Package canoniclayout

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Abstract

This package may be used as an extension to the memoir or as a standalone package that might work with any standard class. It tests if memoir was loaded within the preamble, otherwise it does all the necessary calculations with the usual facilities of a recent LaTeX based engine.

This package computes the page parameters for a canonical layout where the text block is placed onto the page in such a way that: (a) its, diagonal coincides with the page relevant diagonal, and (b) the circle, vertically inscribed within the text block, is also tangent to the page sides. The text block width to height ratio is kept equal to the page ratio, as well as the inner to outer and the top to bottom margin ratios. See figure 1

Contents

1 Introduction

As any user of the memoir class knows well, this class allows to customise the page layout virtually without any limitation; such limitations are connected mainly with the user inconsistent data that miss to specify necessary information or give unnecessary and conflicting information. The same happens when memoir is not being used. In facts, if memoir is not used, the package computes the necessary data that turn out to be correct with the standard document classes; they might be correct also with other classes, and users can check the correctness by using some commands that are described below, within the code documented section.

Many packages exist in order to specify a specific layout; this package canoniclayout is another one that computes the page parameters to determine the horizontal and vertical dimensions of the margins and the text block. All other details

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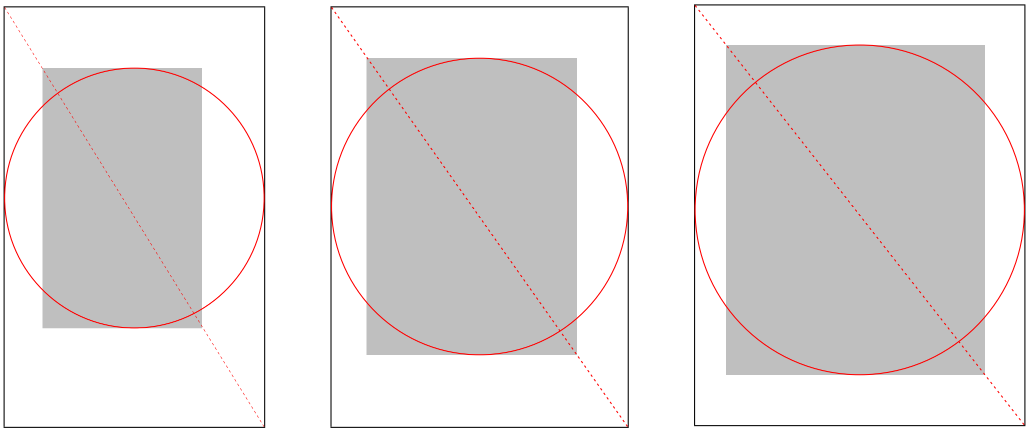

Golden number canonical layout ISO canonical layout Letter paper canonical layout

Figure 1: A right page with the relevant diagonal, the text block and the canonical circle. In this figure the important pieces of information are the page proportions, not the drawing scale; matter of fact the letter paper is 17.6 mm shorter than the A4 paper, but the drawings to the same height emphasises the relative proportions of the various page parts.

shall be specified by the user, for example the dimensions of the stock paper, the trimming widths, and therefore the position of the page onto the stock paper, and so on. This package deals only with the trimmed page, not with the page and stock paper relationship. See the documentation of class memoir in order to deal with stock paper and the details for configuring the position of the page to be trimmed on the stock paper. With the standard document classes this package works with the standard paper sizes that LaTeX can handle. An attempt to use package geometry was made, but it was abandoned, because this package has limitations due to the two digit integer values of element ratios; may be in the future it might be resumed.

Figure 1 depicts the situation described above; the grey rectangle represents the type block; the dotted page diagonal, as it can be seen, passes through the diagonal vertices of the type block; at the same time the circle is tangent to both the type block and the page contour[1]. . It must also be noticed, in the sketch on the left, that the page rectangle is a golden one; therefore also the type block is a golden rectangle; the inner to the outer margin ratio is the golden section value so as this same ratio exists between the top and the bottom margin.

This canonical layout implies that the type block height is equal to the page width. Therefore this canonical layout is not suited when the page width is small compared to the page height: with the golden section[2] this ratio is 0.618.

With the ISO paper shape, in the sketch on the center, this ratio is 0.707, and so on.

But it is also evident that this layout is unsuitable with squarish pages, such

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[1] Geometrically speaking this sentence is meaningless, but the drawings in the picture show what we mean.

