The fibnum package

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Abstract

The package fibnum provides expandable fibonacci numbers for both LaTeX and plain TeX.

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1 Documentation

In the mailing list texhax Jan Abraham asked the question, how to get Fibonacci numbers in TeX [texhax:abraham]:

Write a Macro in TeX that compute the function \fib{m} All fibonacci numbers from 1 to $m\ (m<40)$.

 $^{{\}rm *Please\ report\ any\ issues\ at\ https://github.com/ho-tex/oberdiek/issues}$

This packages provides an expandable implementation for the calculation of these numbers for a much larger set of indexes. For practical reasons the index is restricted to the same limitations that apply for TEX integer numbers. The range of the Fibonacci numbers, however, are not limited by the algorithm. They are only restricted to memory limitations, if they are hit.

The package is loaded as LATEX package in LATEX:

\usepackage{fibnum}

and as file in plain TEX:

\input fibnum.sty

The package does not know any options and it provides the macros \fibnum and \fibnumPreCalc.

\fibnum $\{\langle index \rangle\}$

Macro \fibnum expects a TeX number as $\langle index \rangle$ in the official TeX number range from $-(2^{31}-1)$ up to $2^{31}-1$. In exact two expansion steps the macro expands to the Fibnoacci number $F_{\langle index \rangle}$. In case of a negative $\langle index \rangle$, the "negafibonacci" number [wikipedia:negafibonacci] is used. Formally the Fibonacci number F_n with integer index $n, n \in \mathbb{Z}$ and $n \in [-2147483647, 2147483647]$ that is returned by macro \fibnum with numerical argument n is defined the following way:

$$F_n = \begin{cases} 0 & \text{for } n = 0\\ 1 & \text{for } n = 1\\ F_{n-1} + F_{n-2} & \text{for } n > 1\\ (-1)^{n+1} F_n & \text{for } n < 0 \end{cases}$$
 (1)

Examples:

```
\left\{ -6 \right\}
\left\{ -5 \right\}
\left\{ -4 \right\}

ightarrow -3
              \rightarrow 2
fibnum{-3}
\int \int d^2 x dx
\int \int \int d^2 x dx
\int \int dx dx dx
\int fibnum{1}
              \rightarrow 1
\fibnum{2}
\fibnum{3}
\left\{ 1\right\}
\int fibnum{5}
\fibnum{6}
\left\{10\right\}
\left\{ 46 \right\}
              \rightarrow 1836311903
\mbox{fibnum{200}} \rightarrow 280571172992510140037611932413038677189525
605173717804024817290895365554179490518904
                  038798400792551692959225930803226347752096
                  896232398733224711616429964409065331879382
                  98969649928516003704476137795166849228875
```

\fibnumPreCalc $\{\langle index \rangle\}$

The package already provides precalculated Fibonacci numbers up to index 46. That means that calculations are not necessary for Fibonacci numbers that fit into the range of TeX numbers. Because macro \fibnum is expandable, it cannot store calculated Fibonacci numbers for later use. Macro definitions are forbidden in expandable contexts. If larger Fibonacci numbers are used more than once, than the compilation time can be shortened by calculating and storing the Fibonacci numbers beforehand. The argument $\langle index \rangle$ is a TeX number and macro \fibnumPreCalc ensures that the Fibonacci numbers F_0 up to $F_{|\langle index \rangle|}$ that are not already known are calculated and stored in internal macros. Internally only non-negative Fibonacci numbers are stored. If $\langle index \rangle$ is negative, then the needed positive Fibonacci numbers are calculated and stored. Example:

```
\fibnumPreCalc{50} \\ % calculates and stores the values for indexes 47..50. \\ (Values for 0..46 are already stored by the package.) \\ fibnum{49} \\ % uses the stored value \\ fibnumPreCalc{100} \\ % calculates and stores the values for indexes 51..100 \\ fibnum{100} \\ % uses the stored value for F_{100} \\ fibnum{-100} \\ % uses the stored value for F_{100} \\ fibnum{-100} \\ % uses the stored value for F_{100} \\ % F_{-100} = -F_{100} according to equation (1).
```

