

DocOnce Quick Reference

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WARNING: This quick reference is very incomplete!

Mission. Enable writing documentation with much mathematics and computer code *once, in one place* and include it in traditional \LaTeX books, thesis, and reports, and without extra efforts also make professionally looking web versions with Sphinx or HTML. Other outlets include Google's `blogspot.com`, Wikipedia/Wikibooks, IPython notebooks, plus a wide variety of formats for documents without mathematics and code.

0.1 Supported Formats

DocOnce currently translates files to the following formats:

- \LaTeX (format `latex` and `pdflatex`)
- HTML (format `html`)
- reStructuredText (format `rst`)
- plain (untagged) ASCII (format `plain`)
- Sphinx (format `sphinx`)
- IPython notebook (format `ipynb`)
- MediaWiki (format `mwiki`)
- (Pandoc extended) Markdown (format `pandoc`)
- Googlecode wiki (format `gwiki`)
- Creoloe wiki (format `cwiki`)
- Epydoc (format `epyd`)
- StructuredText (format `st`)

For documents with much code and mathematics, the best (and most supported) formats are `latex`, `pdflatex`, `sphinx`, and `html`; and to a slightly less extent `mwiki` and `pandoc`. The HTML format supports blog posts on Google and Wordpress.

0.2 Emacs syntax support

The file `.doconce-mode.el` in the DocOnce source distribution gives a "DocOnce Editing Mode" in Emacs. Store the raw version of the file in the home directory and add `(load-file "~/doconce-mode.el")` to the `.emacs` file.

Besides syntax highlighting of DocOnce documents, this Emacs mode provides a lot of shortcuts for setting up many elements in a document:

Emacs key	Action
Ctrl+c f	figure
Ctrl+c v	movie/video
Ctrl+c h1	heading level 1 (section/h1)
Ctrl+c h2	heading level 2 (subsection/h2)
Ctrl+c h3	heading level 2 (subsection/h3)
Ctrl+c hp	heading for paragraph
Ctrl+c me	math environment: !bt equation !et
Ctrl+c ma	math environment: !bt align !et
Ctrl+c ce	code environment: !bc code !ec
Ctrl+c cf	code from file: @@@CODE
Ctrl+c table2	table with 2 columns
Ctrl+c table3	table with 3 columns
Ctrl+c table4	table with 4 columns
Ctrl+c exer	exercise outline
Ctrl+c slide	slide outline
Ctrl+c help	print this table

0.3 Title, Authors, and Date

A typical example of giving a title, a set of authors, a date, and an optional table of contents reads

```
TITLE: On an Ultimate Markup Language
AUTHOR: H. P. Langtangen at Center for Biomedical Computing, Simula Research Laboratory & Dept. of Informat.
AUTHOR: Kaare Dump Email: dump@cyb.space.com at Segfault, Cyberspace Inc.
AUTHOR: A. Dummy Author
DATE: today
TOC: on
```

The entire title must appear on a single line. The author syntax is

```
name Email: somename@adr.net at institution1 & institution2
```

where the email is optional, the "at" keyword is required if one or more institutions are to be specified, and the & keyword separates the institutions (the keyword and works too). Each author specification must appear on a single line. When more than one author belong to the same institution, make sure that the institution is specified in an identical way for each author.

The date can be set as any text different from `today` if not the current date is wanted, e.g., Feb 22, 2016.

The table of contents is removed by writing `TOC: off`.

0.4 Section Types

Section type	Syntax
chapter	===== Heading ===== (9 =)
section	===== Heading ===== (7 =)
subsection	===== Heading ===== (5 =)
subsubsection	==== Heading ==== (3 =)
paragraph	__Heading.__ (2 _)
abstract	__Abstract.__ Running text...
appendix	===== Appendix: heading ===== (7 =)
appendix	===== Appendix: heading ===== (5 =)
exercise	===== Exercise: heading ===== (7 =)
exercise	===== Exercise: heading ===== (5 =)

Note that abstracts are recognized by starting with `__Abstract.__` or `__Summary.__` at the beginning of a line and ending with three or more = signs of the next heading.

The `Exercise:` keyword can be substituted by `Problem:` or `Project:`. A recommended convention is that an exercise is tied to the text, a problem can stand on its own, and a project is a comprehensive problem.