[2] Here we denote $\phi = 1,618\dots$ with the name of *golden number*, and its reciprocal $\varphi = 0.618\dots$ with the name of *golden section*.

as the sketch on the right where the page proportions are those of the USA letter paper size: the type block leaves little space for the margins, as it is evident from the properties of the canonical circle, which is tangent to the page lateral sides and to the type block horizontal sides; to the limit in a square trimmed page the type block fills he whole page so that the margins vanish.

2 The mathematics of the canonical layout

With reference to the drawing on figure 1 and what has been described in the Introduction, the following formulas may be easily derived:

Page shape ratio: $x = b/h$ (1)
Inner margin: $I = bx(1-x)/(1+x)$ (2)
External margin: $E = b(1-x)/(1+x)$ (3)
Top margin: $T = hx(1-x)/(1+x)$ (4)
Bottom margin: $B = h(1-x)/(1+x)$ (5)
Text width: $W = xb$ (6)
Text height: $H = b$ (7)
Circle center abscissa: $C_x = b/2$ (8)
Circle center ordinate: $C_y = h(1-x)/(1+x) + b/2$ (9)
Circle radius: $R = b/2$ (10)

Notice that the circle center coordinates are referred to the lower left corner of the trimmed page.

The results of the above formulas are summarised in table 1 for four values of the shape factor including the USA letter paper, that is 8.5 inches wide and 11 inches high.

Table 1: Canonical layout ratios referred to the the base (or width, b) of the trimmed page and its height (h). The circle coordinates are referred to the lower left corner of the trimmed page.

	Page ratio h/b			
Quantity	$\phi : 1$	$3 : 2$	$\sqrt{2} : 1$	$11 : 8.5$
Base to height ratio	0.6180	0.6666	0.7071	0.7727
Inner margin	$0.146b$	$0.133b$	$0.121b$	$0.099b$
External margin	$0.236b$	$0.200b$	$0.172b$	$0.128b$
Top margin	$0.146h$	$0.133h$	$0.121h$	$0.099h$
Bottom margin	$0.236h$	$0.200h$	$0.172h$	$0.128h$
Text width	$0.618b$	$0.666b$	$0.707b$	$0.773b$
Text height	b	b	b	b
Circle center abscissa	$b/2$	$b/2$	$b/2$	$b/2$
Circle center ordinate	$0.545h$	$0.533h$	$0.526h$	$0.515h$
Circle diameter	b	b	b	b

Actually the formulas 1–10, and their numerical values reported in table 1, are just for general information. The actual computations are performed by this package, by means of the package built-in facilities. But it can be easily seen that as the trimmed page becomes more squarish, the page size ratio tends to one, and the margins become smaller and tend to vanish. Therefore it seems that this layout is most suited for intermediate page ratios, such as the ISO one or the common European book page size of 170 mm by 240 mm with a ratio $b/h = 0.708$.

3 Usage

This package is invoked as usual with:

```
\usepackahe{canoniclayout}
```

No options are required; but it is necessary to invoke the package only after the page dimensions are known, be they specified by a class option, such as, for example, `a4paper`, or by means of explicit `\paperwidth` and `\paperheight` assignments.

At a convenient moment after calling this package, the trimming margins with respect to the trimmed page may be computed and the layout rechecked and fixed for consistency. The convenient moment is chosen by the package to be at the `\begin{document}` statement execution, because only at that moment all required packages are loaded and possibly the user's macros are defined and settings are set.

4 Font normal size

At the same time, if this page layout is chosen, the font normal size should be selected on the actual text block width; it is possible that the golden ratio type block, on a golden rectangle paper obtained by trimming an ISO A4 stock paper, might be suitable with a 10pt normal font size (exactly 66 characters per line with 10pt Latin Modern fonts), while a full ISO A4 paper yields a type block that might be more suited for a 12pt normal font size (about 86 characters with 10pt Latin Modern fonts). The computations might be left, for example, to the used class memoir commands or to the user specifications, but it is important that the user is aware of this particular point.

For the user's sake this package provides the command `\currentfontletters` (to be used only after `\begin{document}`, because this package computations are available only after the `\begin{document}` delayed computations are done; in any case the command types out a sentence such as "The number of characters in one text line with the current font is *n*", where the *n* is the actual number printed out. If such number is much outside the ideal Bringhurst range of 66 ± 5, it is wiser to chose a larger or smaller normal font size.

In any case the alternative command `\characterssperpage` types out the same above information, the number of lines and the estimated number of characters per page. These commands are supposed to be useful while setting up or revise the complete preliminary parameters for the page layout.

