

The EXSOL package*

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1 Introduction

1.1 Package goal

The package EXSOL provides macros to allow embedding exercises and solutions in the \LaTeX source of an instructional text (e.g., a book or a course text) while keeping the exercises and the solutions separately in the typeset result.

In *global mode* (the default), this corresponds to generating the following separate documents:

- your original text that only contains the exercises, and
- a solution book that only contains the solutions to the exercises (a package option exists to also copy the exercises themselves to the solution book).

The former is generated when running \LaTeX on your document. This run writes the solutions to a secondary file that can be included into a simple document harness, such that when running \LaTeX on the latter, you can generate a nice solution book.

In *local mode* (invoked by specifying the package option 'local'), this corresponds to inserting the saved solutions in the current document at a later stage in the text.

1.2 Why use ExSol?

- It allows to keep the \LaTeX source of your exercises and their solutions together in a single file, next to each other. Away with the nightmare to keep your solutions in sync with the exercises!
- It separates exercises and solutions, allowing you
 - to only release the solution book to the instructors of the course (using global mode);
 - to encourage students to first try solving the exercises without peeking into the list of solutions (or the solution book).

*This document corresponds to `exsol 1.4`, dated 2018/10/23.

1.3 Credits

The code of the EXSOL package was taken almost literally from `fancyvrb` [1]. Therefore, all credits go to the authors/maintainers of `fancyvrb`.

Thanks to Paul Levrie, Pieter Pareit, Pekka Pere, Benjamin Grinstein and Philippe Marti for signaling problems and making suggestions for the improvement of the package and the documentation.

1.4 Note

As of version 1.2, the package also contains facilities for generating a formula collection. The only limitation is that exercises and solutions cannot be part of the formula collection. Though this is a restriction, it is not a severe one in my opinion. Formula collections should be as concise as they can be.

Though generating formula collections goes beyond exercises and solutions, I chose not to change the package's name EXSOL. Einstein's name was also not changed into Relativistic Einstein when he got to understand the theory of relativity.

2 Installation

Either you are a package manager and then you'll know how to prepare an installation package for EXSOL.

Either you are a normal user and then you have two options. First, check if there is a package that your favorite L^AT_EX distributor has prepared for you. Second, grab the TDS package from CTAN [2] (`exsol.tds.zip`) and unzip it somewhere in your own TDS tree, regenerate your filename database and off you go. In any case, make sure that L^AT_EX finds the `exsol.sty` file.

The EXSOL package uses some auxiliary packages: `fancyvrb`, `ifthen`, `kvoptions` and, optionally, `babel`. Fetch them from CTAN [2] if your T_EX distributor does not provide them.

3 Usage

3.1 Preparing your document source

3.1.1 Loading the package

The macro package `exsol` can be loaded with:

```
\usepackage{exsol}
```

Your first choice to make is where you want your solutions to appear. The primary objective of the `exsol` package was 'global mode', i.e. separating your solutions

from the exercises, gathering the solutions in a separate book. To this end, don't specify the package option '`[local]`', or specify '`[local=false]`'.

A second mode of operation is 'local mode'. This allows grouping your exercises in series and including them later in your text. Gathering exercises in (numbered) series and 'loading' them locally in your text, allows for simplifying the individual exercise numbers (omitting their prefix containing, chapter number, section number, subsection number a.s.o.).

3.1.2 Global mode - flat grouping exercises

Adding exercises together with their solutions in your document is easy. Just embed them in a `exercise` and a corresponding `solution` environment. Optionally, you may embed several of them in a `exercises` environment to make them stand out in your text.

```
\begin{exercises}[columns=2]

  \begin{exercise}
    Calculate  $y = 5 + 7$ 
  \end{exercise}
  \begin{solution}
     $y = 12$ 
  \end{solution}

  \begin{exercise}
    Calculate  $y = 7 - 12$ 
  \end{exercise}
  \begin{solution}
     $y = -5$ 
  \end{solution}

\end{exercises}
```

The optional argument of the `exercises` environment allows specifying the typesetting in multiple columns.

On how to generate a solution book, take a look at the examples in section 3.2.1.

