Providing some UTF-8 support via \texttt{inputenc}

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\section{A test document}

* Borrowing heavily from code by David Carlisle and tables by Sebastian Rahtz; some table and code cleanup by Javier Bezos
1 Introduction

[The whole section is rather unfinished ... just like the code, sorry!]

1.1 Background and general stuff

For many reasons what this package provides is a long way from any type of ‘Unicode compliance’.

In stark contrast to 8-bit character sets, with 16 or more bits it can easily be very inefficient to support the full range.\footnote{In fact, \LaTeX{}'s current 8-bit support does not go so far as to make all 8-bit characters into valid input.} Moreover, useful support of character input by a typesetting system overwhelmingly means finding an acceptable visual representation of a sequence of characters and this, for \LaTeX{}, means having available a suitably encoded 8-bit font.

Unfortunately it is not possible to predict exactly what valid UTF-8 octet sequences will appear in a particular file so it is best to make all the unsupported but valid sequences produce a reasonably clear and noticeable error message.

There are two directions from which to approach the question of what to load. One is to specify the ranges of Unicode characters that will result in some sensible typesetting; this requires the provider to ensure that suitable fonts are loaded and that these input characters generate the correct typesetting via the encodings of those fonts. The other is to inspect the font encodings to be used and use these to define which input Unicode characters should be supported.

For Western European languages, at least, going in either direction leads to many straightforward decisions and a few that are more subjective. In both cases some of the specifications are \TeX{} specific whilst most are independent of the particular typesetting software in use.

As we have argued elsewhere, \LaTeX{} needs to refer to characters via ‘seven-bit-text’ names and, so far, these have been chosen by reference to historical sources such as Plain \TeX{} or Adobe encoding descriptions. It is unclear whether this ad hoc naming structure should simply be extended or whether it would be useful to supplement it with standardised internal Unicode character names such as one or more of the following:\footnote{Burkhard und Holger Mittelbach spielen mit mir! Sie haben etwas hier geschrieben.}

\begin{verbatim}
\ltxutwochar <4 hex digits>
\ltxuchar {<hex digits>}
    B H U R R
\ltxeightchartwo <2 utf8 octets as 8-bit char tokens>
\ltxeightcharthree <3 utf8 octets ...>
\ltxeightcharfour <4 utf8 octets ...>
\end{verbatim}

1.2 More specific stuff

In addition to setting up the mechanism for reading UTF-8 characters and specifying the \LaTeX{}-level support available, this package contains support for some
default historically expected \TeX-related characters and some example `Unicode
definition files’ for standard font encodings.

1.3 Notes

This package does not support Unicode combining characters as \TeX is not really
equipped to make this possible.

No attempt is made to be useful beyond Latin, and maybe Cyrillic, for Euro-
pean languages (as of now).

1.4 Basic operation of the code

The \inputenc package makes the upper 8-bit characters active and assigns to all
of them an error message. It then waits for the input encoding files to change this
set-up. Similarly, whenever \inputencoding is encountered in a document, first
the upper 8-bit characters are set back to produce an error and then the definitions
for the new input encoding are loaded, changing some of the previous settings.

The 8-bit input encodings currently supported by \inputenc all use declarations
such as \DeclareInputText and the like to map an 8-bit number to some \TeX
internal form, e.g. to \texttt{\textasciitilde a}.

The situation when supporting UTF-8 as the input encoding is different, how-
ever. Here we only have to set up the actions of those 8-bit numbers that can be
the first octet in a UTF-8 representation of a Unicode character. But we cannot
simply set this to some internal \TeX form since the Unicode character consists
of more than one octet; instead we have to define this starting octet to parse the
right number of further octets that together form the UTF-8 representation of
some Unicode character.

Therefore when switching to utf8 within the \inputenc framework the charac-
ters with numbers (hex) from "C2 to "DF are defined to parse for a second octet
following, the characters from "E0 to "EF are defined to parse for two more octets
and finally the characters from "F0 to "F3 are defined to parse for three additional
octets. These additional octets are always in the range "80 to "B9.

Thus, when such a character is encountered in the document (so long as expan-
sion is not prohibited) a defined number of additional octets (8-bit characters) are
read and from them a unique control sequence name is immediately constructed.

This control sequence is either defined (good) or undefined (likely); in the latter
case the user gets an error message saying that this UTF-8 sequence (or, better,
Unicode character) is not supported.

If the control sequence is set up to do something useful then it will expand to
a \TeX internal form: e.g. for the utf8 sequence of two octets "C3 "A4 we get
\texttt{\textasciitilde a} as the internal form which then, depending on the font encoding, eventually
resolves to the single glyph `latin-a-umlaut’ or to the composite glyph `latin-a with
an umlaut accent’.

These mappings from (UTF-8 encoded) Unicode characters to \TeX internal forms are made indirectly. The code below provides a declaration
\DeclareUnicodeCharacter which maps Unicode numbers (as hexadecimal) to
\TeX internal forms.

This mapping needs to be set up only once so it is done at \begin{document}
by looking at the list of font encodings that are loaded by the document and
providing mappings related to those font encodings whenever these are available.
Thus at most only those Unicode characters that can be represented by the glyphs
available in these encodings will be defined.

Technically this is done by loading one file per encoding, if available, that is
supposed to provide the necessary mapping information.