Just to have a comparison, table 2 displays the number of characters in one line of text for several fonts and for page sizes A4, A5, and B5.

It can be seen that the bold typeset numbers satisfy the Bringhurst rule with such numbers falling within the range 66 ± 5; the computed numbers typeset in

Table 2: Text line lengths measured in average number of characters in different fonts

Font collection	A4 paper size			A5 paper size			B5 paper size		
	10 pt	11 pt	12 pt	10 pt	11 pt	12 pt	10 pt	11 pt	12 pt
Times eXtended	*92*	*84*	*77*	**64**	59	*54*	*77*	**70**	**64**
Latin Modern	*86*	*79*	73	60	*55*	*51*	72	**66**	**61**
Kepler Project	*83*	76	**69**	58	*53*	*48*	**69**	**63**	58
Palatino eXtended	*82*	75	**69**	58	*53*	*48*	**69**	**63**	57

normal series and shape are slightly out of the optimal Bringhurst range, and may be considered acceptable; those typeset in italics are completely out of the interval 66 ± 10 and should not be accepted. This means that the large A4 paper size may be best used with intrinsically large fonts such as the Palatino eXtended (package pxfonts or newpxtext) and the Kepler Project (package kpfonts).

With the smaller A5 paper size with 10 pt size fonts, the best ones are the Times eXtended (package txfonts or newtxtext), but substantially all the examined fonts are acceptable except those in 12 pt size.

With an intermediate sized paper, such as a B5 ISO size, all the considered fonts are acceptable inside or just outside the optimal Bringhurst interval.

Many books have trimmed pages sized close the B5 paper size, therefore the page layout produced with this package is most useful with medium and smaller paper sizes (at least with the ISO ones).

5 Conclusion

We don't think this package should set also the header and footer distances, for example, or should set any specification for the page "decorations", such as underlined headers, or over lined footers, or the font size, family, series and shape of the header and footer contents. These specifications are of course important, but have nothing to do with the relationship between the paper size, the page size and the type block size.

6 Documented code

The package preliminaries are already in place. We are going to make some computations in order to determine the page shape factor x; to this end we use the functionalities of the LaTeX 3 language, already contained in the LaTeX kernel since 2020; even dimensions and skip calculations are being available since June 2022. But the first thing to do is to verify if the package is being used with a sufficiently recent version of the LaTeX engine; we test if the kernel has a date of at least 2022/06/01

We exploit also the *varepsilon*TeX dimensional computing capabilities, that are already embedded in the most recent implementations of the program *pdftex*; in fact it must be remarked that these facilities are being embedded into the LaTeX based typesetting engine since the TeX Live distribution of the year 2005. If these facilities are not available, either because the TeX distribution is a little too old, or because the real *tex* typesetting interpreter, not *pdftex*, or*luatex*, or *xetex*, is being used, then this entire package contents is skipped and nothing is done, except issuing a suitable warning.

```
\IfFormatAtLeastTF{2022/06/01}{}{%
\PackageWarning{canoniclayout}{%
The format file is not suited\MessageBreak
for working with this package.\MessageBreak
This package is being skipped and \MessageBreak
its functionalities are not available
\expandafter\endinput}
\fi}

```

Then we test if the memoir class is being used; if that is the case, we use its code (identical to the one of the previous package version), otherwise we set up the code for this package internal computations..

We delay both codes to the `\begin{document}` statement execution, so we are sure that there are no interferences between the document preamble settings and the canoniclayout ones.

The user might start his main document `.tex` file according to the following model:

```
\documentclass[...,a4paper,...]{⟨class⟩}
...
\usepackage{canoniclayout}
...
\begin{document}
⟨main document body⟩
\end{document}
```

It is very important that the paper size be established within the options of the `\documentclass` statement, because this package needs the dimensions of the page to deal with.