2 Implementation

2.1 Identification

```
1 (*package)
Reload check, especially if the package is not used with LATEX.
 2 \begingroup\catcode61\catcode48\catcode32=10\relax%
    \catcode13=5 % ^^M
    \endlinechar=13 %
    \catcode35=6 % #
 5
    \catcode39=12 % '
 6
    \colored{12\%}
    \catcode45=12 % -
    \catcode46=12 % .
 10
    \catcode58=12 % :
    \catcode64=11 % @
 11
    \catcode123=1 % {
 12
    \catcode125=2 % }
 13
    \expandafter\let\expandafter\x\csname ver@fibnum.sty\endcsname
 14
    \ifx\x\relax % plain-TeX, first loading
 15
 16
      \def\empty{}%
 17
      \ifx\x\empty % LaTeX, first loading,
 18
       % variable is initialized, but \ProvidesPackage not yet seen
 19
 20
 21
       \expandafter\ifx\csname PackageInfo\endcsname\relax
 22
         \def\x#1#2{\%}
          \immediate\write-1{Package #1 Info: #2.}%
 23
         1%
 24
       \else
 25
         \def\x#1#2{\PackageInfo{#1}{#2, stopped}}%
 26
 27
       \x{fibnum}{The package is already loaded}%
 28
       \aftergroup\endinput
 29
 30
```

```
31 \fi
    32 \endgroup%
Package identification:
    33 \begingroup\catcode61\catcode48\catcode32=10\relax%
                     \catcode13=5 % ^^M
   34
                     \endlinechar=13 %
   35
    36 \catcode35=6 % #
    37 \catcode39=12 % '
    38 \catcode40=12 % (
    39 \catcode41=12 %)
    40 \catcode44=12 \%,
    41 \catcode45=12 % -
    42 \catcode46=12 %.
    43 \catcode47=12 % /
                     \catcode58=12 %:
    44
                     \catcode64=11 % @
    45
                      \catcode91=12 % [
    46
    47
                      \catcode93=12 % ]
    48
                      \catcode123=1 % {
    49
                      \catcode125=2 % }
    50
                      \expandafter\ifx\csname ProvidesPackage\endcsname\relax
    51
                              \def\x#1#2#3[#4]{\endgroup}
                                    \immediate\write-1{Package: #3 #4}%
    52
                                    \xdef#1{#4}%
    53
                            }%
    54
                      \else
    55
                              \def\x#1#2[#3]{\endgroup}
    56
                                    #2[{#3}]%
    57
                                    \ifx#1\@undefined
    58
                                           \xdef#1{#3}%
    59
    60
                                    \fi
    61
                                    \inf #1 \operatorname{lax}
                                           \xdef#1{#3}%
    62
    63
                                    ۱fi
                            ጉ%
    64
                    \fi
    65
    66 \expandafter\x\csname ver@fibnum.sty\endcsname
    67 \ProvidesPackage{fibnum}%
                     [2016/05/16 v1.1 Fibonacci numbers (HO)]%
    68
    69 \begingroup\catcode61\catcode48\catcode32=10\relax%
                    \catcode13=5 % ^^M
                    \endlinechar=13 %
    71
    72 \catcode123=1 % {
    73 \catcode125=2 % }
    74 \catcode64=11 % @
                     \def\x{\endgroup
    75
                             \verb|\expandafter| edef| csname FibNum@AtEnd| endcsname{% }
    76
                                     \endlinechar=\the\endlinechar\relax
    77
                                     \catcode13=\the\catcode13\relax
    78
                                    \color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\t
    79
                                     \catcode35=\the\catcode35\relax
    80
                                     \colored{catcode61=\the\catcode61\relax}
    82
                                     \catcode64=\the\catcode64\relax
    83
                                    \color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=\color=
    84
                                    \color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\the\color=\t
                            }%
    85
    86 }%
    87 \x\catcode61\catcode48\catcode32=10\relax%
    88 \catcode13=5 % ^^M
    89 \endlinechar=13 %
    90 \catcode35=6 % #
    91 \catcode64=11 % @
```

```
92 \catcode123=1 % {
93 \catcode125=2 % }
94 \def\TMP@EnsureCode#1#2{%
    \edef\FibNum@AtEnd{%
     \FibNum@AtEnd
96
97
     \catcode#1=\the\catcode#1\relax
98
    ጉ%
99
    \color= 42\relax
100 }
101 \TMP@EnsureCode{33}{12}%!
102 %\TMP@EnsureCode{36}{3}% $
103 %\TMP@EnsureCode{38}{4}% &
104 \TMP@EnsureCode{40}{12}% (
105 \TMP@EnsureCode{41}{12}%)
106 \TMP@EnsureCode{45}{12}% -