3.1.3 Local mode - grouping of exercises in series

One might also consider to keep the solutions in the same text, in local mode. In this case, we advise to gather the exercises in series (e.g. according to their degree of difficulty). This can be done by using the `exerciseries` environment instead of the `exercises` environment. This environment takes and also takes a mandatory label argument. In addition it takes two optional arguments:

- `columns` to specify the amount of columns

- `exsubrule` to specify the creation of a horizontal rule below the exercise series.
- `solsubrule` to specify the creation of a horizontal rule below the solution series.
- `subrule` to specify the creation of a horizontal rule below the exercise and the solution series.

```

\begin{exerciseries}[columns=2,subrule=\hrule]{Easy exercises}

  \begin{exercise}
    Calculate  $y = 5 + 7$ 
  \end{exercise}
  \begin{solution}
     $y = 12$ 
  \end{solution}

  \begin{exercise}
    Calculate  $y = 7 - 12$ 
  \end{exercise}
  \begin{solution}
     $y = -5$ 
  \end{solution}

\end{exerciseries}

\begin{exerciseries}{Difficult exercises}

  \begin{exercise}
    Calculate  $y = 5 \cdot 7$ 
  \end{exercise}
  \begin{solution}
     $y = 35$ 
  \end{solution}

  \begin{exercise}
    Calculate  $y = 8 / 4$ 
  \end{exercise}
  \begin{solution}
     $y = 2$ 
  \end{solution}

\end{exerciseries}

```

3.2 Examples

3.2.1 Global mode

Below, you can find an example of a file that contains a number of exercises and solutions, with the goal to generate a separate solution book.

```

%<*example>
\documentclass[a4paper,10pt]{article}

\usepackage{a4wide}
\usepackage[english]{babel}
\usepackage[copyexercisessolutions]{exsol}

\title{Global example, from the \textsf{ExSol} package}
\author{Walter Daems}
\setlength{\parindent}{0em}
\begin{document}
\maketitle

\section{Introduction}

In this text we explain how to solve second-order polynomial
equations.

\section{Solving second-order polynomial equations}

\begin{informatiocollectiononly}
\section*{Solving second-order polynomial equations}
\end{informatiocollectiononly}
\begin{informatiocollection}
The roots of the following equation
\begin{equation}
a x^2 + b x + c = 0
\end{equation}
can be determined as:
\begin{equation}
x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4 a c}}{2 a}
\end{equation}
\end{informatiocollection}

\begin{exercises}[columns = 2]

\begin{exercise}
Solve the following equation for  $x \in \mathbb{C}$ , with  $\mathbb{C}$  the set of
complex numbers:
\begin{equation}
5 x^2 - 3 x = 5
\end{equation}
\end{exercise}
\begin{solution}
Let's start by rearranging the equation, a bit:
\begin{equation}
5.7 x^2 - 3.1 x = 5.3 \\
5.7 x^2 - 3.1 x - 5.3 = 0
\end{equation}
The equation is now in the standard form:
\begin{equation}
a x^2 + b x + c = 0
\end{equation}
For quadratic equations in the standard form, we know that two
solutions exist:
\begin{equation}
x_{1,2} = \frac{-b \pm \sqrt{d}}{2a}
\end{equation}
with
\begin{equation}
d = b^2 - 4 a c
\end{equation}

```

```

If we apply this to our case, we obtain:
\begin{equation}
d = (-3.1)^2 - 4 \cdot 5.7 \cdot (-5.3) = 130.45
\end{equation}
and
\begin{eqnarray}
x_1 &=& \frac{3.1 + \sqrt{130.45}}{11.4} = 1.27\\
x_2 &=& \frac{3.1 - \sqrt{130.45}}{11.4} = -0.73
\end{eqnarray}
The proposed values  $x = x_1, x_2$  are solutions to the given equation.
\end{solution}
\begin{exercise}
Consider a 2-dimensional vector space equipped with a Euclidean
distance function. Given a right-angled triangle, with the sides
 $A$  and  $B$  adjacent to the right angle having lengths,  $3$  and
 $4$ , calculate the length of the hypotenuse, labeled  $C$ .
\end{exercise}
\begin{solution}
This calls for application of Pythagoras' theorem, which
tells us:
\begin{equation}
\left|A\right|^2 + \left|B\right|^2 = \left|C\right|^2
\end{equation}
and therefore:
\begin{eqnarray}
\left|C\right|
&=& \sqrt{\left|A\right|^2 + \left|B\right|^2}\\
&=& \sqrt{3^2 + 4^2}\\
&=& \sqrt{25} = 5
\end{eqnarray}
Therefore, the length of the hypotenuse equals  $5$ .
\end{solution}
\end{exercises}
And now, we can come to conclusion.
\section{Conclusion}
Solving second-order polynomial equations is very easy.
\end{document}
%</example>