6.1 Using the memoir class

```
\@ifclassloaded{memoir}{%
\AtBeginDocument{%
```

Now we can determine the page shape factor and we save it into the control sequence `\CLshape`. The trick of multiplying by `\p@`, a length of 1 pt, is a simple trick for reducing the shape ratio to a length whose numerical value is exactly the ratio we are interested in. By stripping the ‘pt’ part from this dimension value we remain with the real number we want to keep in memory. Of course we need also the reciprocal value so that we have to perform this calculation two times with different factors. This “strange” way of computing real ratios derives from the ability of the *varepsilon*TEX engine to scale lengths with a higher computational precision than “normal” TEX can do with the standard dimension and integer operations. In facts all the computational operations are performed within the computer CPU and the intermediate first result of the multiplication is kept into a double length register, so that no bits are rounded or truncated; the division operation is therefore performed with a double length numerator and a single length denominator, so that, again, almost no information is lost at the inevitable end of the division algorithm with a non vanishing remainder.

```
\dimen@=\dimexpr \p@ * \paperwidth / \paperheight\relax
\edef\CLshape{\strip@pt\dimen@}
\dimen@=\dimexpr \p@ * \p@ / \dimen@\relax
\edef\CLinvshape{\strip@pt\dimen@}
```

We then assign the text height, thanks to the fact that the canonical layout has the block height just as long as the page width, thanks to the circle property mentioned in the Introduction; in any case formulas 1–10 and table 1 confirm this property for any shape.

```
\textheight=\paperwidth
```

This done, we can use the internal memoir commands to determine the other layout dimensions.

```
\settypeblocksize{\textheight}{*}{\CLshape}
\setlrmargins{*}{*}{\CLinvshape}
\setulmargins{*}{*}{\CLinvshape}
\setmarginnotes{7pt}{\dimexpr \foremargin-3\marginparsep}{\onelineskip}

```

We now use the `\checkandfixthelayout` so that it prints the page parameters to the `.log` file.

```
\checkandfixthelayout
}}%              memoir class end code; start code for standard classes
```

6.2 Using a standard class

Now we define the code in case memoir is not being used; the various computations require a longer code. We need the pict2e package in order to use the `picture` environment with the upgrades foreseen by Leslie Lamport himself and available since 2003. We need also package etoolbox in order to have an easy access to the recent LaTeX kernel hooks. In particular we use the `\AtEndPreamble` hook command so as to be sure that all settings for the paper size and the user preamble settings are already fixed.

```
%
{\RequirePackage{etoolbox,pict2e}%
\AtEndPreamble{%
%
```

If we use a standard class, we miss the powerful memoir commands; we do not copy them into this package, but we make our own calculations; by so doing we have full control also on the necessary parameters for drawing the circles and the relevant diagonals. The necessary code is going to be longer that that required for the memoir class, also because we have to redefine the four standard page styles.

We compute the relevant values by using equations from 1 to 10. Notice that we also create the service macros for drawing the circle and the relevant page diagonal in case the user wants them to appear in certain pages; see below for more details. In any case we must check if the `\color` macro is available; in case it is not, we load the xcolor package without any options.

Attention: if users want to use colors in their document, they should load either package color or package xcolor with their options before loading this package canoniclayout. If this is done, users are sure that the package loaded within this module will not override their settings; notice that xcolor redefines some macros that have the same name as those of color; therefore color might be loaded before canoniclayout, absolutely not after, otherwise some xcolor functionalities get corrupted; see the xcolor documentation. In a different wording: avoid loading package color, because its functionalities are given by xcolor and color is not required any more!

```
\unless\ifcsname color\endcsname \RequirePackage{xcolor}\fi
\newlength\CLinner \newlength\CLouter %             new length registers
\newlength\CLtop \newlength\CLbottom  %              other new registers
\edef\CLx{\fpeval{\paperwidth/\paperheight}}%                 equation 1
\edef\CLxx{\fpeval{(1-\CLx)/(1+\CLx)}}%      for equations 2, 3, 4, 5, 9
\CLinner=\fpeval{\paperwidth*\CLx*\CLxx}\p@%                  equation 2
\CLouter=\fpeval{\paperwidth*\CLxx}\p@%                       equation 3
\CLtop=\fpeval{\paperheight*\CLx*\CLxx}\p@%                   equation 4
\CLbottom=\fpeval{\paperheight*\CLxx}\p@%                     equation 5
\textwidth=\fpeval{\CLx*\paperwidth}\p@%                      equation 6
\textheight=\paperwidth%                                      equation 7
\edef\CLcirclecenterX{\fpeval{\paperwidth/2}}%                equation 8
\edef\CLcirclecenterY{\fpeval{\CLxx*\paperheight+\paperwidth/2}}%  eq. 9
\let\CLcircleradius\CLcirclecenterX%                         equation 10
\edef\CLcirclediameter{\strip@pt\paperwidth}%
\let\CLpageW\CLcirclediameter
```

