Greek Language Support for XƎLᴬTEX and LuaLᴬTEX

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Abstract

The xgreek package provides rudimentary support for Greek language typesetting with XƎLATEXand LuaLATEX. In particular, it provides support for modern Greek (either monotonic or polytonic) and ancient Greek.

1 Introduction

The xgreek package provides rudimentary support for Greek language typesetting with XƎLATEXand LuaLATEX. Users will be able to typeset documents in either modern Greek (monotonic or polytonic) or ancient Greek by selecting the appropriate package option. The default "language" is monotonic Greek.

Support for LuaLATEX was provided by Javier Bezos.

2 The Source Code of xgreek

According to the Unicode standard

```
http://www.unicode.org/Public/UNIDATA/UnicodeData.txt
```

the uppercase form of GREEK SMALL LETTER EPSILON WITH TONOS is GREEK CAPITAL LETTER ETA WITH TONOS. This is certainly wrong. The main reason is that accents are not part of the letter as for example is the case with LATIN SMALL LETTER K WITH CARON. Since, XƎLATEX blindly follows the Unicode standard, commands like `\MakeUppercase` produce wrong output. For this reason I first need to set up the correct `\uccodes` and `\lccodes`.

```
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6 \global\lccode"0373="0373 \global\uccode"0373="0372
7 \global\lccode"0376="0377 \global\uccode"0376="0376
8 \global\lccode"0377="0377 \global\uccode"0377="0376
9 \global\lccode"03FD="037B \global\uccode"03FD="03FD
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5

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266 \global\lccode"1FB1="1FB1 \global\uccode"1FB1="1FB9
267 \global\lccode"1FB2="1FB2 \global\uccode"1FB2="1FBC
268 \global\lccode"1FB3="1FB3 \global\uccode"1FB3="1FBC
269 \global\lccode"1FB4="1FB4 \global\uccode"1FB4="1FBC
270 \global\lccode"1FB6="1FB6 \global\uccode"1FB6="0391
271 \global\lccode"1FB7="1FB7 \global\uccode"1FB7="1FBC
272 \global\lccode"1FB8="1FB0 \global\uccode"1FB8="1FB8
273 \global\lccode"1FB9="1FB1 \global\uccode"1FB9="1FB9
274 \global\lccode"1FBA="1F70 \global\uccode"1FBA="0391
275 \global\lccode"1FBB="1F71 \global\uccode"1FBB="0391
276 \global\lccode"1FBC="1FB3 \global\uccode"1FBC="1FBC
277 \global\lccode"1FBD="1FBD \global\uccode"1FBD="1FBD
278 \global\lccode"1FC2="1FC2 \global\uccode"1FC2="1FCC
279 \global\lccode"1FC3="1FC3 \global\uccode"1FC3="1FCC
```

