

# The xgreek package

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## Abstract

The xgreek package provides rudimentary support for Greek language typesetting with X<sub>Y</sub>L<sup>A</sup>T<sub>E</sub>X. 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 X<sub>Y</sub>L<sup>A</sup>T<sub>E</sub>X. 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.

## 2 The Source Code

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, X<sub>Y</sub>L<sup>A</sup>T<sub>E</sub>X blindly follows the Unicode standard, commands like `\MakeUppercase` produce wrong output. For this reason we first need to set up the correct `\uccodes` and `\lccodes`.

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259 \global\lccode"1FAA="1FA2 \global\uccode"1FAA="1FFC  
260 \global\lccode"1FAB="1FA3 \global\uccode"1FAB="1FFC  
261 \global\lccode"1FAC="1FA4 \global\uccode"1FAC="1FFC  
262 \global\lccode"1FAD="1FA5 \global\uccode"1FAD="1FFC  
263 \global\lccode"1FAE="1FA6 \global\uccode"1FAE="1FFC  
264 \global\lccode"1FAF="1FA7 \global\uccode"1FAF="1FFC  
265 \global\lccode"1FB0="1FB0 \global\uccode"1FB0="1FB8  
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  
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="1FEC  
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 we define the various strings that correspond to the standard L<sup>A</sup>T<sub>E</sub>X captions.

We 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\seenname{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{Αναφορές}%
344   \def\indexname{Ευρετήριο}%
345   \def\figurename{Σχήμα}%
346   \def\headtoname{Πρός}%
347   \def\alsoname{βλέπε επίσης}%
348   \def\proofname{Απόδειξη}%
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\refname{Αναφοράι}%
353 \def\abstractname{Περίληψις}%
354 \def\bibName{Βιβλιογραφία}%
355 \def\chaptername{Κεφάλαιον}%
356 \def\appendixname{Παράρτημα}%
357 \def\contentsname{Περιεχόμενα}%
358 \def\listfigurename{Κατάλογος σχημάτων}%
359 \def\listtablename{Κατάλογος πινάκων}%
360 \def\indexname{Εύρετήριον}%
361 \def\figurename{Σχήμα}%
362 \def\tablename{Πίναξ}%
363 \def\partname{Μέρος}%
364 \def\enclname{Συνημμένως}%
365 \def\ccname{Κοινοποιήσις}%
366 \def\headtoname{Πρός}%
367 \def\pagename{Σελίς}%
368 \def\seename{ὄρα}%
369 \def\alsoname{ὄρα ὡσαύτως}%
370 \def\proofname{Ἀπόδειξις}%
371 \def\glossaryname{Γλωσσάριον}%
372 \def\refname{Αναφοράι}%
373 \def\indexname{Εύρετήριον}%
374 \def\figurename{Σχῆμα}%
375 \def\headtoname{Πρός}%
376 }

```

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

```

377 \def\gr@month{%
378   \ifcase\month\or Ιανουαρίου\or Φεβρουαρίου\or Μαρτίου\or Απριλίου\or
379     Μαΐου\or Ιουνίου\or Ιουλίου\or Αυγούστου\or
380     Σεπτεμβρίου\or Οκτωβρίου\or Νοεμβρίου\or Δεκεμβρίου\fi}
381 \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.

```

382 \def\gr@c@month{%
383   \ifcase\month\or Ἰανουαρίου\or Φεβρουαρίου\or Μαρτίου\or Ἀπριλίου\or
384     Μαΐου\or Ἰουνίου\or Ἰουλίου\or Αὐγούστου\or Σεπτεμβρίου\or
385     Ὀκτωβρίου\or Νοεμβρίου\or Δεκεμβρίου\fi}

```

Now that we have defined the language dependant macros, we can safely define the various supported options. Note we follow the standard mechanisms to load hyphenation patterns.

```

386 \DeclareOption{monogreek}{%
387   \language\l@monogreek%
388 }
389 \DeclareOption{polygreek}{%
390   \language\l@polygreek%
391   \polytonicn@mes%

```

```

392 \let\gr@month\gr@c@month%
393 }
394 \DeclareOption{ancientgreek}{%
395 \language\l@ancientgreek%
396 \ncientn@mes%
397 \let\gr@month\gr@c@month%
398 }
399 \ExecuteOptions{monogreek}
400 \ProcessOptions

```

The following commands take care of the basic rules of typography.

```

401 \frenchspacing
402 \let\@afterindentfalse\@afterindenttrue
403 \@afterindenttrue

```

Before we proceed let us define a few macros, which allow one to access characters that are not usually easily accessible such as the sampi or koppa symbols.

```

404 \def\anwtonos{\char"0374\relax}
405 \def\katwtonos{\char"0375\relax}
406 \def\koppa{\char"03DF\relax}
407 \def\stigma{\char"03DA\relax}
408 \def\sampi{\char"03E1\relax}
409 \def\Digamma{\char"03DC\relax}
410 \def\ddigamma{\char"03DD\relax}
411 \def\euro{\char"20AC\relax}
412 \def\permil{\char"2030\relax}

```

Now we are 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).

```

413 \def\gr@ill@value#1{%
414 \PackageWarning{xgreek}{Illegal value (#1) for greeknumeral}}

```

`\anw@true` When a large number with three *trailing* zero's 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 (`\anwtonos`).