2 Coding

2.1 Housekeeping

The usual introductory bits and pieces:

1 ⟨utf8⟩ \ProvidesFile{utf8.def}
2 ⟨text⟩ \ProvidesFile{utf8-test.tex}
3 ⟨+lcy⟩ \ProvidesFile{lcyenc.dfu}
4 ⟨+ly1⟩ \ProvidesFile{ly1enc.dfu}
5 ⟨+oms⟩ \ProvidesFile{omsenc.dfu}
6 ⟨+ot1⟩ \ProvidesFile{ot1enc.dfu}
7 ⟨+ot2⟩ \ProvidesFile{ot2enc.dfu}
8 ⟨+t1⟩ \ProvidesFile{t1enc.dfu}
9 ⟨+t2a⟩ \ProvidesFile{t2aenc.dfu}
10 ⟨+t2b⟩ \ProvidesFile{t2benc.dfu}
11 ⟨+t2c⟩ \ProvidesFile{t2cenc.dfu}
12 ⟨+ts1⟩ \ProvidesFile{ts1enc.dfu}
13 ⟨+x2⟩ \ProvidesFile{x2enc.dfu}
14 ⟨+all⟩ \ProvidesFile{utf8enc.dfu}
15 [2015/09/07 v1.1p UTF-8 support for inputenc]
16 ⟨*utf8⟩

\makeatletter

We restore the \catcode of space (which is set to ignore in inputenc) while
reading .def files. Otherwise we would need to explicitly use \space all over the
place in error and log messages.

17 \catcode' \saved@space@catcode

2.2 Parsing UTF-8 input

A UTF-8 char (that is not actually a 7-bit char, i.e. a single octet) is parsed as fol-
lows: each starting octet is an active \TeX character token; each of these is defined
below to be a macro with one to three arguments nominally (depending on the
starting octet). It calls one of \UTFviii@two@octets, \UTFviii@three@octets,
or \UTFviii@four@octets which then actually picks up the argument(s).

From the arguments a control sequence with a name of the form u8:#1#2... is
constructed where the #1 (i > 1) are the arguments and #1 is the starting octet
(as a \TeX character token). Since some or even all of these characters are active
(when inputenc is loaded) we need to use \string when building the csname.

The csname thus constructed can of course be undefined but to avoid producing
an unhelpful low-level undefined command error we pass it to \UTFviii@defined
which is responsible for producing a more sensible error message (not yet done!!).
If, however, it is defined we simply execute the thing (which should then expand
to an encoding specific internal \TeX form).

19 \def\UTFviii@two@octets#1#2{\expandafter
20 \UTFviii@defined\csname u8:#1\string#2\endcsname}
\def\UTFviii@three@octets#1#2#3{\expandafter\UTFviii@defined\csname u8:#1\string#2\string#3\endcsname}
\def\UTFviii@four@octets#1#2#3#4{\expandafter\UTFviii@defined\csname u8:#1\string#2\string#3\string#4\endcsname}

\UTFviii@defined
This tests whether its argument is different from \relax: it either calls for a sensible error message (not done), or it gets the \fi out of the way (in case the command has arguments) and executes it.

\def\UTFviii@defined#1{\ifx#1\relax\PackageError{inputenc}{Unicode\space char\space\UTFviii@splitcsname\string#1\relax\MessageBreak not\space set\space up\space for\space use\space with\space LaTeX}\@eha\else\expandafter#1\fi}

\UTFviii@loop
This wonderful bit of code from Dr Carlisle defines the starting octets to call \UTFviii@two@octets etc as appropriate. The starting octet itself is passed directly as the first argument, the others are picked up later en route.

The \UTFviii@loop loops through the numbers starting at \count@ and ending at \@tempcnta − 1, each time executing the code in \UTFviii@tmp.

All this is done in a group so that temporary catcode changes etc. vanish after everything is set up.

It may be a good idea to add code to deal with ‘illegal utf8 octets’: at present these will be handled by whatever code was in use for 8-bit input before this code is executed.

\begingroup
\catcode`\~13
\catcode`\"12
\def\UTFviii@loop{\uccode`\~\count@
\uppercase\expandafter{\UTFviii@tmp}%
\advance\count@\@ne
\ifnum\count@<\@tempcnta
\expandafter\UTFviii@loop
\fi}

Setting up 2-byte UTF-8:
\count@"C2
\@tempcnta"E0
\def\UTFviii@tmp{\xdef{\noexpand\UTFviii@two@octets\string"}}

Setting up 3-byte UTF-8:
\count@"E0
For this case we must disable the warning generated by `inputenc` if it doesn’t see any new `\DeclareInputText` commands.

If this file (utf8.def) is not being read while setting up `inputenc`, i.e. in the preamble, but when `\inputencoding` is called somewhere within the document, we do not need to input the specific Unicode mappings again. We therefore stop reading the file at this point.

The `\fi` must be on the same line as `\endinput` or else it will never be seen!

\section*{2.3 Mapping Unicode codes to \LaTeX{} internal forms}

\DeclareUnicodeCharacter The `\DeclareUnicodeCharacter` declaration defines a mapping from a Unicode character code point to a \LaTeX{} internal form. The first argument is the Unicode number as hexadecimal digits and the second is the actual \LaTeX{} internal form.

We start by making sure that some characters have the right `\catcode` when they are used in the definitions below.
[\texttt{t_{C2} and t_{A3} are the characters corresponding to these two octets}]

\texttt{\textbackslash UTFviii\textbackslash@\textbackslash two\textbackslash@\textbackslash octets} \texttt{t_{C2}t_{A3}}

what we actually need to produce is a definition of the form

\texttt{\textbackslash def\textbackslash u8: \texttt{t_{C2}t_{A3}} \{B\TeX\ internal form\}.}

So here we temporarily redefine the prefix commands \texttt{\textbackslash UTFviii\textbackslash@\textbackslash two\textbackslash@\textbackslash octets}, etc. to generate the \texttt{csname} that we wish to define; the \texttt{strings} are added in case these tokens are still active.