6

```
280 \global\lccode"1FC4="1FC4 \global\uccode"1FC4="1FCC
281 \global\lccode"1FC6="1FC6 \global\uccode"1FC6="0397
282 \global\lccode"1FC7="1FC7 \global\uccode"1FC7="1FCC
283 \global\lccode"1FC8="1F72 \global\uccode"1FC8="0395
284 \global\lccode"1FC9="1F73 \global\uccode"1FC9="0395
285 \global\lccode"1FCA="1F74 \global\uccode"1FCA="0397
286 \global\lccode"1FCB="1F75 \global\uccode"1FCB="0397
287 \global\lccode"1FCC="1FC3 \global\uccode"1FCC="1FCC
288 \global\lccode"1FD0="1FD0 \global\uccode"1FD0="1FD8
289 \global\lccode"1FD1="1FD1 \global\uccode"1FD1="1FD9
290 \global\lccode"1FD2="1FD2 \global\uccode"1FD2="03AA
291 \global\lccode"1FD3="1FD3 \global\uccode"1FD3="03AA
292 \global\lccode"1FD6="1FD6 \global\uccode"1FD6="0399
293 \global\lccode"1FD7="1FD7 \global\uccode"1FD7="03AA
294 \global\lccode"1FD8="1FD0 \global\uccode"1FD8="1FD8
295 \global\lccode"1FD9="1FD1 \global\uccode"1FD9="1FD9
296 \global\lccode"1FDA="1F76 \global\uccode"1FDA="0399
297 \global\lccode"1FDB="1F77 \global\uccode"1FDB="0399
298 \global\lccode"1FE0="1FE0 \global\uccode"1FE0="1FE8
299 \global\lccode"1FE1="1FE1 \global\uccode"1FE1="1FE9
300 \global\lccode"1FE2="1FE2 \global\uccode"1FE2="03AB
301 \global\lccode"1FE3="1FE3 \global\uccode"1FE3="03AB
302 \global\lccode"1FE4="1FE4 \global\uccode"1FE4="03A1
303 \global\lccode"1FE5="1FE5 \global\uccode"1FE5="03A1
304 \global\lccode"1FE6="1FE6 \global\uccode"1FE6="03A5
305 \global\lccode"1FE7="1FE7 \global\uccode"1FE7="03AB
306 \global\lccode"1FE8="1FE0 \global\uccode"1FE8="1FE8
307 \global\lccode"1FE9="1FE1 \global\uccode"1FE9="1FE9
308 \global\lccode"1FEA="1F7A \global\uccode"1FEA="03A5
309 \global\lccode"1FEB="1F7B \global\uccode"1FEB="03A5
310 \global\lccode"1FEC="1FE5 \global\uccode"1FEC="1FEC
311 \global\lccode"1FF2="1FF2 \global\uccode"1FF2="1FFC
312 \global\lccode"1FF3="1FF3 \global\uccode"1FF3="1FFC
313 \global\lccode"1FF4="1FF4 \global\uccode"1FF4="1FFC
314 \global\lccode"1FF6="1FF6 \global\uccode"1FF6="03A9
315 \global\lccode"1FF7="1FF7 \global\uccode"1FF7="1FFC
316 \global\lccode"1FF8="1F78 \global\uccode"1FF8="039F
317 \global\lccode"1FF9="1F79 \global\uccode"1FF9="039F
318 \global\lccode"1FFA="1F7C \global\uccode"1FFA="03A9
319 \global\lccode"1FFB="1F7D \global\uccode"1FFB="03A9
320 \global\lccode"1FFC="1FF3 \global\uccode"1FFC="1FFC
```

Next I define the various strings that correspond to the standard LaTeX captions.
I first define the strings for monotonic Greek.

```
321 \def\prefacename{Πρόλογος}%
322 \def\refname{Αναφορές}%
323 \def\abstractname{Περίληψη}%
324 \def\bibname{Βιβλιογραφία}%
325 \def\chaptername{Κεφάλαιο}%
326 \def\appendixname{Παράρτημα}%
327 \def\contentsname{Περιεχόμενα}%
328 \def\listfigurename{Κατάλογος σχημάτων}%
329 \def\listtablename{Κατάλογος πινάκων}%
330 \def\indexname{Ευρετήριο}%
```

```
331 \def\figurename{Σχήμα}%
332 \def\tablename{Πίνακας}%
333 \def\partname{Μέρος}%
334 \def\enclname{Συνημμένα}%
335 \def\ccname{Κοινοποίηση}%
336 \def\headtoname{Προς}%
337 \def\pagename{Σελίδα}%
338 \def\seename{βλέπε}%
339 \def\alsoname{βλέπε επίσης}%
340 \def\proofname{Απόδειξη}%
341 \def\glossaryname{Γλωσσάρι}%
```

Macro `\polytonicn@mes` is invoked when polytonic Greek is the main language of the document.

```
342 \def\polytonicn@mes{%
343    \def\refname{Ἀναφορὲς}%
344    \def\indexname{Εὑρετήριο}%
345    \def\figurename{Σχῆμα}%
346    \def\headtoname{Πρὸς}%
347    \def\alsoname{βλέπε ἐπίσης}%
348    \def\proofname{Ἀπόδειξη}%
349 }
```