```

The result in the original document, can be seen in the file `example.pdf`. As you can see, the `formulacollection` entry and the exercise appear. There's no trace of the solution.

When running \LaTeX on your document (e.g., the file `example.tex` as part of the `exsol` package, as a side effect files with the extension `.sol.tex` and `.fc.tex` have been written to disk (in our case, the files `example.sol.tex` and `example.fc.tex`), containing all solutions and entries for the formula collection in sequence.

Generating a solution book is as simple as including the solution file into a simple \LaTeX harness, that allows you giving it a proper title page and to add other bells and whistles. This can be seen below:

```

%<*examplesol>
\documentclass[a4paper,10pt]{article}

\usepackage{a4wide}
\usepackage[english]{babel}
\usepackage{exsol}

```

```

\setlength{\parindent}{0em}

\title{Solutions to the exercises, specified in the example of the
\textsf{ExSol} package}
\author{Walter Daems}

\begin{document}

\maketitle

\input{example.sol.tex}

\end{document}
%</examplesol>

```

Generating a formula collection is as simple as including the formula collectoin file into a simple L^AT_EX harness, that allows you giving it a proper title page and to add other bells and whistles. This can be seen below:

```

%<*examplefor>
\documentclass[a4paper,10pt]{article}

\usepackage{a4wide}
\usepackage[english]{babel}
\usepackage{exsol}

\setlength{\parindent}{0em}

\title{Formula collection, specified in the example of the
\textsf{ExSol} package}
\author{Walter Daems}

\begin{document}

\maketitle

\input{example.fc.tex}

\end{document}
%</examplefor>

```

3.2.2 Local mode

Below, you can find an example of a file that contains a number of exercises and solutions, with the goal to include them later in the same document. This is done by issuing the `loadSolutions` macro at the very end of the file. This macro can be called multiple times and will gobble up and include all solutions so far. As a consequence the solutions file is emptied and can be filled again by specifying new exercise/solution pairs.

```

%<*example-local>
\documentclass[a4paper,10pt]{article}

\usepackage{a4wide}
\usepackage[german]{babel}
\usepackage[local,nolabels,exerciseaslist,usesolutionserieslabels]{exsol}

```

```

\usepackage{enumitem}

\setlength{\exsolexercisetopbottomsep}{0pt plus 0pt minus 1pt}
\setlength{\exsolexercisefleftmargin}{2em}
\setlength{\exsolexerciserightmargin}{1em}
\setlength{\exsolexerciseparindent}{0em}
\setlength{\exsolexerciselabelsep}{1ex}
\setlength{\exsolexerciselabelwidth}{30pt}
\setlength{\exsolexerciseitemindent}{0pt}
\setlength{\exsolexerciseparsep}{\parskip}

\title{Local example, from the \textsf{ExSol} package}
\author{Philippe Marti}
\setlength{\parindent}{0em}
\begin{document}
\maketitle

\section{\exercisename}

\begin{exerciseries}[columns=2,solsubrule=\hrule]{Gleichungen  $\$$  Gleichungssysteme}

\begin{exercise}
Die Summe zweier Zahlen ist 17 und ihre Differenz 7. Bestimme die
beiden Zahlen!
\end{exercise}
\begin{solution}
5 und 12
\end{solution}

\begin{exercise}
Die Differenz einer Zahl und dem Dreifachen einer zweiten Zahl ist
14. Bestimme die beiden Zahlen, falls die zweite Zahl ein Zehntel
der ersten ist.
\end{exercise}
\begin{solution}
20 und 2
\end{solution}

\end{exerciseries}

\begin{exerciseries}[columns=2]{Geraden}
\begin{exercise}
Berechne den Schnittpunkt von  $y=3x+1$  und  $y=3x-7$ .
\end{exercise}
\begin{solution}
Es gibt keinen Schnittpunkt
\end{solution}

\begin{exercise}
Die Familie Meier fordert Offerten f"ur eine Heizungsreparatur
ein. Firma A berechnet f"ur die Fahrtkosten Fr. 42.- und f"ur
jede Arbeitsstunde 76.-. Bei der Firma B sind die Fahrtkosten
Fr. 35.- und jede Arbeitsstunde wird mit Fr. 80.- berechnet.
\begin{enumerate}[label=\alph*]
\item Welche Kosten entstehen f"ur beide Firmen, wenn ein Monteur
3.5 Stunden
f"ur die Arbeit bentigt? Welche Firma ist in diesem Fall
kostengnstiger?

\item Wie lauten die Gleichungen derjenigen zwei linearen
Funktionen, die jeder Arbeitszeit  $x$  (in Stunden) die
entstehenden Kosten  $y$  (in Franken) zuordnet?