76 \texttt{\textbackslash def\textbackslash UTFviii\textbackslash@\textbackslash two\textbackslash@\textbackslash octets\#1\#2\{\texttt{csname u8:\#1\textbackslash string\#2\textbackslash endcsname}\}\%}
77 \texttt{\textbackslash def\textbackslash UTFviii\textbackslash@\textbackslash three\textbackslash@\textbackslash octets\#1\#2\#3\{\texttt{csname u8:\#1\#2\#3\textbackslash string\#2\textbackslash endcsname}\}\%}
78 \texttt{\textbackslash def\textbackslash UTFviii\textbackslash@\textbackslash four\textbackslash@\textbackslash octets\#1\#2\#3\#4\{\texttt{csname u8:\#1\#2\#3\#4\textbackslash string\#2\textbackslash string\#3\textbackslash string\#4\textbackslash endcsname}\}\%}

Now we simply:-) need to use the right number of \texttt{\textbackslash expandafters} to finally construct the definition: expanding \texttt{\textbackslash UTFviii\textbackslash@\textbackslash tmp} once to get its contents, a second time to replace the prefix command by its \texttt{\csname} expansion, and a third time to turn the expansion into a \texttt{csname} after which the \texttt{\gdef} finally gets applied. We add an irrelevant \texttt{\textbackslash IeC} and braces around the definition, in order to avoid any space after the command being gobbled up when the text is written out to an auxiliary file (see \texttt{\textbackslash inputenc} for further details)

81 \texttt{\textbackslash expandafter\textbackslash expandafter\textbackslash expandafter}
82 \texttt{\textbackslash expandafter\textbackslash expandafter\textbackslash expandafter}
83 \texttt{\expandafter}
84 \texttt{\gdef\textbackslash UTFviii\textbackslash@\textbackslash tmp\{\texttt{\textbackslash IeC\textbackslash[#2]}\}\%}
85 \texttt{endgroup}
86}

\texttt{\textbackslash parse\textbackslash XML\textbackslash charref}

This macro parses a Unicode number (decimal) and returns its UTF-8 representation as a sequence of non-active \TeX\ character tokens. In the original code it had two arguments delimited by ; here, however, we supply the Unicode number implicitly.

87 \texttt{\gdef\textbackslash parse\textbackslash XML\textbackslash charref\{\%}
88 \texttt{\% \texttt{\textbackslash be\textbackslash begin\textbackslash group}}
89 \texttt{\% \texttt{\textbackslash uppercase\{\texttt{\textbackslash count\textbackslash@\textbackslash if \textbackslash x\textbackslash no\textbackslash expand\textbackslash#1\texttt{\textbackslash else\textbackslash#1\textbackslash f\textbackslash#2}\textbackslash relax}}}
90 \texttt{\% \texttt{\textbackslash ifnum\texttt{\textbackslash count\textbackslash@\textbackslash c=\textbackslash A0}}\texttt{\textbackslash relax}}
91 \texttt{\PackageError\{\textbackslash inputenc\{Cannot\space define\space Unicode\space char\space value\space <\space 00A0\}\textbackslash eha}
92
Do not ask us to provide an explanation for the code below, it is borrowed straight from xmltex by David and we trust him totally (and we are too lazy to reread the Unicode book to see if this is the correct algorithm). 3

\else\ifnum\count@<"800\relax
\parse@UTFviii@a,\%
\parsetext{UTFviii\twooctets.\%
\else\ifnum\count@<"10000\relax
\parsetext{UTFviii\threeoctets.}{,;}{%}
\else
\parsetext{UTFviii\fouroctets.}{,;}{%
\fi
\fi
\fi
% \endgroup
}
\parse@UTFviii@a... so somebody else can document this part :-) ... David?:-)))))!
\gdef\parse@UTFviii@a#1{%
\@tempcnta\count@
\divide\count@ 64
\@tempcntb\count@
\multiply\count@ 64
\advance\@tempcnta-\count@
\advance\@tempcnta 128
\uccode'#1\@tempcnta
\count@\@tempcntb}
\parse@UTFviii@b... same here
\gdef\parse@UTFviii@b#1#2#3#4{%
\advance\count@ "#1\relax
\uccode'#3\count@
\uppercase{\gdef\UTFviii@tmp{#2#3#4}}}
\decode@UTFviii In the reverse direction, take a sequence of octects(bytes) representing a character in UTF-8 and construct the Unicode number. The sequence is terminated by \relax.

In this version, if the sequence is not valid UTF-8 you probably get a low level arithmetic error from \numexpr or stray characters at the end. Getting a better error message would be somewhat expensive. As the main use is for reporting characters in messages, this is done just using expansion, so \numexpr is used. A stub returning 0 is defined if \numexpr is not available.

\ifx\numexpr\@undefined
\gdef\decode@UTFviii#1{0}
\else
\gdef\decode@UTFviii#1{0}
\else
\gdef\decode@UTFviii#1{0}
\end
If the input is malformed UTF-8 there may not be enough closing ) so add 5 so there are always some remaining then cleanup and remove any remaining ones at the end. This avoids \numexpr parse errors while outputting a package error.

\gdef\decode@UTFviii#1\relax{\expandafter\UTFviii@cleanup\the\numexpr\dec@de@UTFviii#1\relax))))))\@empty}
\gdef\UTFviii@cleanup#1)#2\@empty{#1}
\gdef\dec@de@UTFviii#1{\ifx\relax#1\else\ifnum'#1>"EF(((('#1-"F0)\else\ifnum'#1>"DF((('#1-"E0)\else\ifnum'#1>"BF("('#1-"C0)\else*64+('#1-"80)\else+'#1\fi\fi\fi\fi\fi\expandafter\dec@de@UTFviii\fi\fi\expandafter\UTFviii@hexnumber\fi\fi\expandafter\UTFviii@hexdigit\hexnumber@}

\UTFviii@hexnumber Convert a number to a sequence of uppercase hex digits. If \numexpr is not available, it returns its argument unchanged.