Macro `\@ncientn@mes` is invoked when ancient Greek is the main language of the document.

```
350 \def\@ncientn@mes{%
351    \def\prefacename{Προοίμιον}%
352    \def\abstractname{Περίληψις}%
353    \def\bibname{Βιβλιογραφία}%
354    \def\chaptername{Κεφάλαιον}%
355    \def\appendixname{Παράρτημα}%
356    \def\contentsname{Περιεχόμενα}%
357    \def\listfigurename{Κατάλογος σχημάτων}%
358    \def\listtablename{Κατάλογος πινάκων}%
359    \def\indexname{Εὑρετήριον}%
360    \def\tablename{Πίναξ}%
361    \def\partname{Μέρος}%
362    \def\enclname{Συνημμένως}%
363    \def\ccname{Κοινοποίησις}%
364    \def\headtoname{Πρὸς}%
365    \def\pagename{Σελὶς}%
366    \def\seename{ὅρα}%
367    \def\alsoname{ὅρα ὡσαύτως}%
368    \def\proofname{Ἀπόδειξις}%
369    \def\glossaryname{Γλωσσάριον}%
370    \def\refname{Ἀναφοραὶ}%
371    \def\figurename{Σχῆμα}%
372    \def\headtoname{Πρὸς}%
373 }
```

I redefine `\today` so as to produce dates in Greek. The names of months are defined by the macro `\gr@month`.

```
374 \def\gr@month{%
375    \ifcase\month\or Ιανουαρίου\or Φεβρουαρίου\or Μαρτίου\or Απριλίου\or
376       Μαΐου\or Ιουνίου\or Ιουλίου\or Αυγούστου\or
```

```
377    Σεπτεμβρίου\or Οκτωβρίου\or Νοεμβρίου\or Δεκεμβρίου\fi}
378 \def\today{\number\day \space \gr@month\space \number\year}
```

When either polytonic Greek or ancient Greek is the main language of the document, then the macro `\gr@c@month` becomes active.

```
379 \def\gr@c@month{%
380   \ifcase\month\or Ἰανουαρίου\or Φεβρουαρίου\or Μαρτίου\or Ἀπριλίου\or
381   Μαΐου\or Ἰουνίου\or Ἰουλίου\or Αὐγούστου\or Σεπτεμβρίου\or
382   Ὀκτωβρίου\or Νοεμβρίου\or Δεκεμβρίου\fi}
```

Next, I define a few macros that allow one to access characters that are not usually easily accessible from the keyboard (e.g., the sampi or the koppa symbol). The list includes a command for the unicode symbol GREEK ANO TELEIA, which, in some systems, is confused with MIDDLE DOT. The use of command `\numer@lsign` will be explained later.

```
383 \def\anwtonos{´} %GREEK NUMERAl SIGN
384 \let\numer@lsign\anwtonos
385 \def\katwtonos{͵} %GREEK LOWER NUMERAL SIGN
386 \def\koppa{\char"03DF\relax}
387 \def\sampi{\char"03E1\relax}
388 \def\Digamma{\char"03DC\relax}
389 \def\ddigamma{\char"03DD\relax}
390 \def\anoteleia{\char"0387\relax}
391 \def\euro{\char"20AC\relax}
392 \def\permill{\char"2030\relax}
```

Many users prefer the use of the letters sigma and tau instead of the stigma symbol in Greek numerals, therefore, by default the `\stigma` command expands to "στ".

```
393 \def\stigma{στ\relax}
```

The following commands take care of the basic rules of typography. Note that the first command changes the way space is added after punctuation symbols and the last two commands force LaTeX to add indentation space to the first paragraph after a header. Since a number of users need, for their own reasons, to be able to disable this particular feature I have introduced a new package option, namely `noindentfirst`, which restores the default behavior. In order to be able to do this I need the original value of the boolean variable `\@afterindentfalse`.

```
394 \frenchspacing
395 \let\@saveafterindentfalse\@afterindentfalse
396 \let\@afterindentfalse\@afterindenttrue
397 \@afterindenttrue
```