0.5 Inline Formatting

Words surrounded by `*` are emphasized: `*emphasized words*` becomes *emphasized words*. Similarly, an underscore surrounds words that appear in boldface: `_boldface_` becomes **boldface**. Colored words are also possible: the text

```
'color{red}{two red words}'
```

becomes **two red words**. Quotations appear inside double backticks and double single quotes:

```
This is a sentence with 'words to be quoted'.
```

A forced linebreak is specified by `<linebreak>` at the point where the linebreak in the output is wanted.

Footnotes use a label in the text with the footnote text separate, preferably after the paragraph where the footnote appears:

```
Differentiating[diff2] (ref{eq1}) leads  
to a new and simpler equation.
```

```
[diff2]: More precisely, we apply the divergence  
$ \nabla \cdot $ on both sides.
```

```
Here comes a new paragraph...
```

Non-breaking space is inserted using the tilde character as in \LaTeX :

```
This distance corresponds to 7.5~km, which is traveled in $7.5/5$~s.
```

0.6 Lists

There are three types of lists: *bullet lists*, where each item starts with *, *enumeration lists*, where each item starts with o and gets consqutive numbers, and *description lists*, where each item starts with - followed by a keyword and a colon.

Here is a bullet list:

```
* item1
* item2
  * subitem1 of item2
  * subitem2 of item2
* item3
```

Note that sublists are consistently indented by one or more blanks..
Here is an enumeration list:

```
o item1
o item2
  may appear on
  multiple lines
o subitem1 of item2
o subitem2 of item2
o item3
```

And finally a description list:

```
- keyword1: followed by
  some text
  over multiple
  lines
- keyword2:
  followed by text on the next line
- keyword3: and its description may fit on one line
```

The code above follows.

Here is a bullet list:

- item1
- item2
 - subitem1 of item2
 - subitem2 of item2
- item3

Note that sublists are indented. Here is an enumeration list:

1. item1
2. item2 may appear on multiple lines
 - (a) subitem1 of item2
 - (b) subitem2 of item2

3. item3

And finally a description list:

keyword1: followed by some text over multiple lines

keyword2: followed by text on the next line

keyword3: and its description may fit on one line

0.7 Comment lines

Lines starting with # are treated as comments in the document and translated to the proper syntax for comments in the output document. Such comment lines should not appear before \LaTeX math blocks, verbatim code blocks, or lists if the formats `rst` and `sphinx` are desired.

Comment lines starting with ## are not propagated to the output document and can be used for comments that are only of interest in the DocOnce file.

Large portions of text can be left out using Preprocess. Just place # `#ifdef EXTRA` and # `#endif` around the text. The command line option `-DEXTRA` will bring the text alive again.

When using the Mako preprocessor one can also place comments in the DocOnce source file that will be removed by Mako before DocOnce starts processing the file.

0.8 Inline comments

Inline comments meant as messages or notes, to authors during development in particular, are enabled by the syntax

```
[name: running text]
```

where `name` is the name or ID of an author or reader making the comment, and `running text` is the comment. Here goes an example. **hpl 1:** *There must be a space after the colon, but the running text can occupy multiple lines.* The inline comments have simple typesetting in most formats, typically boldface name and everything surrounded by parenthesis, but with \LaTeX output and the `-DTOTONOTES` option to `ptex2tex` or `doconce ptex2tex`, colorful margin or inline boxes (using the `todonotes` package) make it very easy to spot the comments.

Running

```
doconce format html mydoc.do.txt --skip_inline_comments
```

removes all inline comments from the output. This feature makes it easy to turn on and off notes to authors during the development of the document.

All inline comments to readers can also be physically removed from the DocOnce source by

```
doconce remove_inline_comments mydoc.do.txt
```

0.9 Verbatim/Computer Code

Inline verbatim code is typeset within back-ticks, as in

```
Some sentence with 'words in verbatim style'.
```

resulting in Some sentence with words in verbatim style.

Multi-line blocks of verbatim text, typically computer code, is typeset in between `!bc xxx` and `!ec` directives, which must appear on the beginning of the line. A specification `xxx` indicates what verbatim formatting style that is to be used. Typical values for `xxx` are nothing, `cod` for a code snippet, `pro` for a complete program, `sys` for a terminal session, `dat` for a data file (or output from a program), `Xpro` or `Xcod` for a program or code snippet, respectively, in programming `X`, where `X` may be `py` for Python, `cy` for Cython, `sh` for Bash or other Unix shells, `f` for Fortran, `c` for C, `cpp` for C++, `m` for MATLAB, `p1` for Perl. For output in latex one can let `xxx` reflect any defined verbatim environment in the `ptex2tex` configuration file (`.ptex2tex.cfg`). For sphinx output one can insert a comment

```
# sphinx code-blocks: pycod=python cod=fortran cppcod=c++ sys=console
```

that maps environments (`xxx`) onto valid language types for Pygments (which is what sphinx applies to typeset computer code).