\ifx\numexpr\@undefined\global\let\UTFviii@hexnumber\@firstofone\global\UTFviii@hexdigit\hexnumber@
\else\gdef\UTFviii@hexnumber#1{\ifnum#1>15 \expandafter\UTFviii@hexnumber\expandafter{\the\numexpr(#1-8)/16\relax}\else\UTFviii@hexdigit{\numexpr#1\ifnum#1>0-((#1-8)/16)*16\fi\relax}\fi\fi\fi\fi\fi\fi\expandafter\UTFviii@hexdigit\hexnumber@
Almost but not quite \hexnumber@.
\gdef\UTFviii@hexdigit#1{\ifcase\numexpr#1\relax0\or1\or2\or3\or4\or5\or6\or7\or8\or9\or A\or B\or C\or D\or E\or F\fi\fi
\UTFviii@splitcsname  Split a csname representing a unicode character and return the character and (if \numexpr is defined) the unicode number in hex.

167 \ifx\numexpr\@undefined
168 \gdef\UTFviii@splitcsname#1:#2\relax{#2}}
169 \else
170 \gdef\UTFviii@splitcsname#1:#2\relax{%
Need to pre-expand the argument to ensure cleanup in case of mal-formed UTF-8.
171 #2 (U+\expandafter\UTFviii@hexnumber\expandafter{\the\numexpr\decode@UTFviii#2\relax})
172 }%\fi
173 \endgroup
174 \@onlypreamble\DeclareUnicodeCharacter
175 \@onlypreamble\parse@XML@charref
176 \@onlypreamble\parse@UTFviii@a
177 \@onlypreamble\parse@UTFviii@b

2.4 Loading Unicode mappings at begin document

The original plan was to set up the UTF-8 support at \begin{document}; but then any text characters used in the preamble (as people do even though advised against it) would fail in one way or the other. So the implementation was changed and the Unicode definition files for already defined encodings are loaded here. We loop through all defined font encodings (stored in \cdp@list) and for each load a file \texttt{nameenc.dfu} if it exist. That file is then supposed to contain \DeclareUnicodeCharacter declarations.

\begingroup
\def\cdp@elt#1#2#3#4{%
\wlog{Now handling font encoding #1 ...}%
\lowercase{\InputIfFileExists{#1enc.dfu}}%
\wlog{... processing UTF-8 mapping file for font %
encoding #1}%
\endgroup

The previous line is written to the log with the newline char being ignored (thus not producing a space). Therefore either everything has to be on a single input line or some special care must be taken. From this point on we ignore spaces again, i.e., while we are reading the .dfu file. The \endgroup below will restore it again.

\catcode\ 9\relax}
\wlog{... no UTF-8 mapping file for font encoding #1}%
\endgroup
\cdp@list
\endgroup

However, we don’t know if there are font encodings still to be loaded (either with \fontenc or directly with \input by some some package). Font encoding files are loaded only if the corresponding encoding has not been loaded yet, and they
always begin with \DeclareFontEncoding. We now redefine the internal kernel
version of the latter to load the Unicode file if available.

\begin{verbatim}
\def\DeclareFontEncoding@#1#2#3{\
\expandafter\ifx\csname T@#1\endcsname\relax
\def\cdp@elt{\noexpand\cdp@elt}\
\xdef\cdp@list{\cdp@list\cdp@elt{#1}\
\{\default@family}{\default@series}\}
\{\default@shape}\}
\expandafter\let\csname#1-cmd\endcsname\@changed@cmd
\begingroup
\wlog{Now handling font encoding #1 ...}\
\lowercase{\InputIfFileExists{#1enc.dfu}}\
{\wlog{... processing UTF-8 mapping file for font %
encoding #1}}\
{\wlog{... no UTF-8 mapping file for font encoding #1}}\
\endgroup
\else
\@font@info{Redeclaring font encoding #1}\
\fi
\global\@namedef{T@#1}{#2}\
\global\@namedef{M@#1}{\default@M#3}\
\xdef\LastDeclaredEncoding{#1}\
\}
\end{verbatim}

3 Mapping characters —
based on font (glyph) encodings

This section is a first attempt to provide Unicode definitions for characters whose
standard glyphs are currently provided by the standard \LaTeX font-encodings T1,
OT1, etc. They are by no means completed and need checking.

For example, one should check the already existing input encodings for glyphs
that may in fact be available and required, e.g. latin4 has a number of glyphs
with the \= accent. Since the T1 encoding does not provide such glyphs, these
characters are not listed below (yet).

The list below was generated by looking at the current \LaTeX font en-
coding files, e.g., tienc.def and using the work by Sebastian Rahtz (in
ucharacters.sty) with a few modifications. In combinations such as \^i the
preferred form is that and not \^i.

This list has been built from several sources, obviously including the Uni-
code Standard itself. These sources include Passive \TeX by Sebastian Rahtz, the
unicode package by Dominique P. G. Unruh (mainly for Latin encodings) and
text4ht by Eitan Gurari (for Cyrillic ones).

Note that it strictly follows the Mittelbach principles for input character en-
codings: thus it offers no support for using utf8 representations of math symbols
such as × or ÷ (in math mode).
3.1 About the table itself

In addition to generating individual files, the table below is, at present, a one-one (we think) partial relationship between the (ill-defined) set of LICRs and the Unicode slots "0080 to "FFFF. At present these entries are used only to define a collection of partial mappings from Unicode slots to LICRs; each of these mappings becomes full if we add an exception value (‘not defined’) to the set of LICRs.