LuaLaTeX and XꟸLaTeX have different ways to load hyphenation patterns. Package luahyphenrules by Javier Bezos facilitates this process for people who want to use LuaLaTeX and the "traditional" way to load hyphenation patterns. To ensure proper inclusion of LuaTeX staff, I use the following "idiom":

> `\ifx\directlua\undefined` *non LuaLaTeX code*`\else` *LuaLaTeX code*`\fi`

```
398 \ifx\directlua\undefined\else\RequirePackage{luahyphenrules}\fi
```

The code that follows specifies which hyphenation patterns will be active. The XꟸLaTeX code is quite standard and depends on the babel pattern loading mechanism, while the LuaLaTeX code uses the `\HyphenRules` macro, which has essentially the functionality of the `\selectlanguage` macro.

9

```
399 \DeclareOption{monogreek}{%
400     \ifx\directlua\undefined%
401     \language\l@monogreek\else\HyphenRules{monogreek}\fi%
402 }
403 \DeclareOption{polygreek}{%
404     \ifx\directlua\undefined%
405     \language\l@polygreek\else\HyphenRules{polygreek}\fi%
406     \polytonicn@mes%
407     \let\gr@month\gr@c@month%
408 }
409 \DeclareOption{ancientgreek}{%
410     \ifx\directlua\undefined%
411     \language\l@ancientgreek\else\HyphenRules{ancientgreek}\fi%
412     \@ncientn@mes%
413     \let\gr@month\gr@c@month%
414 }
```

If a user wants to use the stigma symbol in Greek numerals, she should use the `stigma` option.

```
415 \DeclareOption{stigma}{%
416     \def\stigma{\char"03DB\relax}
417 }
```

As noted above, the new option `noindentfirst` restores the default LaTeX behavior of adding no indentation to the first paragraph after any header.

```
418 \DeclareOption{noindentfirst}{%
419     \let\@afterindentfalse\@saveafterindentfalse
420 }
```

Nowadays it is customary in Greece to use Greek numerals without the GREEK NUMERAL SIGN at the end of numeral. Thus, the `nonumeralsign` option disables the typesetting of the GREEK NUMERAL SIGN at the end of Greek numerals.

```
421 \DeclareOption{nonumeralsign}{%
422     \let\numer@lsign\relax
423 }
```

Package listings does not work properly with UTF-8 encoded files. So this option should be used whenever one wants to use this package and see Greek text come out correctly. In versaion 3.1.0 of this package, I had included the code that modifies package listings in the source code of this package. However, this decision was wrong since when one does not use the `listings` option, processing of the input file stops with an error message about a text line that contains an invalid character. So the best way to solve this problem is to move the code in a different file and load it when the user has specified `listings` option. To enable this option, I use a boolean variable.

```
424 \newif\if@mylistings
425 \@mylistingsfalse
426 \DeclareOption{listings}{\@mylistingstrue}
```

By default the `monogreek` option is activated.

```
427 \ExecuteOptions{monogreek}
428 \ProcessOptions
```

If the user has enabled the `listings` option, then it loads the package xelistings

```
429 \if@mylistings
430 \RequirePackage{xelistings}
431 \fi
```

Now I am going to define the macros that typeset alphabetic Greek numerals. The code is borrowed from the greek option for the babel package.

\gr@ill@value　When the argument of \greeknumeral has a value outside of the acceptable bounds ($0 < x < 999999$) a warning will be issued (and nothing will be printed).

```
432 \def\gr@ill@value#1{%
433   \PackageWarning{xgreek}{Illegal value (#1) for greeknumeral}}
```

\anw@true　When a large number with three *trailing* zeros is to be printed those zeros *and*
\anw@false　the numeric mark need to be discarded. As each 'digit' is processed by a separate
\anw@print　macro *and* because the processing needs to be expandable we need some helper macros that help remember to *not* print the numeric mark (\numer@lsign).