```



```

\item Berechne, bei welcher Arbeitszeit die Kosten bei beiden
      Firmen gleich sind.
\end{enumerate}
\end{exercise}
\begin{solution}
\begin{enumerate}[label=\alph*]
\item Firma A: 308.-  $\$$  Firma B: 315.-
\item A:  $y=76x+42$   $\$$  B:  $y=80x+35$ 
\item Bei  $\frac{3}{4}$  Stunden
\end{enumerate}
\end{solution}
\end{exerciseries}

\section{\solutionsname}
\loadSolutions

\end{document}
%</example-local>

```

3.3 Fiddling with the spacing

The default spacing provided by the ExSol package should be fine for most users. However, if you like to tweak, below you can find the controls.

As the formula collection generation is intended to interfere as little as possible with the flow of the main document, you will notice that it is impossible to control the extra spacing, as no extra spacing should originate from using the `in formulacollection` environment.

3.3.1 Spacing before and after the exercises environment

The lengths below control the spacing of the `exercises` environment:

- `exsolexerciseaboveskip`: rubber length controlling the vertical space after the top marker line of the environment
- `exsolexercisebelowskip`: rubber length controlling the vertical space before the bottom marker line of the environment

You can simply specify them like:

```

\setlength{\exsolexerciseaboveskip}{1ex plus 1pt minus 1pt}
\setlength{\exsolexercisebelowskip}{1ex plus 1pt minus 1pt}

```

The spacings specified here are the package defaults.

3.3.2 Spacing of the individual exercises

Caution: the spacing can only be tuned, when one invokes the `exerciseaslist` package option!

Then lengths below control the spacing of the `exercise` environment:

- `exercisetopbottomsep`: rubber length controlling the vertical space before and after individual exercises
- `exercisefleftmargin`: length controlling the horizontal space between the surrounding environment's left margin (most often the page margin) and the left edge of the exercise environment
- `exerciserightmargin`: length controlling the horizontal space between the surrounding environment's right margin (most often the page margin) and the right edge of the exercise environment
- `exerciseitemindent`: length controlling the first-line indentation of the first paragraph in the exercise environment (actually, the label is set w.r.t. this position, that we will conveniently call position 'x')
- `exerciseparindent`: length controlling the first-line indentation of the other paragraphs in the exercise environment.
- `exerciselabelsep`: length controlling the distance between the label and position 'x'
- `exerciselabelwidth`: minimal width of the (internally right-aligned) box to use for the exercises label; if the box is not sufficiently big, position 'x' is shifted to the right
- `exerciseparsep`: internal paragraph separation (vertically)

You can simply specify them like:

```
\setlength{\exsolexercisetopbottomsep}{0pt plus 0pt minus 1pt}
\setlength{\exsolexercisefleftmargin}{1em}
\setlength{\exsolexerciserightmargin}{1em}
\setlength{\exsolexerciseparindent}{0em}
\setlength{\exsolexerciselabelsep}{0.5em}
\setlength{\exsolexerciselabelwidth}{0pt}
\setlength{\exsolexerciseitemindent}{0pt}
\setlength{\exsolexerciseparsep}{\parskip}
```

The spacings specified here are the package defaults.