It is probably not essential for the relationship in the full table to be one-one; this raises questions such as: the exact role of LICRs; the formal relationships on the set of LICRs; the (non-mathematical) relationship between LICRs and Unicode (which has its own somewhat fuzzy equivalences); and ultimately what a character is and what a character representation and/or name is.

It is unclear the extent to which entries in this table should resemble the closely related ones in the 8-bit inputenc files. The Unicode standard claims that the first 256 slots ‘are’ ASCII and Latin-1.

Of course, \texttt{\LaTeX} itself typically does not treat even many perfectly ‘normal text’ 7-bit slots as text characters, so it is unclear whether \texttt{\LaTeX} should even attempt to deal in any consistent way with those Unicode slots that are not definitive text characters.

3.2 The mapping table

Note that the first argument must be a hex-digit number greater than 00BF and at most 10FFFF.

There are few notes about inconsistencies etc at the end of the table.

```latex
\begin{verbatim}
216 {all,t1,ot1,ly1}\DeclareUnicodeCharacter{00A0}{\nobreakspace}
217 {all,t1,ot1,ly1}\DeclareUnicodeCharacter{00A1}{\textexclamdown}
218 {all,ts1,ly1}\DeclareUnicodeCharacter{00A2}{\textcent}
219 {all,ts1,t1,ot1,ly1}\DeclareUnicodeCharacter{00A3}{\textsterling}
220 {all,x2,ts1,t2c,t2b,t2a,ly1}\DeclareUnicodeCharacter{00A4}{\textcurrency}
221 {all,ts1,ly1}\DeclareUnicodeCharacter{00A5}{\textyen}
222 {all,ts1,ly1}\DeclareUnicodeCharacter{00A6}{\textbrokenbar}
223 {all,x2,ts1,t2c,t2b,t2a,oms,ly1}\DeclareUnicodeCharacter{00A7}{\textsection}
224 {all,ts1}\DeclareUnicodeCharacter{00A8}{\textasciimacron}
225 {all,ts1,utf8}\DeclareUnicodeCharacter{00A9}{\textcopyright}
226 {all,ts1,utf8,ly1}\DeclareUnicodeCharacter{00AA}{\textregistered}
227 {all,ts1,utf8}\ DeclareUnicodeCharacter{00AB}{\guillemotleft}
228 \ DeclareUnicodeCharacter{00AC}{\guillemotright}
229 {all,x2,t2c,t2b,t2a,t1,ot2,ly1,lyc}\textasciitilde
230 {all,ts1}\DeclareUnicodeCharacter{00AD}{\textasciitilde}
231 {all,t1,ot1,ly1}\DeclareUnicodeCharacter{00AE}{\textasciicircum}
232 {all,ts1}\DeclareUnicodeCharacter{00AF}{\textasciitilde}
233 {all,ts1}\DeclareUnicodeCharacter{00B0}{\textdegree}
234 {all,ts1}\DeclareUnicodeCharacter{00B1}{\textdagger}
235 {all,ts1}\DeclareUnicodeCharacter{00B2}{\texttwosuperior}
236 {all,ts1}\DeclareUnicodeCharacter{00B3}{\textthreesuperior}
237 {all,ts1}\DeclareUnicodeCharacter{00B4}{\textasciitilde}
238 {all,ts1}\DeclareUnicodeCharacter{00B5}{\textmu}
239 {all,ts1,self,ly1}\DeclareUnicodeCharacter{00B6}{\c}
240 {all,ts1}\DeclareUnicodeCharacter{00B7}{\textdagger}
241 {all,oms,ts1,ly1}\DeclareUnicodeCharacter{00B8}{\textparagraph}
242 {all,ot1}\DeclareUnicodeCharacter{00B9}{\c}
\end{verbatim}
```