　　The command \anw@false switches the printing of the numeric mark off by making \anw@print expand to nothing. The command \anw@true (re)enables the printing of the numeric marc. These macro's need to be robust in order to prevent improper expansion during writing to files or during \uppercase.

```
434 \DeclareRobustCommand\anw@false{%
435   \DeclareRobustCommand\anw@print{}}
436 \DeclareRobustCommand\anw@true{%
437   \DeclareRobustCommand\anw@print{\numer@lsign}}
438 \anw@true
```

\@greeknumeral　This command is used to get Greek numerals. The command uses \numer@lsign to get the NUMERAL SIGN. Obviously, when the user has specified the no-numeralsign option, then numeral comes out without the trailing NUMERAL SIGN. However, when a user wants to typeset a Greek numeral, the numeral must come out correctly, regardless of what appears in headers, etc. And that is exactly the reason why this command is inaccessible to users. The command \@greeknumeral needs to be *fully* expandable in order to get the right information in auxiliary files. Therefore we use a big \if-construction to check the value of the argument and start the parsing at the right level.

```
439 \def\@greeknumeral#1{%
```

If the value is negative or zero nothing is printed and a warning is issued.

```
440   \ifnum#1<\@ne\space\gr@ill@value{#1}%
441   \else
442     \ifnum#1<10\expandafter\gr@num@i\number#1%
443     \else
444       \ifnum#1<100\expandafter\gr@num@ii\number#1%
445       \else
```

The available shorthands for 1.000 (\@m) and 10.000 (\@M) are used to save a few tokens.

```
446         \ifnum#1<\@m\expandafter\gr@num@iii\number#1%
447         \else
448           \ifnum#1<\@M\expandafter\gr@num@iv\number#1%
449           \else
450             \ifnum#1<100000\expandafter\gr@num@v\number#1%
451             \else
452               \ifnum#1<1000000\expandafter\gr@num@vi\number#1%
```

```
453              \else
```

If the value is too large, nothing is printed and a warning is issued.

```
454                  \space\gr@ill@value{#1}%
455                \fi
456              \fi
457            \fi
458          \fi
459        \fi
460      \fi
461    \fi
462 }
```

What is left to make complete the definition of command `\greeknumeral` is a set of macros to produce the various digits.

`\gr@num@i` As there is no "digit" representing 0 in this system, the zeros are simply discarded.
`\gr@num@ii` When there is a large number with three *trailing* zeros also the numeric mark is
`\gr@num@iii` discarded. Therefore these macros need to pass the information to each other about the (non-)translation of a zero.

```
463 \def\gr@num@i#1{%
464    \ifcase#1\or α\or β\or γ\or δ\or ε\or \stigma\or ζ\or η\or θ\fi
465    \ifnum#1=\z@\else\anw@true\fi\anw@print}
466 \def\gr@num@ii#1{%
467    \ifcase#1\or ι\or κ\or λ\or μ\or ν\or ξ\or o\or π\or \koppa\fi
468    \ifnum#1=\z@\else\anw@true\fi\gr@num@i}
469 \def\gr@num@iii#1{%
470    \ifcase#1\or ρ\or σ\or τ\or υ\or φ\or χ\or ψ\or ω\or \sampi\fi
471    \ifnum#1=\z@\anw@false\else\anw@true\fi\gr@num@ii}
```

`\gr@num@iv` The first three "digits" always have the numeric mark, except when one is dis-
`\gr@num@v` carded because it's value is zero.
`\gr@num@vi`
```
472 \def\gr@num@iv#1{%
473    \ifnum#1=\z@\else\katwtonos\fi
474    \ifcase#1\or α\or β\or γ\or δ\or ε\or \stigma\or ζ\or η\or θ\fi
475    \gr@num@iii}
476 \def\gr@num@v#1{%
477    \ifnum#1=\z@\else\katwtonos\fi
478    \ifcase#1\or ι\or κ\or λ\or μ\or ν\or ξ\or o\or π\or \koppa\fi
479    \gr@num@iv}
480 \def\gr@num@vi#1{%
481    \katwtonos
482    \ifcase#1\or ρ\or σ\or τ\or υ\or φ\or χ\or ψ\or ω\or \sampi\fi
483    \gr@num@v}
```