The `xxx` specifier has only effect for latex and sphinx output. All other formats use a fixed monospace font for all kinds of verbatim output.

Here is an example of computer code (see the source of this document for exact syntax):

```
from numpy import sin, cos, exp, pi
def f(x, y, z, t):
    return exp(-t)*sin(pi*x)*sin(pi*y)*cos(2*pi*z)
```

Computer code can also be copied from a file:

```
@@@CODE doconce_program.sh
@@@CODE doconce_program.sh  fromto: doconce clean~doconce split_rst
@@@CODE doconce_program.sh  from-to: doconce clean~doconce split_rst
@@@CODE doconce_program.sh  enviro=shpro fromto: name=@
```

The `@@@CODE` identifier must appear at the very beginning of the line. The first specification copies the complete file `doconce_program.sh`. The second specification copies from the first line matching the *regular expression* `doconce clean` up to, but not including the line matching the *regular expression* `~doconce split_rst`. The third specification behaves as the second, but the line matching the first regular expression is not copied (aimed at copying text between begin-end comment pair in the file).

The copied lines from file are in this example put inside `!bc shpro` and `!ec` directives, if a complete file is copied, while the directives become `!bc shcod` and `!ec` when a code snippet is copied from file. In general, for a filename extension `.X`, the environment becomes `!bc Xpro` or `!bc Xcod` for a complete program or snippet, respectively. The environments (`Xcod` and `Xpro`) are only

active for `latex`, `pdflatex`, `html`, and `sphinx` output. The fourth specification above specifies the code environment explicitly such that the becomes `shpro` even if we copy a part of the file (here from `name=` until the end of the file).

Important warnings:

- A code block must come after some plain sentence (at least for successful output in `reStructuredText`), not directly after a section/paragraph heading, table, comment, figure, or movie.
- Verbatim code blocks inside lists can be ugly typeset in some output formats. A more robust approach is to replace the list by paragraphs with headings.

0.10 L^AT_EX Mathematics

DocOnce supports inline mathematics and blocks of mathematics, using standard L^AT_EX syntax. The output formats `html`, `sphinx`, `latex`, `pdflatex`, `pandoc`, and `mwiki` work with this syntax while all other formats will just display the raw L^AT_EX code.

Inline expressions are written in the standard L^AT_EX way with the mathematics surrounded by dollar signs, as in $Ax = b$. To help increase readability in other formats than `sphinx`, `latex`, and `pdflatex`, inline mathematics may have a more human readable companion expression. The syntax is like

```
$\sin(\norm{\bf u})$|$\sin(|u|)$
```

That is, the L^AT_EX expression appears to the left of a vertical bar (pipe symbol) and the more readable expression appears to the right. Both expressions are surrounded by dollar signs.

Blocks of L^AT_EX mathematics are written within `!bt` and `!et` (begin/end TeX) directives starting on the beginning of a line:

```
!bt
\begin{align*}
\nabla\cdot\pmb{u} &= 0,\\
\nabla\times\pmb{u} &= 0.
\end{align*}
!et
```

This L^AT_EX code gets rendered as

$$\begin{aligned}\nabla \cdot \boldsymbol{u} &= 0, \\ \nabla \times \boldsymbol{u} &= 0.\end{aligned}$$

Here is a single equation:

```
!bt
\[ \frac{\partial\pmb{u}}{\partial t} + \pmb{u}\cdot\nabla\pmb{u} = 0.\]
!et
```


which results in

$$\frac{\partial \mathbf{u}}{\partial t} + \mathbf{u} \cdot \nabla \mathbf{u} = 0.$$

Any \LaTeX syntax is accepted, but if output in the `sphinx`, `pandoc`, `mwiki`, `html`, or `ipynb` formats is also important, one should follow these rules:

- Use only the equation environments `\[`, `\]`, `equation`, `equation*`, `align`, and `align*`.
- MediaWiki (`mwiki`) does not support references to equations.

(DocOnce performs extensions to `sphinx` and other formats such that labels in `align` environments work well.)