\{all,ts1\}\DeclareUnicodeCharacter{00B9}{\textonesuperior}
\{all,ts1,ly1,utf8\}\DeclareUnicodeCharacter{00BA}{\textordmasculine}
\{all,x2,t2c,t2b,t2a,tl,ot2,ly1,lcy\}\DeclareUnicodeCharacter{00BB}{\guillemotright}
\{all,x2,t2c,t2b,t2a,tl,ot2,ly1,lcy\}\DeclareUnicodeCharacter{00BC}{\textonequarter}
\{all,ts1,ly1\}\DeclareUnicodeCharacter{00BD}{\textonehalf}
\{all,ts1,ly1\}\DeclareUnicodeCharacter{00BE}{\textthreequarters}
\{all,tl,ot1,ly1\}\DeclareUnicodeCharacter{00BF}{\textquestiondown}
\{all,tl,ly1\}\DeclareUnicodeCharacter{00C0}{\@tabacckludge'A}
\{all,tl,ly1\}\DeclareUnicodeCharacter{00C1}{\@tabacckludge'E}
\{all,tl,ly1\}\DeclareUnicodeCharacter{00C2}{\^A}
\{all,tl,ly1\}\DeclareUnicodeCharacter{00C3}{\^E}
\{all,tl,ly1\}\DeclareUnicodeCharacter{00C4}{\^I}
\{all,tl,ot1,ly1\}\DeclareUnicodeCharacter{00C5}{\textordmasculine A}
\{all,tl,ot1,ly1,lcy\}\DeclareUnicodeCharacter{00C6}{\AE}
\{all,tl,ly1\}\DeclareUnicodeCharacter{00C7}{\c C}
\{all,tl,ly1\}\DeclareUnicodeCharacter{00C8}{\@tabacckludge'E}
\{all,tl,ly1\}\DeclareUnicodeCharacter{00C9}{\@tabacckludge'E}
\{all,tl,ly1\}\DeclareUnicodeCharacter{00CA}{\^E}
\{all,tl,ly1\}\DeclareUnicodeCharacter{00CB}{\^I}
\{all,tl,ly1\}\DeclareUnicodeCharacter{00CC}{\DH}
\{all,tl,ly1\}\DeclareUnicodeCharacter{00CD}{\^I}
\{all,tl,ly1\}\DeclareUnicodeCharacter{00CE}{\DH}
\{all,tl,ly1\}\DeclareUnicodeCharacter{00CF}{\textordmasculine}
The Cyrillic code points have been recently checked (2007) and extended and corrected by Matthias Noe (a9931078@unet.univie.ac.at) — thanks.
\langle \text{all}, x_2, t_2a, \text{ot}_2, \text{lcy} \rangle \cdot \text{DeclareUnicodeCharacter}(0404)\{\text{CYRIE} \}
\langle \text{all}, x_2, t_2c, \text{t}_2b, \text{t}_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0405)\{\text{CYRDZE} \}
\langle \text{all}, x_2, t_2c, \text{t}_2b, \text{t}_2a, \text{ot}_2, \text{lcy} \rangle \cdot \text{DeclareUnicodeCharacter}(0406)\{\text{CYRII} \}
\langle \text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0409)\{\text{CYRNJE} \}
\langle \text{all}, x_2, t_2b, t_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0410)\{\text{CYRJE} \}
\langle \text{all}, x_2, t_2b, t_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0411)\{\text{CYRLJE} \}
\langle \text{all}, x_2, t_2b, t_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0412)\{\text{CYRJ} \}
\langle *\text{all}, x_2, t_2b, t_2a, \text{ot}_2, \text{lcy} \rangle \cdot \text{DeclareUnicodeCharacter}(0413)\{\text{CYRSSUN} \}
\langle *\text{all}, x_2, t_2b, t_2a, \text{ot}_2, \text{lcy} \rangle \cdot \text{DeclareUnicodeCharacter}(0414)\{\text{CYRTSHE} \}
\langle \text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0415)\{\text{CYRUSHRT} \}
\langle *\text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2, \text{lcy} \rangle \cdot \text{DeclareUnicodeCharacter}(0416)\{\text{CYRZH} \}
\langle \text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0417)\{\text{CYRI} \}
\langle *\text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2, \text{lcy} \rangle \cdot \text{DeclareUnicodeCharacter}(0418)\{\text{CYRA} \}
\langle \text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0419)\{\text{CYRB} \}
\langle *\text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2, \text{lcy} \rangle \cdot \text{DeclareUnicodeCharacter}(0420)\{\text{CYRV} \}
\langle \text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0421)\{\text{CYRG} \}
\langle *\text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2, \text{lcy} \rangle \cdot \text{DeclareUnicodeCharacter}(0422)\{\text{CYRD} \}
\langle \text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0423)\{\text{CYRE} \}
\langle *\text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2, \text{lcy} \rangle \cdot \text{DeclareUnicodeCharacter}(0424)\{\text{CYRZH} \}
\langle \text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0425)\{\text{CYRH} \}
\langle *\text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2, \text{lcy} \rangle \cdot \text{DeclareUnicodeCharacter}(0426)\{\text{CYRS} \}
\langle \text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0427)\{\text{CYRT} \}
\langle *\text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2, \text{lcy} \rangle \cdot \text{DeclareUnicodeCharacter}(0428)\{\text{CYRU} \}
\langle \text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0429)\{\text{CYRF} \}
\langle *\text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2, \text{lcy} \rangle \cdot \text{DeclareUnicodeCharacter}(0430)\{\text{CYRM} \}
\langle \text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0431)\{\text{CYRSH} \}
\langle *\text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2, \text{lcy} \rangle \cdot \text{DeclareUnicodeCharacter}(0432)\{\text{CYRS} \}
\langle \text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0433)\{\text{CYRSF} \}
\langle *\text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2, \text{lcy} \rangle \cdot \text{DeclareUnicodeCharacter}(0434)\{\text{CYSFT} \}
\langle \text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2 \rangle \cdot \text{DeclareUnicodeCharacter}(0435)\{\text{CYRT} \}
\langle *\text{all}, x_2, t_2c, t_2b, t_2a, \text{ot}_2, \text{lcy} \rangle \cdot \text{DeclareUnicodeCharacter}(0436)\{\text{CYRT} \}
The next two declarations are questionable, the encoding definition should probably contain \CYROTLD and \cyrotld. Or alternatively, if the characters in the X2 encodings are really meant to represent the historical characters in Ux0472 and
Unicode standard only describes “Cyrillic barred O” while TLD mappings are wrong or rather the names in OT2 should change for consistency. Ux0473 (they look like them) then they would need to change instead.

However, their looks are probably a font designer’s decision and the next two mappings are wrong or rather the names in OT2 should change for consistency. Ux0473 (they look like them) then they would need to change instead.

On the other hand the names \CYROTLD are somewhat questionabled as the Unicode standard only describes “Cyrillic barred O” while TLD refers to a tilde (which is more less what the “Cyrillic FITA looks according to the Unicode book).