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`.

```

415 \DeclareRobustCommand\anw@false{%
416 \DeclareRobustCommand\anw@print{}}
417 \DeclareRobustCommand\anw@true{%
418 \DeclareRobustCommand\anw@print{\anwtonos}}
419 \anw@true

```

`\greeknumeral` 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.

```
420 \def\greeknumeral#1{%
```

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

```
421 \ifnum#1<\@ne\space\gr@ill@value{#1}%
```

```
422 \else
```

```
423 \ifnum#1<10\expandafter\gr@num@i\number#1%
```

```
424 \else
```

```
425 \ifnum#1<100\expandafter\gr@num@ii\number#1%
```

```
426 \else
```

We use the available shorthands for 1.000 (`\@m`) and 10.000 (`\@M`) to save a few tokens.

```
427 \ifnum#1<\@m\expandafter\gr@num@iii\number#1%
```

```
428 \else
```

```
429 \ifnum#1<\@M\expandafter\gr@num@iv\number#1%
```

```
430 \else
```

```
431 \ifnum#1<100000\expandafter\gr@num@v\number#1%
```

```
432 \else
```

```
433 \ifnum#1<1000000\expandafter\gr@num@vi\number#1%
```

```
434 \else
```

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

```
435 \space\gr@ill@value{#1}%
```

```
436 \fi
```

```
437 \fi
```

```
438 \fi
```

```
439 \fi
```

```
440 \fi
```

```
441 \fi
```

```
442 \fi
```

```
443 }
```

`\Greeknatural` The command `\Greeknatural` prints uppercase greek numerals. The parsing is performed by the macro `\greeknumeral`.

```
444 \def\Greeknatural#1{%
```

```
445 \expandafter\MakeUppercase\expandafter{\greeknumeral{#1}}}
```

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. Most 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)
- II 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 II) denote five times their original value. In particular, the symbol  $\text{P}$ , denotes the number 50, the symbol  $\text{P}^{\text{P}}$  denotes the number 500, the symbol  $\text{P}^{\text{P}^{\text{P}}}$  denotes the number 5000, and the symbol  $\text{P}^{\text{P}^{\text{P}^{\text{P}}}}$  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, we turn our attention to the definition of the macro `\@@atticnum`. This macro uses one integer variable (or counter in  $\text{T}_{\text{E}}\text{X}$ 's jargon.)

```
446 \newcount\@attic@num
```

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

```
447 \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, we simply produce a `\space`, warn the user about it and quit. 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 above 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.

```
448     \@attic@num#1\relax
449     \ifnum\@attic@num<\@ne%
450         \space%
451         \PackageWarning{xgreek}{%
452             Illegal value (\the\@attic@num) for acrophonic Attic numeral}%
453     \else\ifnum\@attic@num>249999%
454         \space%
455         \PackageWarning{xgreek}{%
456             Value too large (\the\@attic@num) for acrophonic Attic numeral}%
457     \else
```

Having done all the necessary checks, we are now ready to do the actual computation. If the number is greater than 49999, then it certainly has at least one  $\mathbb{F}$  “digit”. We find all such digits by continuously subtracting 50000 from  $\backslash\text{@attic@num}$ , until  $\backslash\text{@attic@num}$  becomes less than 50000.

```
458      \@whilenum\@attic@num>49999\do{%
459          ~~~~~10147\advance\@attic@num-50000}%
```

We now check for tens of thousands.

```
460      \@whilenum\@attic@num>9999\do{%
461          M\advance\@attic@num-\@M}%
```

Since a number can have only one  $\mathbb{F}$  “digit” (equivalent to 5000), it is easy to check it out and produce the corresponding numeral in case it does have one.

```
462      \ifnum\@attic@num>4999%
463          ~~~~~10146\advance\@attic@num-5000%
464      \fi\relax
```

Next, we check for thousands, the same way we checked for tens of thousands.

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

Like the five thousands, a numeral can have at most one  $\mathbb{F}$  “digit” (equivalent to 500).

```
467      \ifnum\@attic@num>499%
468          ~~~~~10145\advance\@attic@num-500%
469      \fi\relax
```

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

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

A numeral can have only one  $\mathbb{F}$  “digit” (equivalent to 50).

