

xfor v1.01: Reimplementation of `\@for` to allow premature termination of the loop

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1 Introduction

The `xfor` package redefines `\@for` so that the loop can be prematurely terminated, akin to C/Java's `break` statement except that the loop will terminate at the *end* of the current iteration. The syntax for `\@for` remains the same:

```
\@for<cmd>:=<list>\do{<body>}
```

where `<cmd>` is a command name that is assigned to the current element of the list given by `<list>` at each iteration.

```
\@endfortrue
```

To terminate the loop at the end of the current iteration, use the command `\@endfortrue`. This command may be used anywhere in `<body>`, but will only take effect at the end of the current iteration. The remainder of the list is stored in `\@forremainder`. You can test whether the loop was prematurely terminated using the conditional `\if@endfor`.

```
\@forremainder
```

```
\if@endfor
```

1.1 Example (ordered insertion)

Suppose you have list of sorted numbers stored in the command `\mylist`, e.g.:

```
\def\mylist{1,3,5,7,8,12,15,20}
```

and you want to insert a new value given by the command `\newval`, e.g.

```
\def\newval{11}
```

in the correct order. You can use `\@for` to iterate through each element in the sorted list, testing the value against the new value to be inserted. Once the new value has been inserted, the loop can be terminated, and any remaining elements can be appended to the new list. The following defines the command `\insertinto{⟨new val⟩}{⟨list⟩}` which uses this method:

```
\newcommand{\insertinto}[2]{%
\def\nlst{}%
\@for\n:=#2\do{%
% store new list in \toks@
\expandafter\toks@\expandafter{\nlst}%
% test current value against new value
\ifnum\n>#1\relax
\edef\newstuff{\number#1,\n}%
% end for loop at the end of this iteration
\@endfortrue
\else
\edef\newstuff{\n}%
\fi
% append new stuff to new list
\ifx\nlst\empty
\edef\nlst{\newstuff}%
\else
\edef\nlst{\the\toks@,\newstuff}%
\fi
}%
% check to see if for loop was prematurely terminated
\if@endfor
% loop may have been terminated during final iteration, in
% which case \@forremainder is empty.
\ifx\@forremainder\empty
% do nothing
\else
% loop prematurely ended, append remainder of original list
% to new list
\expandafter\toks@\expandafter{\nlst}%
\edef\nlst{\the\toks@,\@forremainder}%
\fi
\else
% wasn't prematurely terminated, so new value hasn't been added
% add now.
\expandafter\toks@\expandafter{\nlst}%
\ifx\nlst\empty
\edef\nlst{\number#1}%
\else
\edef\nlst{\the\toks@,\number#1}%
\fi
\fi
\let#2=\nlst
}
```

The `\insertinto` macro can then be used as follows:

```
\def\mylist{1,2,5,9,12,15,18,20}%
\def\newval{11}%
Original list: \mylist. New value: \newval.

\insertinto{\newval}{\mylist}
New list: \mylist.
```

1.2 Example (numerical insertion sort)

Care needs to be taken when nesting `\@for`-loops. Suppose you have a list of unsorted numbers, say

```
\def\mylist{4,2,7,1,10,11,20,15}
```

and you want to sort the list in numerical order using an insertion sort method. To do this, a macro needs to be defined which iterates through each element in the unordered list, and the element is then inserted into an ordered list. The previous example described the macro `\insertinto` which does this, but this results in nested `\@for` commands. The `\insertinto` command will need to be grouped to avoid errors:

```
\newcommand*{\insertionsort}[1]{%
\def\sortedlist{}%
\@for\val:=#1\do{{\insertinto{\val}{\sortedlist}}}%
\let#1=\sortedlist
}
```

This won't work with the definition of `\insertinto` as given in the previous section, as the grouping causes the definition of the sorted list to be localised to that group. Replacing

```
\let#2=\nlst
```

with

```
\global\let#2=\nlst
```

at the end of the definition of `\insertinto` will fix that.

2 The Code

Declare package:

```
\NeedsTeXFormat{LaTeX2e}
\ProvidesPackage{xfor}[2007/07/11 v1.01 (NLCT)]
```

Define a switch to determine if the for loop should be terminated:

```
\if@endfor
```

```
\newif\if@endfor
```

Redefine `\@for`, so that it resets `\if@endfor` and `\@forremainder`:

```

\@for
    \long\def\@for#1:=#2\do#3{%
    \@endforfalse
    \def\@forremainder{}%
    \expandafter\def\expandafter\@fortmp\expandafter{#2}%
    \ifx\@fortmp\@empty
    \else
        \expandafter\@forloop#2,\@nil,\@nil\@#1{#3}%
    \fi
    }

```

Redefine \@fornoop to be a long command:

```

\@fornoop
    \long\def\@fornoop#1\@#2#3{}

```

Redefine \@forloop to check for \if@endfor:

```

\@forloop
    \long\def\@forloop#1,#2,#3\@#4#5{%
    \def#4{#1}%
    \ifx#4\@nnil
    \else
        #5%
        \if@endfor
            \@iforgatherrest#2,#3%
        \else
            \def#4{#2}%
            \ifx#4\@nnil
            \else
                #5%
                \if@endfor
                    \@iforgatherrest#3%
                \else
                    \@iforloop#3\@#4{#5}%
                \fi
            \fi
        \fi
    \fi
}

```

Get remainder of list (stores in \@forremainder):

```

\@forgatherrest
    \long\def\@forgatherrest#1,\@nil,\@nil{\def\@forremainder{#1}}

```

As above, but there may not be anything before \@nil:

```

\@iforgatherrest
    \long\def\@iforgatherrest#1,\@nil,\@nil{%
    \def\@fortmp{#1}%
    \ifx\@fortmp\@empty
        \def\@forremainder{}%
    \else
        \@forgatherrest#1\@nil,\@nil
    \fi
}

```

```
\fi
}
```

Redefine \@iforloop to check \if@endfor:

```
\@iforloop
\long\def\@iforloop#1,#2\@#3#4{%
\def#3{#1}%
\ifx#3\@nnil
\let\@ifornext\@fornoop
\else
#4\relax
\if@endfor
\@iforgatherrest#2\relax
\let\@ifornext\@fornoop
\else
\let\@ifornext\@iforloop
\fi
\fi
\@ifornext#2\@#3{#4}%
}
```

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Numbers written in *italic* refer to the page where the corresponding entry is described; numbers underlined refer to the definition; numbers in **roman** refer to the pages where the entry is used.

| | | | | | | | | |
|-----------------|-----------|-------------|------------------|------------|----------|------------|-------|-------------|
| Symbols | | | | | | | | |
| | \@forloop | | <u>4</u> | \@iforloop | | <u>5</u> | | |
| \@endfortrue | | <i>1</i> | \@fornoop | | <u>4</u> | | | |
| \@for | | <i>1, 4</i> | \@forremainder | | <i>1</i> | I | | |
| \@forgatherrest | | <u>4</u> | \@iforgatherrest | ... | <u>4</u> | \if@endfor | | <i>1, 3</i> |