`\@Greeknumeral` The command `\@Greeknumeral` prints uppercase Greek numerals. The parsing is performed by the macro `\@greeknumeral`. The printing of the NUMERAL SIGN depends on the value of `\numer@lsign`.

```
484 \def\@Greeknumeral#1{%
485    \expandafter\MakeUppercase\expandafter{\@greeknumeral{#1}}}
```

`\greeknumeral` This command prints lowercase Greek numerals and the NUMERAL SIGN is always printed.

```
486 \def\greeknumeral#1{%
487   \let\@numer@lsign\numer@lsign%
488   \let\numer@lsign\anwtonos%
489   \@greeknumeral{#1}
490   \let\numer@lsign\@numer@lsign}
```

\Greeknumeral This command prints uppercase Greek numerals and the NUMERAL SIGN is always printed.

```
491 \def\Greeknumeral#1{%
492   \let\@numer@lsign\numer@lsign%
493   \let\numer@lsign\anwtonos%
494   \@Greeknumeral{#1}
495   \let\numer@lsign\@numer@lsign}
```

The alphabetic numbering system is not the only numbering system employed by Greeks. In fact, Greeks used various systems that are now known as *acrophonic* numbering systems. Many scholars are familiar with the acrophonic Attic numbering system and the the command \atticnum can be used to generate acrophonic Attic numerals. The acrophonic Attic numbering system, like the Roman one, employs letters to denote important numbers. Multiple occurrence of a letter denote a multiple of the "important" number, e.g., the letter I denotes 1, so III denotes 3. Here are the basic digits used in the acrophonic Attic numbering system:

- I denotes the number one (1)

- Π denotes the number five (5)

- Δ denotes the number ten (10)

- H denotes the number one hundred (100)

- X denotes the number one thousand (1000)

- M denotes the number ten thousands (10000)

Moreover, the letters Δ, H, X, and M under the letter Γ (a form of Π) denote five times their original value. In particular, the symbol ⊩, denotes the number 50, the symbol ⊩ denotes the number 500, the symbol ⊩ denotes the number 5000, and the symbol ⊩ denotes the number 50,000. It must be noted that the numbering system does not provide negative numerals or a symbol for zero.

\@@atticnum Now, let me definite the macro \@@atticnum. This macro uses one integer variable (or counter in TEX's jargon.)

```
496 \newcount\@attic@num
```

The macro \@@atticnum is also defined as a robust command.

```
497 \DeclareRobustCommand*{\@@atticnum}[1]{%
```

After assigning to variable \@attic@num the value of the macro's argument, we make sure that the argument is in the expected range, i.e., it is greater than zero, and less or equal to 249999. In case it isn't, it simply produces a \space, warns the user about it and quits. Although, the \atticnum macro is capable to produce an Athenian numeral for even greater intergers, the following argument by Claudio Beccari convised me to place this upper limit:

According to psychological perception studies (that ancient Athenians and Romans perfectly knew without needing to study Freud and Jung) living beings (which includes at least all vertebrates, not only humans) can perceive up to four randomly set objects of the same kind without the need of counting, the latter activity being a specific acquired ability of human kind; the biquinary numbering notation used by the Athenians and the Romans exploits this natural characteristic of human beings.

```
498        \@attic@num#1\relax
499        \ifnum\@attic@num<\@ne%
500          \space%
501          \PackageWarning{xgreek}{%
502          Illegal value (\the\@attic@num) for acrophonic
503          Attic numeral}%
504        \else\ifnum\@attic@num>249999%
505          \space%
506          \PackageWarning{xgreek}{%
507          Value too large (\the\@attic@num) for acrophonic
508          Attic numeral}%
509        \else
```

Having done all the necessary checks, it is possible to proceed with the actual computation. If the number is greater than 49999, then it certainly has at least one ⊓ "digit". The macro finds all such digits by continuously subtracting 50000 from `\@attic@num`, until `\@attic@num` becomes less than 50000.

```
510          \@whilenum\@attic@num>49999\do{%
511            ^^^^^^010147\advance\@attic@num-50000}%
```

Next the macro checks for tens of thousands.

```
512          \@whilenum\@attic@num>9999\do{%
513            M\advance\@attic@num-\@M}%
```