Notice.

\LaTeX supports lots of fancy formatting, for example, multiple plots in the same figure, footnotes, margin notes, etc. Allowing other output formats, such as `sphinx`, makes it necessary to only utilize very standard \LaTeX and avoid, for instance, more than one plot per figure. However, one can use preprocessor if-tests on the format (typically `if FORMAT in ("latex", "pdflatex")`) to include special code for `latex` and `pdflatex` output and more straightforward typesetting for other formats. In this way, one can also allow advanced \LaTeX features and fine tuning of resulting PDF document.

LaTeX Newcommands. The author can define `newcommand` statements in files with names `newcommands*.tex`. Such commands should only be used for mathematics (other \LaTeX constructions are only understood by \LaTeX itself). The convention is that `newcommands_keep.tex` contains the newcommands that are kept in the document, while those in `newcommands_replace.tex` will be replaced by their full \LaTeX code. This conventions helps make readable documents in formats without \LaTeX support. For `html`, `sphinx`, `latex`, `pdflatex`, `mwiki`, `ipynb`, and `pandoc`, the mathematics in newcommands is rendered nicely anyway.

0.11 Hyperlinks

Links use either a link text or the raw URL:

```
Here is some "some link text": "http://some.net/address"
(as in "search google": "http://google.com")
or just the raw address: URL: "http://google.com".
```

Links to files typeset in verbatim mode applies backtics:
`"myfile.py": "http://some.net/some/place/myfile.py".`

Mail addresses works too: send problems to
"hpl@simula.no": "mailto:hpl@simula.no"
or just "send mail": "mailto:hpl@simula.no".

0.12 Figures and Movies

Figures and movies have almost equal syntax:

FIGURE: [relative/path/to/figurefile, width=500 frac=0.8] Here goes the caption which must be on

MOVIE: [relative/path/to/moviefile, width=500] Here goes the caption which must be on a single l

Note three important syntax details:

1. A mandatory comma after the figure/movie filename,
2. no comments between width, height, and frac and no spaces around the = characters,
3. all of the command must appear on a single line,
4. there must be a blank line after the command.

The figure file can be listed without extension. DocOnce will then find the version of the file with the most appropriate extension for the chosen output format. If not suitable version is found, DocOnce will convert another format to the needed one.

The caption is optional. If omitted, the figure will be inlined (meaning no use of any figure environment in HTML or \LaTeX formats). The width and height parameters affect HTML formats (html, rst, sphinx), while frac is the width of the image as a fraction of the total text width in the latex and pdflatex formats.

Movie files can either be a video or a wildcard expression for a series of frames. In the latter case, a simple device in an HTML page will display the individual frame files as a movie.

Combining several image files into one can be done by the

```
doconce combine_images image1 image2 ... output_image
```

This command applies montage or PDF-based tools to combine the images to get the highest quality.

YouTube and Vimeo movies will be embedded in html and sphinx documents and otherwise be represented by a link. The syntax is

MOVIE: [http://www.youtube.com/watch?v=_07iUiftbKU, width=420 height=315] YouTube movie.

MOVIE: [http://vimeo.com/55562330, width=500 height=278] Vimeo movie.

The latter results in

<http://vimeo.com/55562330>

Movie 1: Vimeo movie.

0.13 Tables

The table in Section 0.4 was written with this syntax:

Section type	Syntax
chapter	'===== Heading =====' (9 '=')
section	'===== Heading =====' (7 '=')
subsection	'===== Heading =====' (5 '=')
subsubsection	'=== Heading ===' (3 '=')
paragraph	'__Heading.__' (2 '_')

Note that

- Each line begins and ends with a vertical bar (pipe symbol).
- Column data are separated by a vertical bar (pipe symbol).
- There may be horizontal rules, i.e., lines with dashes for indicating the heading and the end of the table, and these may contain characters 'c', 'l', or 'r' for how to align headings or columns. The first horizontal rule may indicate how to align headings (center, left, right), and the horizontal rule after the heading line may indicate how to align the data in the columns (center, left, right).
- If the horizontal rules are without alignment information there should be no vertical bar (pipe symbol) between the columns. Otherwise, such a bar indicates a vertical bar between columns in \LaTeX .
- Many output formats are so primitive that heading and column alignment have no effect.

The command-line option `--tables2csv` (to `doconce` format) makes DocOnce dump each table to CSV format in a file `table_X.csv`, where `X` is the table number. This feature makes it easy to load tables into spreadsheet programs for further analysis.