107 \TMP@EnsureCode{46}{12}%.
108 \TMP@EnsureCode{47}{12}% /
109 \TMP@EnsureCode{58}{12}%:
110 \TMP@EnsureCode{60}{12}% <
111 \TMP@EnsureCode{62}{12}% >
112 \TMP@EnsureCode{91}{12}% [
113 %\TMP@EnsureCode{96}{12}%
114 \TMP@EnsureCode{93}{12}% ]
115 %\TMP@EnsureCode{94}{12}% ^ (superscript) (!)
116 %\TMP@EnsureCode{124}{12}% |
117 \edef\FibNum@AtEnd{\FibNum@AtEnd\noexpand\endinput}
2.2
      Package resources
118 \begingroup\expandafter\expandafter\expandafter\endgroup
119 \expandafter\ifx\csname RequirePackage\endcsname\relax
120
    \def\TMP@RequirePackage#1[#2]{%
121
      \begingroup\expandafter\expandafter\expandafter\endgroup
     \expandafter\ifx\csname ver@#1.sty\endcsname\relax
122
       \input #1.sty\relax
123
124
125
    }%
    \TMP@RequirePackage{ltxcmds}[2011/04/18]%
126
    \TMP@RequirePackage{intcalc}[2007/09/27]%
    \TMP@RequirePackage{bigintcalc}[2007/11/11]%
128
129 \else
    \RequirePackage{ltxcmds}[2011/04/18]%
130
    \RequirePackage{intcalc}[2007/09/27]%
    \RequirePackage{bigintcalc}[2007/11/11]%
132
133 \fi
      Setup precalculated values
134 \def\FibNum@temp#1{%
    \expandafter\def\csname FibNum@#1\endcsname
135
136 }
137 \catcode46=9 % dots are ignored
138 \FibNum@temp{0}{0}
139 \FibNum@temp{1}{1}
140 \FibNum@temp{2}{1}
141 \FibNum@temp{3}{2}
142 \FibNum@temp{4}{3}
143 \FibNum@temp{5}{5}
144 \FibNum@temp{6}{8}
145 \FibNum@temp{7}{13}
146 \FibNum@temp{8}{21}
147 \FibNum@temp{9}{34}
148 \FibNum@temp{10}{55}
149 \FibNum@temp{11}{89}
```

```
150 \FibNum@temp{12}{144}
                  151 \FibNum@temp{13}{233}
                  152 \FibNum@temp{14}{377}
                  153 \FibNum@temp{15}{610}
                  154 \FibNum@temp{16}{987}
                  155 \FibNum@temp{17}{1.597}
                  156 \FibNum@temp{18}{2.584}
                  157 \FibNum@temp{19}{4.181}
                  158 \FibNum@temp{20}{6.765}
                  159 \FibNum@temp{21}{10.946}
                  160 \FibNum@temp{22}{17.711}
                  161 \FibNum@temp{23}{28.657}
                  162 \FibNum@temp{24}{46.368}
                  163 \FibNum@temp{25}{75.025}
                  164 \FibNum@temp{26}{121.393}
                  165 \FibNum@temp{27}{196.418}
                  166 \FibNum@temp{28}{317.811}
                  167 \FibNum@temp{29}{514.229}
                  168 \FibNum@temp{30}{832.040}
                  169 \FibNum@temp{31}{1.346.269}
                  170 \FibNum@temp{32}{2.178.309}
                  171 \FibNum@temp{33}{3.524.578}
                  172 \FibNum@temp{34}{5.702.887}
                  173 \FibNum@temp{35}{9.227.465}
                  174 \FibNum@temp{36}{14.930.352}
                  175 \FibNum@temp{37}{24.157.817}
                  176 \FibNum@temp{38}{39.088.169}
                  177 \FibNum@temp{39}{63.245.986}
                  178 \FibNum@temp{40}{102.334.155}
                  179 \FibNum@temp{41}{165.580.141}
                  180 \FibNum@temp{42}{267.914.296}
                  181 \FibNum@temp{43}{433.494.437}
                  182 \FibNum@temp{44}{701.408.733}
                  183 \FibNum@temp{45}{1.134.903.170}
                  184 \FibNum@temp{46}{1.836.311.903}
   \FibNum@max
                  185 \def\FibNum@max{46}
                        Macros for precalculating values
  \fibnumPreCalc
                  186 \def\fibnumPreCalc#1{%
                  187 \expandafter\expandafter\expandafter
                      \FibNum@PreCalc\intcalcNum{#1}/%
                  188
                  189 }
\FibNum@PreCalc
                  190 \def\FibNum@PreCalc#1/{%
                      \ifnum#1<\ltx@zero
                  191
                        \expandafter\FibNum@PreCalc\ltx@gobble#1/%
                  192
                      \else
                  193
                        \ifnum#1>\FibNum@max
                  194
                         \begingroup
                  195
                          \ltx@LocDimenA=#1sp\relax
                  196
                          \countdef\FibNum@i=255\relax
                  197
                          \FibNum@i=\FibNum@max\relax
                  198
                  199
                          \edef\FibNum@temp{%
                           \csname FibNum@\the\FibNum@i\endcsname/%
                  200
                          }%
                  201
                          \advance\FibNum@i by -1\relax
                  202
```

