# LATEX Table Management\*

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## Contents

	Main commands		
	1.1	The command \@starttoc	3
	1.2	The command \addcontentsline	3
	1.3	The command \addtocontents	4
	1.4	The command \contentsline	4
		The command \@dottedtocline	
	1.6	The command \(\numberline\)	6
2	Conclusion		
	2.1	traditional way	7
		titletoc package	

## 1 Main commands

The main commands for making a table of contents are:

```
1 * \@starttoc{<ext>}
2
3 * \addcontentsline{}{<tpe>}{<entry>}
4
5 * \addtocontents{}{<text>}
6
7 * \contentsline{<type>}{<entry>}{<page>}{<hyperref option>}
8
9 * \@dottedtocline{<level>}{<indent>}{<numwidth>}{<title>}{<page>}
10
11 * \numberline{<number>}
```

Firstly, we need to know that what is **contents(table)**? Then we could know what the following commands will operator will. It is a file with extension .toc, .lof, .lot, etc. which contains the information about the table of contents, list of figures, list of tables, etc. respectively.

<sup>\*</sup>All implement can be found in "latex.ltx"

When and How does these commands add these contentsline? If you see the definition of \@sect, you will see:

```
1 \def\@sect#1#2#3#4#5#6[#7]#8{%
     \ifdim \@tempskipa>\z@
 3
 4
5
       \csname #1mark\endcsname{#7}%
 6
       \addcontentsline{toc}{#1}{% The key command lies here !!
 7
         \ifnum #2>\c@secnumdepth \else
 8
           \protect\numberline{\csname the#1\endcsname}%
9
         \fi
10
         #7}%
    \else
11
12
       \def\@svsechd{%
13
         \addcontentsline{toc}{#1}{% The key command lies here !!
14
15
           \ifnum #2>\c@secnumdepth \else
16
             \protect\numberline{\csname the #1\endcsname}%
17
           \fi
18
           #7}}%
19
    \fi
20
    \ensuremath{\texttt{0xsect}}
21
22 % Remark:
23 % * counter definition: \newcount\c@secnumdepth
                           \newcount\c@tocdepth
```

To see these counter values, use:

```
1 \makeatletter
2 \the\c@tocdepth
3 \the\c@secnumdepth
4
5 \setcounter{tocdepth}{2}
6 \setcounter{secnumdepth}{5}
7 \the\c@tocdepth
8 \the\c@secnumdepth
9 \makeatother
10
11 % Result:
12 % 3 3 2 5
```

Please use commands \newcount only in package code and with much care. The other counter is used in command \@dottedtocline, see:

```
1 \def\@dottedtocline#1#2#3#4#5{%
2 \ifnum #1>\c@tocdepth \else
3 ...}
```

Almost all the section commands, like \section, \subsection, etc. are defined by \@sect. Thus they will call this command to add the contentsline. Something like:

```
1 \contentsline {section}{\numberline {1}<sse I>}{<page>}{}%
2 \contentsline {subsection}{\numberline {1.1}<sss I>}{<page>}{}%
3 \contentsline {subsection}{\numberline {1.2}<sss II>}{<page>}{}%
4 \contentsline {subsection}{\numberline {1.3}<sss III>}{<page>}{}%
5
6 % Remark:
7 % * The \numberline was added for that '\ifnum #2 < \c@secnumdepth'
If you load package 'hyperref', then the ToC file will look like:
1 \contentsline {section}{<sse I>s}{<page>}{subsection.1}%
2 \contentsline {subsection}{<sss I>}{<page>}{subsection.1.1}%
3 \contentsline {subsection}{<sss II>}{<page>}{subsection.1.2}%
4 \contentsline {subsection}{<sss III>}{<page>}{subsection.1.3}%
```

## 1.1 The command \@starttoc

This command can be used to define \tableofcontents, \listoffigures etc. For example:

- \@starttoc{lof} is used in \listoffigures.
- \@starttoc{lot} is used in \listoftables.
- \@starttoc{toc} is used in \tableofcontents.