Then the text body height is proportional to the text body width trough the above determined ratios. We now set the other necessary page settings, even if by so doing, it becomes impossible to modify them either in the preamble or after the `\begin{document}` command. May be in the future this constraint may be eliminated.

```
\normalsize
\headheight=\baselineskip
\headsep=\baselineskip
\footskip=2\baselineskip
\marginparsep=0.1\CLouter\relax
\marginparwidth=0.8\CLouter\relax
\topmargin=\dimexpr\CLtop-\headsep-\headheight-1in\relax
\oddsidemargin=\dimexpr\CLinner-1in \relax
\evensidemargin=\dimexpr\CLouter-1in \relax
```

While memoir uses its computed results and applies them to all pages; with the local calculations it is necessary to redesign the page styles; we redefine also the `empty` and `plain` styles so as to have a place holder in the otherwise empty headers, such that users can verify the correct layout geometry by placing under the text being typeset, a red drawing that shows the circle and the diagonal. Since the place holder may contain some executable code, it is necessary to have handy user macros to set it on or off.

```
\edef\CLdiagX{\strip@pt\paperwidth}%       diagonal horizontal component
\edef\CLdiagY{\strip@pt\paperheight}%        diagonal vertical component
\let\@CLdrawing\relax%                 initially drawings are turned off
%Coordinates of the lower left page corner relative to the header origin
\edef\CLlly{-\expandafter\strip@pt%           both pages corner ordinate
    \dimexpr\paperheight-\CLtop+\headsep}%
\edef\CLllLx{-\strip@pt\CLouter}%   lower left left-page corner abscissa
```

```
\edef\CLllRx{-\strip@pt\CLinner}%  lower left right-page corner abscissa
```

The user commands for turning on and off the canonical layout drawings are the following; sometimes it might be necessary to delay them to the start of a new page; this may me easily done by using the afterpage package and its command `\afterpage`. There are two commands, one for starting to insert drawings in consecutive pages, and another to stop this functionality.

```

\newcommand*\CLstartdrawings{\let\@CLdrawing\CLdrawing}
\newcommand*\CLstopdrawings{\let\@CLdrawing\relax}

\newcommand*\CLdrawing{%
  \begin{picture}(0,0)\color{red}%
  \unitlength=\p@
  \if@twoside
    \ifodd\value{page}%
      \put(\CLllRx,\CLlly){%     right page: displaces the origin to the
%                                                lower left paper corner
        \put(\CLcirclecenterX,\CLcirclecenterY){\circle{\CLcirclediameter}}
          \put(\CLpageW,0){\line(-\CLdiagX,\CLdiagY){\CLpageW}}
      }
    \else
      \put(\CLllLx,\CLlly){%      left page: displaces the origin to the
%                                                lower left paper corner
        \put(\CLcirclecenterX,\CLcirclecenterY){\circle{\CLcirclediameter}}
        \put(0,0){\line(\CLdiagX,\CLdiagY){\CLpageW}}
      }
    \fi
  \else
    \put(\CLllRx,\CLlly){%         one side: displaces the origin to the
%                                                lower left paper corner
      \put(\CLcirclecenterX,\CLcirclecenterY){\circle{\CLcirclediameter}}
      \put(\CLcirclecenterX,\CLcirclecenterY){%
        \put(0,0){\line(\CLdiagX,\CLdiagY){\CLcircleradius}}
        \put(0,0){\line(-\CLdiagX,-\CLdiagY){\CLcircleradius}}
      }
    }
  \fi
  \end{picture}
}
```

Now we redefine the four standard page styles so as to set the place holder in all the headers; when this place holder is activated by `\CLstartdrawings`, it gets defined with an environment `picture` code extended by the use of package pict2e. The environment `picture` initial command has zero dimensions, therefore it does not occupy any space in the headers. Command `\CLstopdrawings` redefines the place holder to `\relax` and stops all drawings relative to the page design.

```
\def\ps@empty{%
  \let\@mkboth\@gobbletwo
  \def\@oddhead{\makebox[\textwidth][l]{{\@CLdrawing}}}\let\@oddfoot\@empty
  \def\@evenheadhead{\makebox[\textwidth][l]{{\@CLdrawing}}}
  \let\@evenfoot\@empty}
```

The above settings for an empty page may be useful to get the drawing in a completely empty page, without any other object entering the page.

