)\leaders\hbox{~}\hfill {1}
...
\end{korean}

\begin{hebrew}

  \indexspace

\centerline{--- א ---}\par\nobreak
  \item אשדוד\leaders\hbox{~}\hfill {2}
...
\end{hebrew}
```

Output of Multilingual Index



索 引

— symbols —
€ 1
3.14159265 1

— c —
Ciudad de México 1

— i —
İstanbul 1

— s —
São Paulo 1

— б —
Београд 2
Бишкек 2

— к —
Київ 2

— м —
Москва 2

— オ —
大阪 1

— サ —
さいたま 1
札幌 1

— ト —
東京 1

— ㄷ —
대구 (大邱) 1
대전 (大田) 1

— ㅅ —
서울 1

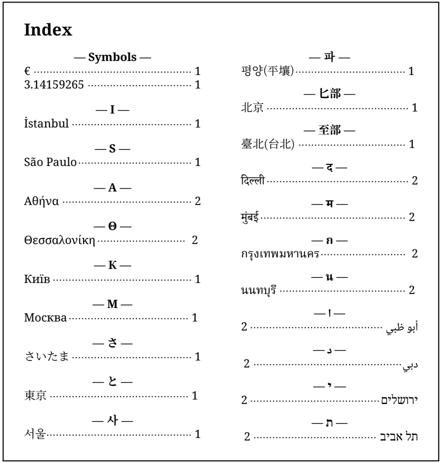
— ㅍ —
평양 (平壤) 1

— 五畫 —
北京 1

— 十三畫 —
廈門 (厦门) 1

— 十四畫 —
臺北 (台北) 1

with upLaTeX & pxbabel



Index

— Symbols —
€ 1
3.14159265 1

— I —
İstanbul 1

— S —
São Paulo 1

— A —
Αθήνα 2

— Θ —
Θεσσαλονίκη 2

— К —
Київ 1

— М —
Москва 1

— さ —
さいたま 1

— と —
東京 1

— 사 —
서울 1

— 파 —
평양(平壤) 1

— 匕部 —
北京 1

— 至部 —
臺北(台北) 1

— द —
दिल्ली 2

— म —
मुंबई 2

— ก —
กรุงเทพมหานคร 2

— น —
นนทบุรี 2

— ا —
أبو ظبي 2

— د —
دبي 2

— י —
ירושלים 2

— ת —
תל אביב 2

with XeLaTeX & polyglossia

Benchmark

	makeindex	mendex	upmendex	xindy
internal encoding	8bit 1byte	EUC-JP	UTF-16	Unicode
Collator	locale	ASCII, Kana	ICU collator	
Latin	✓	✓ ASCII	Lang:37, Locale:63	Lang:33
Greek			Lang:1, Locale:1	Lang:1
Cyrillic			Lang:9, Locale:9	Lang:6
Chinese			Lang:1, Locale:4	
Japanese		✓ (Yomi, Dict)	✓ (Yomi, Dict) Lang:1, Locale:2	
Korean			Lang:1, Locale:3	
South Asian			Script:10, Lang:13, Locale:16	
Thai / Lao			Script:2, Lang:2, Locale:2	
Arabic			Lang:7, Locale:8	
Hebrew			Lang:2, Locale:2	Lang:1
Other				Lang:4
Total		Lang:2	Script:22, Lang:72, Locale:110	Lang:44

Languages by Number of Native Speakers

	Language	Script	speakers	ICU	polyglossia	upmendex	xindy
1	Chinese	Hanzi	1,370,000,000	✓	✓	✓	
2	English	Latin	530,000,000	✓	✓	✓	✓
3	Hindi	Devanagari	490,000,000	✓	✓	✓	
4	Spanish	Latin	420,000,000	✓	✓	✓	✓
5	Arabic	Arabic	230,000,000	✓	✓	✓	
6	Bengali	Bengali	220,000,000	✓	✓	✓ v1.20	
7	Portuguese	Latin	215,000,000	✓	✓	✓	✓
8	Russian	Cyrillic	180,000,000	✓	✓	✓	✓
9	Japanese	Kana & Hanzi	134,000,000	✓	✓	✓	
10	German	Latin	130,000,000	✓	✓	✓	✓
11	French	Latin	123,000,000	✓	✓	✓	✓
12	Punjabi	Gurmukhi	90,000,000	✓	✓	✓ v1.20	
13	Javanese	Latin	75,000,000	✓	✓	✓	
14	Korean	Hangul	75,000,000	✓	✓	✓	
15	Vietnamese	Latin	70,000,000	✓	✓	✓	✓
16	Telugu	Telugu	70,000,000	✓	✓	✓ v1.20	
17	Marathi	Devanagari	68,000,000	✓	✓	✓	
18	Tamil	Tamil	74,000,000	✓	✓	✓ v1.20	
19	Persian	Arabic	46,000,000	✓	✓	✓	