\edef\FibNum@temp{%

203

```
\FibNum@temp
                                                   204
                                                                          \csname FibNum@\the\FibNum@i\endcsname
                                                   205
                                                   206
                                                                       \advance\FibNum@i\ltx@two
                                                   208
                                                   209
                                                                          \expandafter\FibNum@PreCalcAux\FibNum@temp
                                                   210
                                                                    \endgroup
                                                   211
                                                                 ۱fi
                                                   212
                                                             \fi
                                                   213
                                                   214 }
\FibNum@PreCalcAux
                                                   215 \def\FibNum@PreCalcAux#1/#2\fi\{\%
                                                   216
                                                             \verb|\edg| TibNum@temp{\BigIntCalcAdd#1!#2!}| % \\
                                                   217
                                                             \global\expandafter
                                                   218
                                                             219
                                                             \ifnum\FibNum@i=\ltx@LocDimenA
                                                   220
                                                                \xdef\FibNum@max{\the\FibNum@i}\%
                                                   221
                                                   222
                                                   223
                                                                \advance\FibNum@i\ltx@one
                                                   224
                                                                 \expandafter\FibNum@PreCalcAux\FibNum@temp/#1%
                                                   225
                                                   226 }
                                                   2.5
                                                                 Expandable calculations
                              \fibnum
                                                   227 \def\fibnum#1{%
                                                            \romannumeral
                                                             \end{after} \end
                                                   230 }
                  \FibNum@Do
                                                   231 \def\FibNum@Do#1/{%
                                                   232
                                                             \ifnum#1<\ltx@zero
                                                   233
                                                                 \FibNum@ReturnAfterElseFiFi{%
                                                                    \ifodd#1 %
                                                   235
                                                                       \expandafter\expandafter\ltx@zero
                                                   236
                                                                       \expandafter\expandafter\ltx@zero
                                                   237
                                                                       \expandafter\expandafter\expandafter-%
                                                   238
                                                   239
                                                                    \romannumeral
                                                   240
                                                                    \verb|\expandafter\FibNum@Do\ltx@gobble#1/%|
                                                   241
                                                                }%
                                                   242
                                                             \else
                                                   243
                                                                 \ifnum\FibNum@max<#1 %
                                                   244
                                                                    \ltx@ReturnAfterElseFi{%
                                                   245
                                                   246
                                                                       \expandafter
                                                   247
                                                                       \FibNum@ExpCalc\number\expandafter\IntCalcInc\FibNum@max!%
                                                   248
                                                                       \expandafter\expandafter\expandafter/%
                                                   249
                                                                       \csname FibNum@\FibNum@max
                                                                       \expandafter\expandafter\endcsname
                                                   250
                                                                       \expandafter\expandafter\expandafter/%
                                                   251
                                                                       \csname FibNum@\expandafter\IntCalcDec\FibNum@max!%
                                                   252
                                                                       \endcsname/%
                                                   253
                                                                       #1%
                                                   254
                                                                    }%
                                                   255
                                                   257
                                                                    \expandafter\expandafter\expandafter\ltx@zero
```

```
\csname FibNum@#1\expandafter\expandafter\expandafter\expandafter\expandafter\expandafter\expandafter
                                258
                                259
                                     \fi
                                260
                                261 }
\FibNum@ReturnAfterElseFiFi
                                262 \def\FibNum@ReturnAfterElseFiFi#1\else#2\fi\fi{\fi#1}
           \FibNum@ExpCalc
                                263 \def\FibNum@ExpCalc#1/#2/#3/#4\fi\{\%
                                264 \fi
                                265 \ifnum#1=#4 %
                                      \ltx@ReturnAfterElseFi{%
                                266
                                        \verb|\expandafter| expandafter| ltx@zero|
                                267
                                        \BigIntCalcAdd#2!#3!%
                                268
                                269
                                      }%
                                270
                                     \else
                                271
                                      \expandafter\FibNum@ExpCalc
                                272
                                      \number\IntCalcInc#1!%
                                273
                                       \expandafter\expandafter\expandafter/%
                                274
                                      \BigIntCalcAdd#2!#3!/%
                                      #2/#4%
                                275
                                276 \fi
                                277 }
                                278 \FibNum@AtEnd%
                                279 \langle /package \rangle
```