While the double grave accent seems to exist in X2, T2A, T2B and T2C encoding, the letter izhitsa exists only in X2 and OT2. Therefore, izhitsa with double grave seems to be possible only using X2.

\begin{verbatim}
(\texttt{all.ot2})\DeclareUnicodeCharacter{0472}{\CYRFITA}
(\texttt{all.ot2})\DeclareUnicodeCharacter{0473}{\cyrfita}
(\texttt{all.x2.ot2})\DeclareUnicodeCharacter{0474}{\CYRIZH}
(\texttt{all.x2.ot2})\DeclareUnicodeCharacter{0475}{\cyrizh}
\end{verbatim}

\begin{verbatim}
(\texttt{all.x2})\DeclareUnicodeCharacter{0476}{\CYRIZH}
(\texttt{all.x2})\DeclareUnicodeCharacter{0477}{\cyrizh}
(\texttt{all.t2c})\DeclareUnicodeCharacter{048C}{\CYRSEMISFTSN}
(\texttt{all.t2c})\DeclareUnicodeCharacter{048D}{\cyrsemisftsn}
(\texttt{all.t2c})\DeclareUnicodeCharacter{048E}{\CYRRTICK}
(\texttt{all.t2c})\DeclareUnicodeCharacter{048F}{\cyrrtick}
(\texttt{all.x2.t2a,lc})\DeclareUnicodeCharacter{0490}{\CYRUP}
(\texttt{all.x2.t2a,lc})\DeclareUnicodeCharacter{0491}{\cyrup}
(\texttt{all.x2.t2b,t2a})\DeclareUnicodeCharacter{0492}{\CYRHCBS}
(\texttt{all.x2.t2b,t2a})\DeclareUnicodeCharacter{0493}{\cyrhcbs}
(\texttt{all.x2.t2c,t2b})\DeclareUnicodeCharacter{0494}{\CYRHK}
(\texttt{all.x2.t2c,t2b})\DeclareUnicodeCharacter{0495}{\cyrhk}
(\texttt{all.x2.t2c,t2b})\DeclareUnicodeCharacter{0496}{\CYRZHDSC}
(\texttt{all.x2.t2b,t2a})\DeclareUnicodeCharacter{0497}{\cyrzhdc}
(\texttt{all.x2.t2a})\DeclareUnicodeCharacter{0498}{\CYRZDC}
(\texttt{all.x2.t2a})\DeclareUnicodeCharacter{0499}{\cyrzd}
(\texttt{all.x2.t2c,t2b,t2a})\DeclareUnicodeCharacter{049A}{\CYRDSC}
(\texttt{all.x2.t2c,t2b,t2a})\DeclareUnicodeCharacter{049B}{\cyrdsc}
(\texttt{all.x2.t2a})\DeclareUnicodeCharacter{049C}{\CYRKCBS}
(\texttt{all.x2.t2a})\DeclareUnicodeCharacter{049D}{\cyrkrs}
(\texttt{all.x2.t2c})\DeclareUnicodeCharacter{049E}{\CYRKHCBS}
(\texttt{all.x2.t2c})\DeclareUnicodeCharacter{049F}{\cyrkhs}
(\texttt{all.x2.t2a})\DeclareUnicodeCharacter{04A0}{\CYRKBEAK}
(\texttt{all.x2.t2a})\DeclareUnicodeCharacter{04A1}{\cyrbeak}
(\texttt{all.x2.t2c.t2b,t2a})\DeclareUnicodeCharacter{04A2}{\CYRNDSC}
(\texttt{all.x2.t2c,t2b,t2a})\DeclareUnicodeCharacter{04A3}{\cyrnde}
(\texttt{all.x2.t2b,t2a})\DeclareUnicodeCharacter{04A4}{\CYRNG}
(\texttt{all.x2.t2b,t2a})\DeclareUnicodeCharacter{04A5}{\cyrng}
(\texttt{all.x2.t2c})\DeclareUnicodeCharacter{04A6}{\CYRHK}
(\texttt{all.x2.t2c})\DeclareUnicodeCharacter{04A7}{\cyrkh}
(\texttt{all.x2.t2c})\DeclareUnicodeCharacter{04A8}{\CYRABHHA}
(\texttt{all.x2.t2c})\DeclareUnicodeCharacter{04A9}{\cyrabhha}
(\texttt{all.x2.t2a})\DeclareUnicodeCharacter{04AA}{\CYRSDSC}
(\texttt{all.x2.t2a})\DeclareUnicodeCharacter{04AB}{\cyrsdc}
(\texttt{all.x2.t2c})\DeclareUnicodeCharacter{04AC}{\CYRUDSC}
(\texttt{all.x2.t2c})\DeclareUnicodeCharacter{04AD}{\cyru}
(\texttt{all.x2.t2b,t2a})\DeclareUnicodeCharacter{04AE}{\cyry}
(\texttt{all.x2.t2a})\DeclareUnicodeCharacter{04AF}{\CYRPH}
(\texttt{all.x2.t2c})\DeclareUnicodeCharacter{04B0}{\CYRPHK}
\end{verbatim}
The character \CYRpalochka is not defined by OT2 and LCY. However it is looking identical to \CYRII and the Unicode standard explicitly refers to that (and to Latin I). So perhaps those encodings could get an alias? On the other hand, why are there two distinct slots in the T2 encodings even though they are so pressed for space? Perhaps they don’t always look alike.

According to the Unicode standard Ux04C5 should be an L with “tail” not with descender (which also exists as Ux04A2) but it looks as if the char names do not make this distinction. Should they?

According to the Unicode standard Ux04CD should be an M with “tail” not with descender. However this time there is no M with descender in the Unicode standard.
3.3 Notes

The following inputs are inconsistent with the 8-bit inputenc files since they will always only produce the ‘text character’. This is an area where inputenc is notoriously confused.