The full definition of this command is:

```
1 \def\@starttoc#1{%
2
    \begingroup
      \makeatletter
3
4
      \Cinput{\jobname.#1}% The key command lies here !!
5
      \if@filesw
6
        \expandafter\newwrite\csname tf@#1\endcsname
7
        \immediate\openout \csname tf@#1\endcsname \jobname.#1\relax
8
      \fi
9
      \@nobreakfalse
10
    \endgroup}
```

### 1.2 The command \addcontentsline

Usually, user have to use this command to add her/his own entries to the table of contents. The syntax is:

```
1 \addcontentsline{}{<type>}{<entry>}
```

What does this command do for us? For example, after use command:

```
1 \addcontentsline{toc}{chapter}{References}
2 \addcontentsline{toc}{chapter}{Index}
```

There will be two entries(lines) in file: \jobname.toc as follows:

```
1 % The last empty brace is for hyperref option
2 \contentsline {chapter}{References}{1}{}%
3 \contentsline {chapter}{Index}{1}{}%
```

Thus you can simply see this command as:  $\addcontentsline = add + \contentsline$  The full definition of this command is:

```
1 \def\addcontentsline#1#2#3{%
2   \addtocontents{#1}{\protect\contentsline{#2}{#3}{\thepage}{}%
3   \protected@file@percent}}
4
5 % Remark:
6 % * \protected@file@percent:a percent sign in toc file
```

#### 1.3 The command \addtocontents

This command just add a text to the file without any manipulation. Thus if you use a command like:

```
1 \addtocontents{toc}{something to be added}
```

There will be a line in toc file, something like:

```
1 \contentsline {<type-1>}{<entry-1>}{<page-1>}{}
2 something to be added
3 \contentsline {<type-2>}{<entry-2>}{<page-2>}{}
```

The full definition is:

```
1 \long\def\addtocontents#1#2{%
2 \protected@write\@auxout
3 {\let\label\@gobble \let\index\@gobble \let\glossary\@gobble}%
4 {\string\@writefile{#1}{#2}}}% The key command lies here !!
```

Thus you can add any text to not only toc file but also lof, lot, etc. by using this command.

## 1.4 The command \contentsline

This commands lies in the file, it is not a command in normal context. But if you want to add the contentsline manually, you can use this command in some places, such as the very beginning of document, chapter, etc.

**Remark**: The fourth argument is used when 'hyperref' was loaded. This argument is saveed in a macro \@contentsline@destination.

The full definition is:

```
1 \def\contentsline#1#2#3#4{\gdef\@contentsline@destination{#4}%
2 \csname l@#1\endcsname{#2}{#3}}
3
4 % By default:
5 \let\@contentsline@destination\@empty
```

\csname 10#1\endcsname is the old interface for creating. They are defined in each document class. In article.cls, they are defined as:

```
1 \newcommand*\l@section[2]{%
     \ifnum \c@tocdepth >\z@
3
       \addpenalty\@secpenalty
       \addvspace{1.0em \@plus\p@}%
 5
       \setlength\@tempdima{1.5em}%
 6
       \begingroup
 7
         \parindent \z@ \rightskip \@pnumwidth
8
         \parfillskip -\@pnumwidth
         \leavevmode \bfseries
9
10
         \advance\leftskip\@tempdima
         \hskip -\leftskip
11
12
         #1\nobreak\hfil
13
         \nobreak\hb@xt@\@pnumwidth{\hss #2%
14
                                     \kern -\p@\kern\p@}\par
15
       \endgroup
16
    \fi}
17 \newcommand*\l@subsection{\@dottedtocline{2}{1.5em}{2.3em}}
18 \newcommand*\l@subsubsection{\@dottedtocline\{3\}\{3.8em\}\{3.2em\}\}
19 \mbox{\ newcommand } \mbox{\ l@paragraph {\ dottedtocline {4}}{7.0em}{4.1em}}
20 \newcommand*\l@subparagraph{\@dottedtocline{5}{10em}{5em}}
```

## 1.5 The command \@dottedtocline

This command is used to create a dotted line in table of contents, for sections, for figures, for tables, etc. If we'd like to custom this dotted line, just modify these 4 arguments. The full definition is:

```
1 \def\@dottedtocline#1#2#3#4#5{%
    \ifnum #1>\c@tocdepth \else
 3
      \vskip \z0 \@plus.2\p0
 4
      {\leftskip #2\relax \rightskip \@tocrmarg \parfillskip -\rightskip
 5
         \parindent #2\relax\@afterindenttrue
 6
         \interlinepenalty\@M
 7
         \leavevmode
8
         \@tempdima #3\relax
9
         \advance\leftskip \@tempdima \null\nobreak\hskip -\leftskip
10
         {#4}\nobreak
         \leaders\hbox{$\m@th
11
             \mkern \@dotsep mu\hbox{.}\mkern \@dotsep
12
13
             mu$}\hfill
14
         \nobreak
15
         \hb@xt@\@pnumwidth{\hfil\normalfont \normalcolor #5}%
16
         \par}%
17
18 \def\numberline#1{\hb@xt@\@tempdima{#1\hfil}}
```