20	Urdu	Arabic	61,000,000	✓	✓	✓	

Ref. `https://ja.wikipedia.org/wiki/ネイティブスピーカーの数が多い言語の一覧`

Languages used on the Internet

	Language	share	Script	ICU	pg	upm	xnd
1	English	63.4 %	Latin	root	✓	✓	✓
2	Russian	7.1 %	Cyrillic	ru	✓	✓	✓
3	Spanish	3.9 %	Latin	es	✓	✓	✓
4	German	3.7 %	Latin	de	✓	✓	✓
5	Turkish	3.5 %	Latin	tr	✓	✓	✓
6	Persian	2.5 %	Arabic	fa	✓	✓	
7	French	2.0 %	Latin	root	✓	✓	✓
8	Japanese	1.9 %	Kana	ja	✓	✓	
9	Portuguese	1.8 %	Latin	pt	✓	✓	✓
10	Chinese	1.3 %	Hanzi	zh	✓	✓	
11	Vietnamese	1.3 %	Latin	vi	✓	✓	✓
12	Italian	1.0 %	Latin	root	✓	✓	✓
13	Arabic	0.9 %	Arabic	ar	✓	✓	
14	Polish	0.9 %	Latin	pl	✓	✓	✓
15	Greek	0.7 %	Greek	el	✓	✓	✓
16	Dutch	0.7 %	Latin	nl	✓	✓	✓
17	Indonesian	0.7 %	Latin	root	✓	✓	
18	Korean	0.6 %	Hangul	ko	✓	✓	
19	Czech	0.4 %	Latin	cs	✓	✓	✓
20	Thai	0.4 %	Thai	th	✓	✓	

Ref. `https://ja.wikipedia.org/wiki/インターネットにおける言語の使用`

	Language	share	Script	ICU	pg	upm	xnd
21	Ukrainian	0.3 %	Cyrillic	uk	✓	✓	✓
22	Hebrew	0.3 %	Hebrew	he	✓	✓	✓
23	Swedish	0.3 %	Latin	sv	✓	✓	✓
24	Romanian	0.3 %	Latin	ro	✓	✓	✓
25	Hungarian	0.3 %	Latin	hu	✓	✓	✓
26	Danish	0.2 %	Latin	da	✓	✓	✓
27	Slovak	0.2 %	Latin	sk	✓	✓	✓
28	Serbian	0.2 %	Latn, Cyrl	sr	✓	✓	✓
29	Bulgarian	0.1 %	Cyrillic	bg	✓	✓	✓
30	Finnish	0.1 %	Latin	fi	✓	✓	✓
31	Croatian	0.1 %	Latin	hr	✓	✓	✓
32	Lithuanian	0.1 %	Latin	lt	✓	✓	✓
33	Norwegian (Bokmål)	0.1 %	Latin	nb	✓	✓	✓
34	Hindi	0.1 %	Devanagari	hi	✓	✓	
35	Norwegian (nynorsk)	0.1 %	Latin	nn	✓	✓	✓
36	Slovenian	0.1 %	Latin	sl	✓	✓	✓
37	Latvian	0.1 %	Latin	lv	✓	✓	✓
38	Estonian	0.1 %	Latin	et	✓	✓	✓
39	Azerbaijani	< 0.1 %	Latin	az		✓	
40	Catalan	< 0.1 %	Latin	root	✓	✓	

To Do

- Support more scripts
  - Khmer, Myanmar (Burmese)
  - Tibetan, Mongolian
  - Armenian, Georgian
  - Ethiopic (Amharic)
  - etc.
- Support more locales
  - Latin Script: Sorbian, Hausa, Igbo, Yoruba, Kalaallisut, Breton, Uzbek
  - etc.

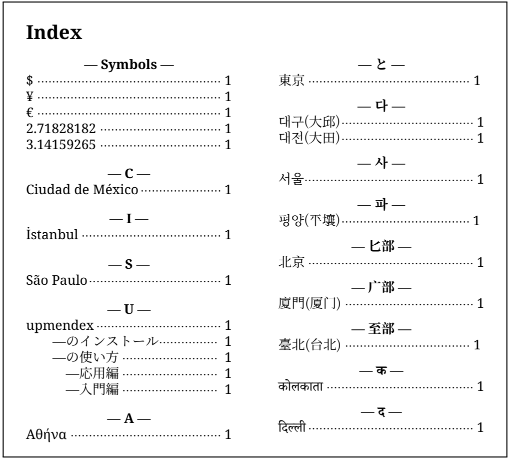
Feedback is welcome

`https://github.com/t-tk/upmendex-package/issues`

Summary

I introduced multilingual index processor **upmendex**.

- Feature
- Localization: 72 Languages, 22 Scripts
  - Latin, Cyrillic, Greek
  - CJK (Chinese, Japanese, Korean)
  - Devanagari, Bengali, Thai, ···
  - Arabic, Hebrew
  - Symbol, Number
- Multilingualization
  - Environment for upLaTeX/babel & XeLaTeX/polyglossia



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