3 Test

3.1 Catcode checks for loading

```
280 (*test1)
281 \catcode`\{=1 %
282 \catcode`\}=2 %
283 \catcode`\#=6 %
284 \catcode`\@=11 %
285 \expandafter\ifx\csname count@\endcsname\relax
286 \countdef\count@=255 %
288 \expandafter\ifx\csname @gobble\endcsname\relax
290 \fi
291 \expandafter\ifx\csname @firstofone\endcsname\relax
292 \long\def\@firstofone#1{#1}%
293 \fi
294 \expandafter\ifx\csname loop\endcsname\relax
295 \expandafter\@firstofone
296 \else
297 \expandafter\@gobble
298 \fi
299 {%
300 \def\loop#1\repeat{\%}
301
     \def\body{#1}\%
     \iterate
302
303 }%
304 \ \def\terate{\%}
    \body
305
306
       \let\next\iterate
307
     \else
       \let\next\relax
```

```
309
     \fi
310
     \next
311
    }%
    \let\repeat=\fi
312
313 }%
314 \def\RestoreCatcodes{}
315 \count@=0 %
316 \loop
    \edef\RestoreCatcodes{%
317
     \RestoreCatcodes
318
     \catcode\the\count@=\the\catcode\count@\relax
319
320 }%
321 \ifnum\count@<255 %
322 \advance\count@ 1 %
323 \repeat
324
325 \def\RangeCatcodeInvalid#1#2{\%
    \count@=#1\relax
326
    \loop
327
328
     \catcode\count@=15 %
    \index(0) = \frac{2}{r}
329
     \advance\count@ 1 %
330
331
    \repeat
332 }
333 \def\RangeCatcodeCheck#1#2#3{%
    \count@=#1\relax
335
    \loop
336
     \ifnum#3=\catcode\count@
337
     \else
338
       \errmessage{%
        Character \the\count@\space
339
        with wrong catcode \theta \subset \
340
341
        instead of \number#3%
      }%
342
     \fi
343
    344
     \advance\count@ 1 %
346
    \repeat
347 }
348 \def\space{} 
349 \expandafter\ifx\csname LoadCommand\endcsname\relax
350 \def\LoadCommand{\input fibnum.sty\relax}%
351 \fi
352 \left\{ \text{Test} \right\}
353
    \RangeCatcodeInvalid{0}{47}%
354
    \RangeCatcodeInvalid{58}{64}%
    \RangeCatcodeInvalid{91}{96}%
356
    \RangeCatcodeInvalid{123}{255}%
357
    \catcode`\@=12 %
    \color=0 \%
358
    \catcode`\%=14 %
359
360 \LoadCommand
361 \RangeCatcodeCheck{0}{36}{15}%
362 \RangeCatcodeCheck{37}{37}{14}%
363 \RangeCatcodeCheck{38}{47}{15}%
364 \RangeCatcodeCheck{48}{57}{12}%
365 \RangeCatcodeCheck{58}{63}{15}%
366 \RangeCatcodeCheck{64}{64}{12}%
367 \RangeCatcodeCheck{65}{90}{11}%
\RangeCatcodeCheck{92}{92}{0}%
369
    \RangeCatcodeCheck{93}{96}{15}%
```

```
\RangeCatcodeCheck{97}{122}{11}%
371
    \RangeCatcodeCheck{123}{255}{15}%
372
    \RestoreCatcodes
373
374 }
375 \Test
376 \csname @@end\endcsname
377 \end
378 (/test1)
```

```
Test calculations
3.2
379 (*test-calc)
380 \catcode^{=1 \%}
381 \catcode`\}=2 %
382 \catcode`\#=6 %
383 \catcode`\@=11 %
384 \begingroup\expandafter\expandafter\expandafter\endgroup
385 \expandafter\ifx\csname RequirePackage\endcsname\relax
386 \input fibnum.sty\relax
387 \else
388 \RequirePackage{fibnum}[2016/05/16]%
389 \fi
390 \def\TestSet{%
391 \test{0}{0}%
392 \test{1}{1}%
393 \test{2}{1}%
394 \test{3}{2}%
395 \test{4}{3}%
396 \test{5}{5}%
397 \test{6}{8}%
398 \test{7}{13}%
    \test{8}{21}%
399
    \text{test}\{9\}\{34\}\%
400
    \test{10}{55}%
401
402
    \test{11}{89}%
403
    \test{12}{144}%
    \test{13}{233}%
405
    \test{14}{377}%
406
    \test{15}{610}%
407
    \test{16}{987}%
    \test{17}{1597}%
408
    \test{18}{2584}%
409
410 \test{19}{4181}%
411 \test{20}{6765}%
412 \test{21}{10946}%
413 \test{22}{17711}%
414 \test{23}{28657}%
415 \test{24}{46368}%
416 \test{25}{75025}%
417 \test{26}{121393}%
418 \test{27}{196418}%
419
    \test{28}{317811}%
    \test{29}{514229}%
420
    \test{30}{832040}%
421
    \test{31}{1346269}%
422
    \test{32}{2178309}%
423
    \test{33}{3524578}%
424
    \test{34}{5702887}%
426
    \test{35}{9227465}%
427
    \test{36}{14930352}%
428
    \test{37}{24157817}%
    \test{38}{39088169}%
429
```