When and How this command generate the dotted line? This commands has not been used in latex.ltx but in some other basic document class, such as article class, book class, etc. See the usage in article.cls:

```
1 \newcommand*\l@section[2]{%
     \ifnum \c@tocdepth >\z@
 3
       \addpenalty\@secpenalty
       \addvspace{1.0em \@plus\p@}%
 4
 5
       \setlength\@tempdima{1.5em}%
 6
       \begingroup
 7
         \parindent \z@ \rightskip \@pnumwidth
8
         \parfillskip -\@pnumwidth
         \leavevmode \bfseries
9
10
         \advance\leftskip\@tempdima
         \hskip -\leftskip
11
12
         #1\nobreak\hfil
         \nobreak\hb@xt@\@pnumwidth{\hss #2%
13
14
                                      \kern - \p@\kern \p@}\par
15
       \endgroup
16
     \fi}
17 \newcommand*\l@subsection{\@dottedtocline{2}{1.5em}{2.3em}}
18 \newcommand*\l@subsubsection{\@dottedtocline\{3\}\{3.8em\}\{3.2em\}\}
19 \mbox{\ensuremath{\mbox{\command}$*\lower.1@paragraph{\ensuremath{\mbox{\command}$$}$}{0.0em}{0.1em}} \
20 \newcommand*\l@subparagraph{\@dottedtocline{5}{10em}{5em}}
21 \newcommand\listoffigures{%
22
       \section * {\listfigurename} %
23
         \@mkboth{\MakeUppercase\listfigurename}%
24
                  {\MakeUppercase\listfigurename}%
25
       \@starttoc{lof}%
26
       }
27 \newcommand*\l@figure{\@dottedtocline{1}{1.5em}{2.3em}}
28 \newcommand\listoftables{%
29
       \section * {\listtablename} %
30
         \@mkboth{%
31
              \MakeUppercase\listtablename}%
32
           {\MakeUppercase\listtablename}%
33
       \@starttoc{lot}%
       }
35 \let\l@table\l@figure
```

**Remark**: This command defines the page number format, the number align, the number width, the number color. See the following definition:

```
1 \def\@dottedtocline#1#2#3#4#5{%
2 ...
3 \hb@xt@\@pnumwidth{\hfil\normalfont \normalcolor #5}%
4 ...
5 }
```

#### 1.6 The command \numberline

This command is simple to use. This command pull page number to right most in a box of width \@tempdim. The full definition is:

```
1 % \hb@xt@ = \hbox to
2 \def\numberline#1{\hb@xt@\@tempdima{#1\hfil}}
```

**Remark**: This command is the left label(such as 1.1, 1.1.1, etc.) in , Thus we can redefine this command the modify the left margin of toc, lof, lot entries.

## 2 Conclusion

### 2.1 traditional way

Then we can see how the table is generated in LATEX:

- Firstly, In each section command, the \addcontentsline will be called, then a line will be added to the file.
  - For the command \contentsline in the file, the \csname 10#1\endcsname will be called. The first 3 arguments of command \@dottedtocline are provided by it.
  - o Then the \@dottedtocline will be called by \csname 10#1\endcsname. The "entry label(like 1.1, 1.1.1, etc) + entry name"[2nd in \contentsline, 4th in \@dottedtocline] and "page number"[3rd in \contentsline, 5th in \@dottedtocline] will be grabbed by this command.
  - o If package "hyperref" is loaded, then the last argument of \contentsline will be saved in a macro \@contentsline@destination, which will be used by hyperref package in the future.
  - o The "entry label" will be packed in a box of width @tempdima, "entry name" will follow the "entry label" out of the box. Then they will be put in the left side of the line; The page number will also be packed in a box of width \@pnumwidth and a dotted line will be added by command \leaders\hbox{\$<item>\$}\nobreak.
- Secondly, In the \@starttoc{toc} command will be called by \tableofcontents,
- Finally, file will be inputed and the contents will be shown in the document.

#### 2.2 titletoc package

If you use package 'titletoc' package or 'titlesec' package, then there will be something defferent.