Since a number can have only one ⊓ "digit" (equivalent to 5000), it is easy to check whether is should have one and produce the corresponding numeral when it does have one.

```
514          \ifnum\@attic@num>4999%
515            ^^^^^^010146\advance\@attic@num-5000%
516          \fi\relax
```

The macro should also check for thousands, the same way it checked for tens of thousands.

```
517          \@whilenum\@attic@num>999\do{%
518            X\advance\@attic@num-\@m}%
```

Since a numeral can have at most one ⊓ "digit" (equivalent to 500), this should be handled the way the macro handled the case of the five thousands "digit".

```
519          \ifnum\@attic@num>499%
520            ^^^^^^010145\advance\@attic@num-500%
521          \fi\relax
```

It is time to check hundreds, which follow the same pattern as thousands.

```
522          \@whilenum\@attic@num>99\do{%
523            H\advance\@attic@num-100}%
```

A numeral can have only one ⊢ "digit" (equivalent to 50).

```
524              \ifnum\@attic@num>49%
525                  ^^^^^^010144\advance\@attic@num-50%
526              \fi\relax
```

The macro now checks now for tens digit.

```
527              \@whilenum\@attic@num>9\do{%
528                  Δ\advance\@attic@num by-10}%
```

Finally, it has to check for fives and the digits 1, 2, 3, and 4.

```
529              \@whilenum\@attic@num>4\do{%
530                  Π\advance\@attic@num-5}%
531              \ifcase\@attic@num\or I\or II\or III\or IIII\fi%
532      \fi\fi}
```

\@atticnum The command \@atticnum has one argument, which is a counter. It calls the command \@@atticnum to process the value of the counter.

```
533 \def\@atticnum#1{%
534      \expandafter\@@atticnum\expandafter{\the#1}}
```

\atticnum The command \atticnum is a wrapper that declares a new counter in a local scope, assigns to it the value of the argument of the command and calls the macro \@atticnum. This way the command can process correctly either a number or a counter.

```
535 \def\atticnum#1{%
536      \@attic@num#1\relax
537      \@atticnum{\@attic@num}}
```

\greek@alph Here I redefine the macros \@alph and \@Alph. First, I define some placeholders
\greek@Alph
```
538 \let\latin@alph\@alph
539 \let\latin@Alph\@Alph
```

Then I define the Greek versions; the additional \expandafters are needed in order to make sure the table of contents will be correct (e.g., when there are appendices).

```
540 \def\greek@alph#1{\expandafter\@greeknumeral\expandafter{\the#1}}
541 \def\greek@Alph#1{\expandafter\@Greeknumeral\expandafter{\the#1}}
```

By default Greek alphabetic enumerals instaed of Latin numerals are used to enumerate items in an enumeration environment.

```
542      \let\@alph\greek@alph
543      \let\@Alph\greek@Alph
```

If for some reason, one needs to have the Latin numerals back, then she has to invoke command \nogreekalph. And if she wants to switch back, then she has to use the \greekalph command:

```
544 \def\nogreekalph{%
545  \let\@alph\latin@alph
546  \let\@Alph\latin@Alph}
547 \def\greekalph{%
548  \let\@alph\greek@alph
549  \let\@Alph\greek@Alph}
```

\setlanguage We provide the \setlanguage command which activates the hypehnation patterns of some other language. It is similar to babel's \selectlanguage, but we opted to use a new name to avoid possible name conflicts. Valid arguments include monogreek, polygreek, ancientgreek, and american. As was noted previously, package luahyphenrules provides the command \HyphenRules which has exactly the same functionality as this command. So when using LuaLaTeX users will actually use the \HyphenRules command.

```
550 \ifx\directlua\undefined%
551   \def\setlanguage#1{%
552     \expandafter\ifx\csname l@#1\endcsname\relax%
553     \typeout{^^J Error: No hyphenation pattern for}%
554     \typeout{ language #1 are loaded,}%
555     \typeout{ default hyphenation patterns are used.^^J}%
556     \language=0%
557     \else\language=\csname l@#1\endcsname\fi}
558 \else
559   \let\setlanguage\HyphenRules
560 \fi
```