\test{39}{63245986}%

430

```
\test{40}{102334155}%
431
     \test{41}{165580141}%
432
    \test{42}{267914296}%
433
    \test{43}{433494437}%
    \test{44}{701408733}%
435
436
    \test{45}{1134903170}%
437
    \test{46}{1836311903}%
438
    \test{47}{2971215073}%
    \text{test}\{48\}\{4807526976\}\%
439
    \test{49}{7778742049}%
440
    \test{50}{12586269025}%
441
    \test{51}{20365011074}%
442
    \test{52}{32951280099}%
443
    \test{53}{53316291173}%
444
    \test{54}{86267571272}%
445
    \test{55}{139583862445}%
446
447
    \test{56}{225851433717}%
    \test{57}{365435296162}%
448
    \text{test}{58}{591286729879}\%
449
450
    \test{59}{956722026041}%
451
    \test{60}{1548008755920}%
    \test{61}{2504730781961}%
452
     \test{62}{4052739537881}%
453
     \test{63}{6557470319842}%
454
     \test{64}{10610209857723}%
455
    \test{65}{17167680177565}%
457
    \test{66}{27777890035288}%
458
    \test{67}{44945570212853}%
    \text{test}\{68\}\{72723460248141\}\%
459
    \test{69}{117669030460994}%
460
    \test{70}{190392490709135}%
461
    \test{71}{308061521170129}%
462
463
    \test{72}{498454011879264}%
    \test{73}{806515533049393}%
464
465 }
466 \def\msg#{\immediate\write16}
467 \def\test#1#2{%
468
    \text{TestAux}\{\#1\}\{\#2\}\%
    \lim#1=0 %
469
470
     \else
      \ifodd#1 %
471
       \TestAux{-#1}{#2}%
472
      \else
473
474
        \TestAux{-#1}{-#2}%
475
      \fi
476
    \fi
477 }
478 \def\TestAux#1#2{%
    \def\Expected{#2}%
480
     \verb|\expandafter| expandafter| def|
     \verb|\expandafter| expandafter| expandafter| Result
481
    \expandafter\expandafter\expandafter{%
482
      \left\{ 1\right\} 
483
    }%
484
    \ltx@onelevel@sanitize\Result
485
486
     \ifx\Result\Expected
487
      msg{* #1: ok.}%
488
489
      \mbox{msg}\{! \mbox{ fib}(\#1) = \#2\}\%
      \errmessage{fib(#1) <> \Result}%
490
    \fi
491
492 }
```

```
493 \TestSet
494 \setbox0=\hbox{%
495 \msg{* PreCalc{73}}%
496 \fibnumPreCalc{73}}%
497 }
498 \ifdim\wd0=0pt
499 \else
500 \errmessage{Unwanted stuff in PreCalc}%
501 \fi
502 \TestSet
503 \csname @@end\endcsname\end
504 \( /test-calc \)
```