%<all,t1,ot1,ly1>\DeclareUnicodeCharacter{00A3}\{textsterling
%<all,x2,t1,t2c,t2b,t2a,oms,ly1>\DeclareUnicodeCharacter{00A7}\{textsection
%<all,x2,t1,t2c,t2b,t2a,oms,ly1>\DeclareUnicodeCharacter{00A9}\{textcopyright
%<all,ts1,oms,ly1>\DeclareUnicodeCharacter{2032}\{textironbendleft
%<all,ly1,ut8>\DeclareUnicodeCharacter{2033}\{textironbendright
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{20AC}\{texteuro
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{221E}\{textmu
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2329}\{textless
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{232A}\{textgreater
%<all,ts1,oms,ly1>\DeclareUnicodeCharacter{2039}\{guilsinglleft
%<all,ts1,oms,ly1>\DeclareUnicodeCharacter{203A}\{guilsinglright

%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2216}\{textnumero
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2217}\{textcircled
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2219}\{textparagraph
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2226}\{textohm
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2227}\{textmho
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2228}\{textrightarrow
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2229}\{textlarrow
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2231}\{textuparrow
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2232}\{textrightarrow
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2233}\{textdownarrow
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2234}\{textleftarrow
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2235}\{textsection
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2236}\{textparagraph
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2237}\{textcopyright
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2238}\{texttrademark
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2239}\{textregistered
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{223A}\{textdagger
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{223B}\{textcopyright
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{223C}\{textparenleft
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{223D}\{textparenright
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{223E}\{textquoteleft
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{223F}\{textquoteright
%<all,x2,t1,t2c,t2b,ts1,ly1>\DeclareUnicodeCharacter{2240}\{textsterling
The following definitions are in an encoding file but have no direct equivalent in Unicode, or they simply do not make sense in that context (or we have not yet found anything or ...:-). For example, the non-combining accent characters are certainly available somewhere but these are not equivalent to a \TeX accent command.

\DeclareTextSymbol{\j}{OT1}{17}
\DeclareTextAccent{\'}{OT1}{19}
\DeclareTextAccent{\,}{OT1}{95}
\DeclareTextAccent{\=}{OT1}{22}
\DeclareTextAccent{\H}{OT1}{125}
\DeclareTextAccent{\^}{OT1}{94}
\DeclareTextAccent{\'}{OT1}{18}
\DeclareTextAccent{\~}{OT1}{126}
\DeclareTextAccent{\H}{OT1}{125}
\DeclareTextAccent{\u}{OT1}{21}
\DeclareTextAccent{\v}{OT1}{20}
\DeclareTextAccent{\j}{OT1}{17}
\DeclareTextAccent{\'}{OT1}{127}
\DeclareTextAccent{\,}{OT1}{19}
\DeclareTextAccent{\,}{OT1}{95}
\DeclareTextAccent{\=}{OT1}{22}
\DeclareTextAccent{\H}{OT1}{125}
\DeclareTextAccent{\u}{OT1}{21}
\DeclareTextAccent{\v}{OT1}{20}
\DeclareTextAccent{\j}{OT1}{17}
\DeclareTextAccent{\'}{OT1}{127}
\DeclareTextAccent{\,}{OT1}{19}
\DeclareTextAccent{\,}{OT1}{95}
\DeclareTextAccent{\=}{OT1}{22}
\DeclareTextAccent{\H}{OT1}{125}
\DeclareTextAccent{\u}{OT1}{21}
\DeclareTextAccent{\v}{OT1}{20}

3.4 Mappings for OT1 glyphs

This is even more incomplete as again it covers only the single glyphs from OT1 plus some that have been explicitly defined for this encoding. Everything that is provided in T1, and that could be provided as composite glyphs via OT1, could and probably should be set up as well. Which leaves the many things that are not provided in T1 but can be provided in OT1 (and in T1) by composite glyphs.

Stuff not mapped (note that \j (j) is not equivalent to any Unicode character):

\DeclareTextSymbol{\j}{OT1}{17}
\DeclareTextAccent{\'}{OT1}{127}
\DeclareTextAccent{\,}{OT1}{19}
\DeclareTextAccent{\,}{OT1}{95}
\DeclareTextAccent{\=}{OT1}{22}
\DeclareTextAccent{\H}{OT1}{125}
\DeclareTextAccent{\u}{OT1}{21}
\DeclareTextAccent{\v}{OT1}{20}
3.5 Mappings for OMS glyphs

Characters like \textbackslash are not mapped as they are (primarily) only in
the lower 127 and the code here only sets up mappings for UTF-8 characters that
are at least 2 octets long.

\DeclareTextSymbol{textbackslash}{OMS}{110} % "6E
\DeclareTextSymbol{textbar}{OMS}{106} % "6A
\DeclareTextSymbol{textbraceleft}{OMS}{102} % "66
\DeclareTextSymbol{textbraceright}{OMS}{103} % "67

But the following (and some others) might actually lurk in Unicode some-
where...

\DeclareTextSymbol{textasteriskcentered}{OMS}{3} % "03
\DeclareTextCommand{textcircled}{OMS}

3.6 Mappings for TS1 glyphs

Exercise for somebody else.

3.7 Mappings for latex.ltx glyphs

There is also a collection of characters already set up in the kernel, one way or the
other. Since these do not clearly relate to any particular font encoding they are
mapped when the utf8 support is first set up.

Also there are a number of \providecommand{s in the various input encoding
files which may or may not go into this part.

4 A test document

Here is a very small test document which may or may not survive if the current
document is transferred from one place to the other.

\documentclass{article}
\usepackage[utf8]{inputenc}
\usepackage[T1]{fontenc}
\usepackage{trace}
\scrollmode % to run past the error below
\begin{document}

\end{document}
German umlauts in UTF-8: \textcopyright{aâöû} % ÄÖÜ
\inputencoding{latin1} % switch to latin1

German umlauts in UTF-8 but read by latin1 (and will produce one error since \verb=\textcurrency= is not provided):
\textcopyright{aâöû}
\inputencoding{utf8} % switch back to utf8

German umlauts in UTF-8: \textcopyright{aâöû}

Some codes that should produce errors as nothing is set up for them: \textcopyright{c3F \textcopyright{e1\textcopyright{a4\textcopyright{b6}}}

And some that are not legal utf8 sequences: \textcopyright{c3X \textcopyright{e1XY}}
\showoutput
\tracingstats=2
\stop
\langle/test\rangle