The following redefinition of the `plain` page style is necessary in order to get a chapter page overlaid on the red drawing.

```
\def\ps@plain{\let\@mkboth\@gobbletwo
     \def\@oddhead{\makebox[\textwidth][l]{{\@CLdrawing}}}
     \def\@oddfoot{\reset@font\hfil\thepage\hfil}
     \def\@evenheadhead{\makebox[\textwidth][l]{{\@CLdrawing}}}
     \let\@evenfoot\@oddfoot}
```

Th redefinition of the `headings` and `myhheadings` page styles are the most useful ones because the typeset text is overlaid on the red drawing and the user can see the effect of the canonical layout in the style of a typeset page.

```
\if@twoside
  \def\ps@headings{%
    \let\@oddfoot\@empty\let\@evenfoot\@empty
    \def\@evenhead{\@CLdrawing\thepage\hfil{\slshape\leftmark}}%
    \def\@oddhead{\@CLdrawing{\slshape\rightmark}\hfil\thepage}%
    \let\@mkboth\markboth
    \def\chaptermark##1{%
      \markboth {\MakeUppercase{%
        \ifnum \c@secnumdepth >\m@ne
          \if@mainmatter
            \@chapapp\ \thechapter. \ %
          \fi
        \fi
        ##1}}{}}%
    \def\sectionmark##1{%
      \markright {\MakeUppercase{%
        \ifnum \c@secnumdepth >\z@
          \thesection. \ %
        \fi
        ##1}}}}
\else
  \def\ps@headings{%
    \let\@oddfoot\@empty
    \def\@oddhead{\@CLdrawing{\slshape\rightmark}\hfil\thepage}%
    \let\@mkboth\markboth
    \def\chaptermark##1{%
      \markright {\MakeUppercase{%
        \ifnum \c@secnumdepth >\m@ne
          \if@mainmatter
            \@chapapp\ \thechapter. \ %
          \fi
        \fi
        ##1}}}}
\fi
```

The `myheadings` page style is much simpler, at least this is the definition based on the standard LaTeX class book code:

```
\def\ps@myheadings{%
    \let\@oddfoot\@empty\let\@evenfoot\@empty
    \def\@evenhead{\@CLdrawing\thepage\hfil{\slshape\leftmark}}%
    \def\@oddhead{\@CLdrawing{\slshape\rightmark}\hfil\thepage}%
    \let\@mkboth\@gobbletwo
    \let\chaptermark\@gobble
    \let\sectionmark\@gobble
    }

```

At this point we may close the argument of the `\AtEndPreamble` command and the test on the use of the memoir class.

```
}}%
```

6.3 Service macros

Just for testing the number of characters in a line the following macros are provided. A couple of scratch dimension registers will be used `dimen@` and `\abcwidth`; `\abcwidth` will hold the current lowercase alphabet length, and `\dimen@` will hold several values in succession. The scratch counters `\count254`, `\count252`, and `count250` will receive the final result to be printed out. *varepsilon*TeX arithmetics will be used throughout, and we know this is possible, since we already tested it at the very beginning.

Another service macro for the user's sake is `\charactersperpage`; this macro typesets the number of characters per line, the numbers of lines per page, and eventually their product, a good estimate of the number of characters per page. Many text editors have facilities for counting a "compuscript" number o words and characters; with this further information users may easily estimate the number of pages of their document; of course they must make a certain allowance for the front and back matter pages, so that they can evaluate the total amount of signatures of the whole typeset document; of course, by typesetting it with any engine based on LaTeX they know exactly the number of pages of the final document, but typographers like to know a good estimate before the source TeX files are finished.

```
\newlength\abc@width
\newcommand*\currentfontletters{%
\settowidth\abc@width{abcdefghijklmnopqrstuvwxyz}\dimen0=26\p@
\dimen0=\dimexpr \textwidth * \dimen0 / \abc@width \relax
\count254=\numexpr \dimen0 / \p@ \relax
\par The number of characters in one text line with the current font is
    \the\count254.\par}

\newcommand*\charactersperpage{%
\settowidth\abc@width{abcdefghijklmnopqrstuvwxyz}\dimen0=26\p@
\dimen0=\dimexpr \textwidth * \dimen0 / \abc@width \relax
\count254=\numexpr \dimen0 / \p@ \relax
\count252=\numexpr \textheight / \baselineskip \relax
\count250=\numexpr \count252 * \count254\relax
\quote The number of characters in one text line with the current
    font is \the\count254;\\
    this text block contains \the\count252\ lines;\\
    a rough estimate of the number of characters per page is
    \the\count250.\par
    This might be used to estimate the total number of pages of
    a document.
\endquote}
```

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