3.4 Tips and tricks

If you want to include the solutions all at the end of the current document in global mode, you need to explicitly close the solution stream before including it:

```
\closeout\solutionstream\input{\jobname.sol.tex}
```

If you want to avoid exercises being split by a page boundary, then provide the package option 'minipage'. This causes the exercises to be wrapped in a minipage environment.

4 Implementation

```
1 <*package>
```

4.1 Auxiliary packages

The package uses some auxiliary packages:

```
2 \RequirePackage{ifmtarg}
3 \RequirePackage{fancyvrb}
4 \RequirePackage{ifthen}
5 \RequirePackage{kvoptions}
6 \RequirePackage{multicol}
7 \RequirePackage{varwidth}
```

4.2 Package options

The package offers some options:

local This boolean option (true, false) allows setting the mode of the package into local, i.e. that the numbering of the exercises is not related to the position in the document, but uses it's own local counter in combination with a exerciseries counter.

```
8 \DeclareBoolOption[false]{local}
```

nolabels This boolean option (true, false) allows suppressing the 'Exercise' and 'Solution' label that normally appear before the exercise and solution number.

```
9 \DeclareBoolOption[false]{nolabels}
```

exercisefontsize This option allows setting the font of the `exercises` environment. You may choose one of tiny, scriptsize, footnotesize, small, normalsize, large, etc. E.g., `[exercisefontsize=small]`.

```
10 \DeclareStringOption[normalsize]{exercisefontsize}
```

exerciseaslist This boolean option (true, false) allows setting the typesetting of the `exercises` in a list environment. This causes the exercises to be typeset in a more compact fashion, with indented left and right margin.

```
11 \DeclareBoolOption[false]{exerciseaslist}
```

copyexercisefinsolutions This boolean option (true, false) allows copying the exercises in the solutions file, to allow for making a complete stand-alone exercises bundle.

```
12 \DeclareBoolOption[false]{copyexercisefinsolutions}
```

`minipage` This boolean option (true, false) causes the exercises to be wrapped in minipages. This avoids them getting split by a page boundary.

```
13 \DeclareBoolOption[false]{minipage}
```

`usesolutionserieslabels` This boolean options (true,false) causes the exerciseries label to be reused when inserting the corresponding solutionseries.

```
14 \DeclareBoolOption[false]{usesolutionserieslabels}
```

The options are processed using:

```
15 \ProcessKeyvalOptions*
```

The options are subsequently handled

```
16 \newcommand{\exercisefontsize}{\csname \exsol@exercisefontsize\endcsname}
```

4.3 Customization of lengths

The commands below allow customizing many lengths that control the typesetting of the exercises.

First some lengths to control the spacing before and after `exercises`.

```
17 \newlength{\exsolexercisaboveskip}
18 \setlength{\exsolexercisaboveskip}{0ex plus 1pt minus 1pt}
19 \addtolength{\exsolexercisaboveskip}{-2\baselineskip}
20 \newlength{\exsolexercisabelowskip}
21 \setlength{\exsolexercisabelowskip}{0ex plus 1pt minus 1pt}
22 \addtolength{\exsolexercisabelowskip}{\baselineskip}
```

Then some lengths to control the spacing for a single exercise. These lengths only work when the `exercisearlist` package option has been specified. Sensible defaults have been set.

```
23 \newlength{\exsolexercisetopbottomsep}
24 \setlength{\exsolexercisetopbottomsep}{0pt plus 0pt minus 1pt}
25 \newlength{\exsolexercisefleftmargin}
26 \setlength{\exsolexercisefleftmargin}{1em}
27 \newlength{\exsolexerciserightmargin}
28 \setlength{\exsolexerciserightmargin}{1em}
29 \newlength{\exsolexerciseparindent}
30 \setlength{\exsolexerciseparindent}{0em}
31 \newlength{\exsolexerciselabelsep}
32 \setlength{\exsolexerciselabelsep}{0.5em}
33 \newlength{\exsolexerciselabelwidth}
34 \setlength{\exsolexerciselabelwidth}{0pt}
35 \newlength{\exsolexerciseitemindent}
36 \setlength{\exsolexerciseitemindent}{0pt}
37 \newlength{\exsolexerciseparsep}
38 \setlength{\exsolexerciseparsep}{\parskip}
```