0.14 Labels and References

The notion of labels and references (as well as bibliography and index) is adopted from \LaTeX with a very similar syntax. As in \LaTeX , a label can be inserted anywhere, using the syntax

```
label{name}
```

with no backslash preceding the label keyword. It is common practice to choose `name` as some hierarchical name, say `a:b:c`, where `a` and `b` indicate some abbreviations for a section and/or subsection for the topic and `c` is some name for the particular unit that has a label.

A reference to the label `name` is written as

`ref{name}`

again with no backslash before `ref`.

Use labels for sections and equations only, and precede the reference by "Section" or "Chapter", or in case of an equation, surround the reference by parenthesis.

0.15 Citations and Bibliography

Single citations are written as

`cite{name}`

where `name` is a logical name of the reference (again, \LaTeX writers must not insert a backslash). Bibliography citations often have `name` on the form `Author1_Author2_YYYY`, `Author_YYYY`, or `Author1_et al_YYYY`, where `YYYY` is the year of the publication. Multiple citations at once is possible by separating the logical names by comma:

`cite{name1,name2,name3}`

The bibliography is specified by a line `BIBFILE: papers.pub`, where `papers.pub` is a publication database in the [Publish](#) format. \LaTeX `.bib` files can easily be combined to a Publish database (which DocOnce needs to create bibliographies in other formats than \LaTeX).

0.16 Generalized Citations

There is a *generalized referencing* feature in DocOnce that allows a reference with `ref` to have one formulation if the label is in the same document and another formulation if the reference is to an item in an external document. This construction makes it easy to work with many small, independent documents in parallel with a book assembly of some of the small elements. The syntax of a generalized reference is

`ref[internal][cite][external]`

Example:

As explained in
`ref[Section ref{subsec:ex}][in cite{testdoc:12}][a "section":
"testdoc.html#__sec2" in the document
"A Document for Testing DocOnce": "testdoc.html" cite{testdoc:12}]`,
DocOnce documents may include movies.

The output from a generalized reference is the text `internal` if all `ref{label}` references in `internal` are references to labels in the present document. Otherwise, if `cite` is non-empty and the format is `latex` or `pdflatex` one assumes that the references in `internal` are to external documents declared by a comment line `# Externaldocuments: testdoc, mydoc` (usually after the title, authors, and date). In this case the output text is `internal cite` and the \LaTeX package `xr` is used to handle the labels in the external documents. If none of the two situations above applies, the `external` text will be the output.

0.17 Index of Keywords

DocOnce supports creating an index of keywords. A certain keyword is registered for the index by a syntax like (no backslash!)

```
index{name}
```

It is recommended to place any index of this type outside running text, i.e., after (sub)section titles and in the space between paragraphs. Index specifications placed right before paragraphs also gives the doconce source code an indication of the content in the forthcoming text. The index is only produced for the latex, pdflatex, rst, and sphinx formats.

0.18 Capabilities of The Program doconce

The doconce program can be used for a number of purposes besides transforming a .do.txt file to some format. Here is the list of capabilities:

Usage: doconce command [optional arguments]