4 Installation

4.1 Download

Package. This package is available on CTAN¹:

CTAN:macros/latex/contrib/oberdiek/fibnum.dtx The source file.

CTAN:macros/latex/contrib/oberdiek/fibnum.pdf Documentation.

Bundle. All the packages of the bundle 'oberdiek' are also available in a TDS compliant ZIP archive. There the packages are already unpacked and the documentation files are generated. The files and directories obey the TDS standard.

CTAN:install/macros/latex/contrib/oberdiek.tds.zip

TDS refers to the standard "A Directory Structure for TEX Files" (CTAN:tds/tds.pdf). Directories with texmf in their name are usually organized this way.

4.2 Bundle installation

Unpacking. Unpack the oberdiek.tds.zip in the TDS tree (also known as texmf tree) of your choice. Example (linux):

```
unzip oberdiek.tds.zip -d ~/texmf
```

Script installation. Check the directory TDS:scripts/oberdiek/ for scripts that need further installation steps. Package attachfile2 comes with the Perl script pdfatfi.pl that should be installed in such a way that it can be called as pdfatfi. Example (linux):

```
chmod +x scripts/oberdiek/pdfatfi.pl
cp scripts/oberdiek/pdfatfi.pl /usr/local/bin/
```

4.3 Package installation

Unpacking. The .dtx file is a self-extracting docstrip archive. The files are extracted by running the .dtx through plain T_FX:

```
tex fibnum.dtx
```

TDS. Now the different files must be moved into the different directories in your installation TDS tree (also known as texmf tree):

```
\label{linear_control_control_control} \begin{array}{ll} \text{fibnum.sty} & \rightarrow \text{tex/generic/oberdiek/fibnum.sty} \\ \text{fibnum.pdf} & \rightarrow \text{doc/latex/oberdiek/fibnum.pdf} \\ \text{test/fibnum-test1.tex} & \rightarrow \text{doc/latex/oberdiek/test/fibnum-test1.tex} \\ \text{test/fibnum-test-calc.tex} & \rightarrow \text{doc/latex/oberdiek/fibnum-test-calc.tex} \\ \text{fibnum.dtx} & \rightarrow \text{source/latex/oberdiek/fibnum.dtx} \end{array}
```

¹http://ctan.org/pkg/fibnum

If you have a docstrip.cfg that configures and enables docstrip's TDS installing feature, then some files can already be in the right place, see the documentation of docstrip.

4.4 Refresh file name databases

If your TEX distribution (teTEX, mikTEX, ...) relies on file name databases, you must refresh these. For example, teTEX users run texhash or mktexlsr.

4.5 Some details for the interested

Unpacking with LATEX. The .dtx chooses its action depending on the format:

plain T_EX: Run docstrip and extract the files.

LATEX: Generate the documentation.

If you insist on using LATEX for docstrip (really, docstrip does not need LATEX), then inform the autodetect routine about your intention:

latex \let\install=y\input{fibnum.dtx}

Do not forget to quote the argument according to the demands of your shell.

Generating the documentation. You can use both the .dtx or the .drv to generate the documentation. The process can be configured by the configuration file ltxdoc.cfg. For instance, put this line into this file, if you want to have A4 as paper format:

\PassOptionsToClass{a4paper}{article}

An example follows how to generate the documentation with pdfIATEX:

pdflatex fibnum.dtx bibtex fibnum.aux makeindex -s gind.ist fibnum.idx pdflatex fibnum.dtx makeindex -s gind.ist fibnum.idx pdflatex fibnum.dtx

5 History

[2012/04/08 v1.0]

• First version.

[2016/05/16 v1.1]

• Documentation updates.

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