4.4 Con- and destruction of the auxiliary streams

At the beginning of your document, we start by opening a stream to a file that will be used to write the solutions to. At the end of your document, the package closes the stream.

```
39 \AtBeginDocument{
40   \typeout{Writing solutions to solution file \jobname.sol.tex}
41   \newwrite\solutionstream
42   \immediate\openout\solutionstream=\jobname.sol.tex
43   \typeout{Using intermediate exercise file \jobname.exc.tex}
44   \newwrite\exercisestream
45   \typeout{Writing formulae to formula collection file \jobname.fc.tex}
46   \newwrite\formulacollectionstream
47   \immediate\openout\formulacollectionstream=\jobname.fc.tex
48   \typeout{Using intermediate formula file \jobname.for.tex}
49   \newwrite\formulastream
50 }
51 \AtEndDocument{
52   \immediate\closeout\formulacollectionstream
53   \immediate\closeout\solutionstream
54 }
```

In local mode we also want to close the solutionstream, read it and open it again:

```
55 \newcommand\loadSolutions{
56   \immediate\closeout\solutionstream
57   \input{\jobname.sol.tex}
58 % \immediate\openout\solutionstream=\jobname.sol.tex
59 }
```

4.5 Series counter

By providing an exerciseries counter, proper numbering of the exercise series is provided. Note that separate series, render the numbering of the exercises from document-global, to series-local, therefore hindering the concordance of solutions to exercises.

```
60 \newcounter{exerciseries}[subsubsection]
61 \setcounter{exerciseries}{0}
62 \renewcommand{\theexerciseries}{\arabic{exerciseries}}
```

4.6 Exercise counter

By providing an exercise counter, proper numbering of the exercises is provided to allow for good cross referencing of the solutions to the exercises.

```
63 \newcounter{exercise}[exerciseries]
64 \setcounter{exercise}{0}
65 \renewcommand{\theexercise}{%
66   \ifxsol@local
```

```

67 \arabic{exerciseries}.\arabic{exercise}%
68 \else
69 \@ifundefined{c@chapter}{\if0\arabic{chapter}\else\arabic{chapter}.\fi}%
70 \if0\arabic{section}\else\arabic{section}\fi%
71 \if0\arabic{subsection}\else.\arabic{subsection}\fi%
72 \if0\arabic{subsubsection}\else.\arabic{subsubsection}\fi%
73 \if0\arabic{exercise}\else%
74 \@ifundefined{c@chapter}%
75 {\if0\arabic{section}\else-\fi}%
76 {-}%
77 \arabic{exercise}%
78 \fi
79 \fi
80 }

```

4.7 Detokenization in order to cope with utf8

Combining old-school L^AT_EX (before X_YL^AT_EX and Lua_T_EX) and UTF-8 is a pain. Detokenization has been suggested by Geoffrey Poore to solve issues with UTF-8 characters messing up the fancyvrb internals.

```

81 \newcommand{\GPES@write@detok}[1]{%
82 \immediate\write\exercisestream{\detokenize{#1}}}%
83 \newcommand{\GPSS@write@detok}[1]{%
84 \immediate\write\solutionstream{\detokenize{#1}}}%
85 \newcommand{\GPES@write@detok}[1]{%
86 \GPES@write@detok{#1}%
87 \GPSS@write@detok{#1}}%
88 \newcommand{\GPFORCOL@write@detok}[1]{%
89 \immediate\write\formulacollectionstream{\detokenize{#1}}}%
90 \immediate\write\formulastream{\detokenize{#1}}}%
91 \newcommand{\GPFORCOLONLY@write@detok}[1]{%
92 \immediate\write\formulacollectionstream{\detokenize{#1}}}%

```

5 The user environments

exercise The `exercise` environment is used to typeset your exercises, provide them with a nice label and allow for copying the exercise to the solutions file (if the package option `copyexercisessolution` is set). The label can be set by redefining the `\exercisename` macro, or by relying on the Babel provisions. The code is almost literally taken from the fancyvrb package.

```

93 \def\exercise{\FV@Environment{}{exercise}}
94 \def\FVB@exercise{%
95 \refstepcounter{exercise}%
96 \immediate\openout\exercisestream=\jobname.exc.tex
97 \ifxsol@local
98 % \immediate\write\solutionstream{}
99 \else
100 % \immediate\write\solutionstream{\string\vspace*\string{2ex}\string}%
101 % \string\quad\string\newline}