commands: format help sphinx_dir subst replace replace_from_file clean spellcheck ptex2tex guess_encoding e

```
# transform doconce file to another format
doconce format html|latex|pdflatex|rst|sphinx|plain|gwiki|mwiki|cwiki|pandoc|st|epytex dofile

# substitute a phrase by another using regular expressions
doconce subst [-s -m -x --restore] regex-pattern regex-replacement file1 file2 ...
(-s is the re.DOTALL modifier, -m is the re.MULTILINE modifier,
 -x is the re.VERBOSE modifier, --restore copies backup files back again)

# replace a phrase by another literally
doconce replace from-text to-text file1 file2 ...
(exact text substitution)

# doconce replace using from and to phrases from file
doconce replace_from_file file-with-from-to file1 file2 ...
(exact text substitution, but a set of from-to relations)

# replace all mako function calls by the results of the calls
doconce expand_mako mako_code_file funcname file1 file2 ...

# remove all inline comments in a doconce file
doconce remove_inline_comments dofile

# create a directory for the sphinx format
doconce sphinx_dir author='John Doe' title='Long title' \
    short_title="Short title" version=0.1 intersphinx \
    dirname=sphinx-rootdir theme=default logo=mylogo.png \
    do_file [do_file2 do_file3 ...]
(requires sphinx version >= 1.1)

# walk through a directory tree and insert doconce files as
# docstrings in *.p.py files
doconce insertdocstr rootdir

# remove all files that the doconce format can regenerate
doconce clean

# change encoding
```

```

doconce change_encoding utf-8 latin1 dofile

# guess the encoding in a text
doconce guess_encoding filename

# transform a .bbl file to a .rst file with reST bibliography format
doconce bbl2rst file.bbl

# split a sphinx/rst file into parts
doconce format sphinx complete_file
doconce split_rst complete_file          # !split delimiters
doconce sphinx_dir complete_file
python automake_sphinx.py

# split an html file into parts according to !split commands
doconce split_html complete_file.html

# create HTML slides from a (doconce) html file
doconce slides_html slide_type complete_file.html

# create LaTeX Beamer slides from a (doconce) latex/pdflatex file
doconce slides_beamer complete_file.tex

# replace bullets in lists by colored bullets
doconce html_colorbullets file1.html file2.html ...

# grab selected text from a file
doconce grab --from[-] from-text [--to[-] to-text] somefile > result

# remove selected text from a file
doconce remove --from[-] from-text [--to[-] to-text] somefile > result

# list all figure, movie or included code files
doconce grep FIGURE|MOVIE|CODE dofile

# run spellcheck on a set of files
doconce spellcheck [-d .mydict.txt] *.do.txt

# transform ptex2tex files (.p.tex) to ordinary latex file
# and manage the code environments
doconce ptex2tex mydoc -DMINTED pycod=minted sys=Verbatim \
    dat=\begin{quote}\begin{verbatim};\end{verbatim}\end{quote}

# make HTML file via pandoc from Markdown (.md) file
doconce md2html file.md

# make LaTeX file via pandoc from Markdown (.md) file
doconce md2latex file.md

# combine several images into one
doconce combine_images image1 image2 ... output_file

# report problems from a LaTeX .log file
doconce latex_problems mydoc.log [overfull-hbox-limit]

# list all labels in a document (for purposes of cleaning them up)
doconce list_labels myfile

# generate script for substituting generalized references
doconce ref_external mydoc [pubfile]

# check all links in HTML files
doconce linkchecker *.html

```

```

# change headings from "This is a Heading" to "This is a heading"
doconce capitalize [-d .mydict.txt] *.do.txt

# translate a latex document to doconce (requires usually manual fixing)
doconce latex2doconce latexfile

# check if there are problems with translating latex to doconce
doconce latex_dislikes latexfile

# typeset a doconce document with pygments (for pretty print of doconce itself)
doconce pygmentize myfile [pygments-style]

# generate a make.sh script for translating a doconce file to various formats
doconce makefile docname doconcefile [html sphinx pdflatex ...]

# find differences between two files
doconce diff file1.do.txt file2.do.txt [diffprog]
(diffprog can be diff, pdiff, latexdiff, kdiff3, diff, ...)

# find differences between the last two Git versions of several files
doconce gitdiff file1 file2 file3 ...

# convert csv file to doconce table format
doconce csv2table somefile.csv

# edit URLs to local files and place them in _static
doconce sphinxfix_local_URLs file.rst

# replace latex-1 (non-ascii) characters by html codes
doconce latin2html file.html

# fix common problems in bibtex files for publish import
doconce fix_bibtex4publish file1.bib file2.bib ...

# print the header (preamble) for latex file
doconce latex_header

# print the footer for latex files
doconce latex_footer

# expand short cut commands to full form in files
doconce expand_commands file1 file2 ...

# insert a table of exercises in a latex file myfile.p.tex
doconce latex_exercise_toc myfile

```

0.19 Exercises

DocOnce supports *Exercise*, *Problem*, *Project*, and *Example*. These are typeset as ordinary sections and referred to by their section labels. Exercise, problem, project, or example sections contains certain *elements*:

- a headline at the level of a subsection containing one of the words "Exercise:", "Problem:", "Project:", or "Example:", followed by a title (required)
- a label (optional)
- a solution file (optional)
- name of file with a student solution (optional)

- main exercise text (required)
- a short answer (optional)
- a full solution (optional)
- one or more hints (optional)
- one or more subexercises (subproblems, subprojects), which can also contain a text, a short answer, a full solution, name student file to be handed in, and one or more hints (optional)