The macros \grtoday and \Grtoday produces the current date, only that the month and the day are shown as greek numerals instead of arabic as it is usually the case. In addition, the two commands differ in that the later produces the Greek numerals in uppercase.

```
561 \def\grtoday{%
562   \expandafter\greeknumeral\expandafter{\the\day}\space
563   \gr@c@month\space
564   \expandafter\greeknumeral\expandafter{\the\year}}
565 \def\Grtoday{%
566   \expandafter\Greeknumeral\expandafter{\the\day}\space
567   \gr@c@month\space
568   \expandafter\Greeknumeral\expandafter{\the\year}}
569 ⟨/xgreek⟩
```

3   The Source Code of xelistings

If the user has enabled the listings option, then the package loads the rudimentary package xelistings. This package loads the listings package and makes accessible to it all characters in the range 128–255 plus all Greek letters that belong to the Greek and Coptic Unicode block. This is achieved by redefining the command \lst@DefEC.

```
570 ⟨*xelistings⟩
571 \RequirePackage{listings}
572 \lstset{inputencoding=utf8}
573 \lst@InputCatcodes
574 \gdef\lst@DefEC{%
575 \lst@CCECUse \lst@ProcessLetter
576   ^^80^^81^^82^^83^^84^^85^^86^^87^^88^^89^^8a^^8b^^8c^^8d^^8e^^8f%
577   ^^90^^91^^92^^93^^94^^95^^96^^97^^98^^99^^9a^^9b^^9c^^9d^^9e^^9f%
578   ^^a0^^a1^^a2^^a3^^a4^^a5^^a6^^a7^^a8^^a9^^aa^^ab^^ac^^ad^^ae^^af%
579   ^^b0^^b1^^b2^^b3^^b4^^b5^^b6^^b7^^b8^^b9^^ba^^bb^^bc^^bd^^be^^bf%
580   ^^c0^^c1^^c2^^c3^^c4^^c5^^c6^^c7^^c8^^c9^^ca^^cb^^cc^^cd^^ce^^cf%
```

```
581    ^^d0^^d1^^d2^^d3^^d4^^d5^^d6^^d7^^d8^^d9^^da^^db^^dc^^dd^^de^^df%
582    ^^e0^^e1^^e2^^e3^^e4^^e5^^e6^^e7^^e8^^e9^^ea^^eb^^ec^^ed^^ee^^ef%
583    ^^f0^^f1^^f2^^f3^^f4^^f5^^f6^^f7^^f8^^f9^^fa^^fb^^fc^^fd^^fe^^ff%
584    ^^^^0396^^^^0388^^^^0389^^^^038a^^^^038c% <--- Begin of Greek Letters
585    ^^^^038e^^^^038f^^^^0390^^^^0391^^^^0392%
586    ^^^^0393^^^^0394^^^^0395^^^^0396^^^^0397%
587    ^^^^0398^^^^0399^^^^039a^^^^039b^^^^039c%
588    ^^^^039d^^^^039e^^^^039f^^^^03a0^^^^03a1%
589    ^^^^03a3^^^^03a4^^^^03a5^^^^03a6^^^^03a7%
590    ^^^^03a8^^^^03a9^^^^03aa^^^^03ab^^^^03ac%
591    ^^^^03ad^^^^03ae^^^^03af^^^^03b0^^^^03b1%
592    ^^^^03b2^^^^03b3^^^^03b4^^^^03b5^^^^03b6%
593    ^^^^03b7^^^^03b8^^^^03b9^^^^03ba^^^^03bb%
594    ^^^^03bc^^^^03bd^^^^03be^^^^03bf^^^^03c0%
595    ^^^^03c1^^^^03c2^^^^03c3^^^^03c4^^^^03c5%
596    ^^^^03c6^^^^03c7^^^^03c8^^^^03c9^^^^03ca%
597    ^^^^03cb^^^^03cc^^^^03cd^^^^03ce% <--- End of Greek Letters
598    ^^00}%
599 \lst@RestoreCatcodes
600 ⟨/xelistings⟩
```