```
472      \ifnum\@attic@num>49%
473          ~~~~~10144\advance\@attic@num-50%
474      \fi\relax
```

Let’s check now decades.

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

We check for five and, finally, for the digits 1, 2, 3, and 4.

```
477      \@whilenum\@attic@num>4\do{%
478          Π\advance\@attic@num-5}%
479      \ifcase\@attic@num\or I\or II\or III\or IIII\fi%
480      \fi\fi}
```

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

```
481 \def\@atticnum#1{%
482     \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 argument of the command and calls the macro `\@atticnum`. This way the command can process correctly either a number or a counter.

```
483 \def\atticnum#1{%
484     \@attic@num#1\relax
485     \@atticnum{\@attic@num}}
```

`\greek@alph` Here we redefine the macros `\@alph` and `\@Alph`. First we define some placeholders  
`\greek@Alph`

```
486 \let\latin@alph\@alph
487 \let\latin@Alph\@Alph
```

Then we define the Greek versions; the additional `\expandafters` are needed in order to make sure the table of contents will be correct, e.g., when we have appendixes.

```
488 \def\greek@alph#1{\expandafter\greeknumeral\expandafter{\the#1}}
489 \def\greek@Alph#1{\expandafter\Greeknatural\expandafter{\the#1}}
```

By default use Greek alphabetic numerals instead of Latin numerals to enumerate items in an enumeration environment.

```
490 \let\@alph\greek@alph
491 \let\@Alph\greek@Alph
```

If for some reason, we need to have the Latin numerals, then we just have to invoke command `\nogreekalph`. And if we want to switch back, then we have to use the `\greekalph` command:

```
492 \def\nogreekalph{%
493     \let\@alph\latin@alph
494     \let\@Alph\latin@Alph}
495 \def\greekalph{%
496     \let\@alph\greek@alph
497     \let\@Alph\greek@Alph}
```

What is left now is the definition of a set of macros to produce the various digits.

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

```
498 \def\gr@num@i#1{%
499     \ifcase#1\or \alpha\or \beta\or \gamma\or \delta\or \epsilon\or \stigma\or \zeta\or \eta\or \theta\fi
500     \ifnum#1=\z@\else\anw@true\fi\anw@print}
501 \def\gr@num@ii#1{%
502     \ifcase#1\or \iota\or \kappa\or \lambda\or \mu\or \nu\or \xi\or \omicron\or \pi\or \koppa\fi
503     \ifnum#1=\z@\else\anw@true\fi\gr@num@i}
504 \def\gr@num@iii#1{%
505     \ifcase#1\or \rho\or \sigma\or \tau\or \upsilon\or \phi\or \chi\or \psi\or \omega\or \sampi\fi
506     \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 discarded  
`\gr@num@v` because it’s value is zero.

```

\gr@num@vi 507 \def\gr@num@iv#1{%
508   \ifnum#1=\z@\else\katwtonos\fi
509   \ifcase#1\or \alpha\or \beta\or \gamma\or \delta\or \epsilon\or \stigma\or \zeta\or \eta\or \theta\fi
510   \gr@num@iii}
511 \def\gr@num@v#1{%
512   \ifnum#1=\z@\else\katwtonos\fi
513   \ifcase#1\or \iota\or \kappa\or \lambda\or \mu\or \nu\or \xi\or \omicron\or \pi\or \koppa\fi
514   \gr@num@iv}
515 \def\gr@num@vi#1{%
516   \katwtonos
517   \ifcase#1\or \rho\or \sigma\or \tau\or \upsilon\or \phi\or \chi\or \psi\or \omega\or \sampi\fi
518   \gr@num@v}

```

`\setlanguage` We provide the `\setlanguage` command which activates the hyphenation patterns of some other language. It is similar to babel’s `\selectlanguage`, but we opted to use a new name to avoid any name conflicts. Valid arguments include `monogreek`, `polygreek`, and `ancientgreek`.

```

519 \def\setlanguage#1{%
520   \expandafter\ifx\csname l@#1\endcsname\relax%
521   \typeout{^^J Error: No hyphenation pattern for language #1 loaded,}%
522   \typeout{ default hyphenation patterns are used.^^J}%
523   \language=0%
524   \else\language=\csname l@#1\endcsname\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.

```

525 \def\grtoday{%
526   \expandafter\greeknumeral\expandafter{\the\day}\space
527   \gr@c@month \space
528   \expandafter\greeknumeral\expandafter{\the\year}}
529 \def\Grtoday{%
530   \expandafter\Greeknumeral\expandafter{\the\day}\space
531   \gr@c@month \space
532   \expandafter\Greeknumeral\expandafter{\the\year}}
533 \</xgreek>

```