A typical sketch of a a problem without subexercises goes as follows:

```
===== Problem: Derive the Formula for the Area of an Ellipse =====
label{problem:ellipsearea1}
file=ellipse_area.pdf
solution=ellipse_area1_sol.pdf
```

Derive an expression for the area of an ellipse by integrating the area under a curve that defines half of the ellipse. Show each step in the mathematical derivation.

```
!bhint
Wikipedia has the formula for the curve.
!ehint
```

```
!bhint
"Wolframalpha": "http://wolframalpha.com" can perhaps
compute the integral.
!ehint
```

If the exercise type (Exercise, Problem, Project, or Example) is enclosed in braces, the type is left out of the title in the output. For example, the if the title line above reads

```
===== {Problem}: Derive the Formula for the Area of an Ellipse =====
```

the title becomes just "Derive the ...".

An exercise with subproblems, answers and full solutions has this setup-up:

```
===== Exercise: Determine the Distance to the Moon =====
label{exer:moondist}
```

Intro to this exercise. Questions are in subexercises below.

```
!bsubex
Subexercises are numbered a), b), etc.
```

```
file=subexer_a.pdf
```

```
!bans
Short answer to subexercise a).
!eans
```

```
!bhint
First hint to subexercise a).
!ehint
```



```

!bhint
Second hint to subexercise a).
!ehint
!esubex

!bsubex
Here goes the text for subexercise b).

file=subexer_b.pdf

!bhint
A hint for this subexercise.
!ehint

!bsol
Here goes the solution of this subexercise.
!esol
!esubex

!bremarks
At the very end of the exercise it may be appropriate to summarize
and give some perspectives. The text inside the ‘!bremarks’ and ‘!eremarks’
directives is always typeset at the end of the exercise.
!eremarks

!bsol
Here goes a full solution of the whole exercise.
!esol

```

By default, answers, solutions, and hints are typeset as paragraphs. The command-line arguments `--without_answers` and `--without_solutions` turn off output of answers and solutions, respectively, except for examples.

0.20 Environments

DocOnce environments start with `!benvirname` and end with `!eenvirname`, where `envirname` is the name of the environment. Here is a listing of the environments:

- `c`: computer code (or verbatim text)
- `t`: math blocks with \LaTeX syntax
- `subex`: sub-exercise
- `ans`: short answer to exercise or sub-exercise
- `sol`: full solution to exercise or sub-exercise
- `quote`: indented text
- `notice`, `summary`, `warning`, `question`, `hint`: admonition boxes with custom title, special icon, and (frequently) background color
- `pop`: text to gradually pop up in slide presentations
- `slidecell`: indication of cells in a grid layout for elements on a slide

0.21 Preprocessing

DocOnce documents may utilize a preprocessor, either `preprocess` and/or `mako`. The former is a C-style preprocessor that allows if-tests and including other files (but not macros with arguments). The `mako` preprocessor is much more advanced - it is actually a full programming language, very similar to Python.

The command `doonce format` first runs `preprocess` and then `mako`. Here is a typical example on utilizing `preprocess` to include another document, "comment out" a large portion of text, and to write format-specific constructions:

```
# #include "myotherdoc.do.txt"

# #if FORMAT in ("latex", "pdflatex")
\begin{table}
\caption{Some words... label{mytab}}
\begin{tabular}{lrr}
\hline\noalign{\smallskip}
\multicolumn{1}{c}{time} & \multicolumn{1}{c}{velocity} & \multicolumn{1}{c}{acceleration} \\
\hline
0.0 & 1.4186 & -5.01 \\
2.0 & 1.376512 & 11.919 \\
4.0 & 1.1E+1 & 14.717624 \\
\hline
\end{tabular}
\end{table}
# #else
|-----|
|time | velocity | acceleration |
|--l-----r-----r-----|
| 0.0 | 1.4186 | -5.01 |
| 2.0 | 1.376512 | 11.919 |
| 4.0 | 1.1E+1 | 14.717624 |
|-----|
# #endif

# #ifdef EXTRA_MATERIAL
...large portions of text...
# #endif
```

With the `mako` preprocessor the if-else tests have slightly different syntax. An [example document](#) contains some illustrations on how to utilize `mako` (clone the GitHub project and examine the DocOnce source and the `doc/src/make.sh` script).

0.22 Resources

- Excellent "Sphinx Tutorial" by C. Reller: "<http://people.ee.ethz.ch/~creller/web/tricks/reST.html>"