```

```

102 \fi
103 \ifexsol@copyexercisessolutions
104 % WDSC tofix
105 % \typeout{Writing exercise to \jobname.sol.tex}
106 \immediate\write\solutionstream{\string\begin{exsol@exercise}{\theexercise}}
107 \fi
108 \immediate\write\exercisestream{\string\begin{exsol@exercise}{\theexercise}}
109 \@bsphack
110 \beginingroup
111 \FV@UseKeyValues
112 \FV@DefineWhiteSpace
113 \def\FV@Space{\space}%
114 \FV@DefineTabOut
115 \ifexsol@copyexercisessolutions
116 \let\FV@ProcessLine\GPES@write@detok %
117 \else
118 \let\FV@ProcessLine\GPES@write@detok %
119 \fi
120 \relax
121 \let\FV@FontScanPrep\relax
122 \let\@noligs\relax
123 \FV@Scan
124 }
125 \def\FVE@exercise{
126 \endgroup\@esphack
127 \immediate\write\exercisestream{\string\end{exsol@exercise}}
128 \ifexsol@copyexercisessolutions
129 \immediate\write\solutionstream{\string\end{exsol@exercise}}
130 \fi
131 \immediate\closeout\exercisestream
132 \input{\jobname.exc.tex}
133 }
134 \DefineVerbatimEnvironment{exercise}{exercise}{}

```

exsol@exercise The `exsol@exercise` environment is an internal macro used to typeset your exercises and provide them with a nice label and number. Do not use it directly. Use the proper environment `exercise` instead.

```

135 \newenvironment{exsol@exercise}[1]
136 {%
137 \ifthenelse{\boolean{exsol@minipage}}{\begin{minipage}[t]{\textwidth}}{%
138 \ifthenelse{\boolean{exsol@exerciseaslist}}
139 {
140 \begin{list}%
141 {}
142 {%
143 \setlength{\topsep}{\exsol@exercisetopbottomsep}%
144 \setlength{\leftmargin}{\exsol@exercisefleftmargin}%
145 \setlength{\rightmargin}{\exsol@exerciserightmargin}%
146 \setlength{\listparindent}{\exsol@exerciseparindent}%
147 \setlength{\itemindent}{\exsol@exercisemitementind}%
148 \setlength{\parsep}{\exsol@exerciseparsep}
149 \setlength{\labelsep}{\exsol@exerciselabelsep}
150 \setlength{\labelwidth}{\exsol@exerciselabelwidth}}

```

```

151     \item[\ifexsol@nolabels~#1:\else\exercisename{~#1:\fi}%
152     }
153     {\ifexsol@nolabels #1:\else%
154     \subparagraph{\exercisename{~#1:}\fi}
155     }
156     {%
157     \ifthenelse{\boolean{exsol@exerciseaslist}}%
158     {\end{list}}{}%
159     \ifthenelse{\boolean{exsol@minipage}}{\end{minipage}}{\par}%
160 }

```

solution The `solution` environment is used to typeset your solutions and provide them with a nice label and number that corresponds to the exercise that preceded this solution. The no label can be set by redefining the `\solutionname` macro, or by relying on the Babel provisions. The code is almost literally taken from the `fancyvrb` package.

```

161 \def\solution{\FV@Environment{}{solution}}
162 \def\FVB@solution{%
163   %\typeout{Writing solution to \jobname.sol.tex}
164   \ifexsol@copyexercisessolutions
165   \immediate\write\solutionstream{\string\begin{exsol@solution}}{}
166   \else
167   \immediate\write\solutionstream{\string\begin{exsol@solution}{\theexercise}}
168   \fi
169   \@sphack
170   \begingroup
171     \FV@UseKeyValues
172     \FV@DefineWhiteSpace
173     \def\FV@Space{\space}%
174     \FV@DefineTabOut
175     \let\FV@ProcessLine\GPSS@write@detok %
176     \relax
177     \let\FV@FontScanPrep\relax
178     \let\@noligs\relax
179     \FV@Scan
180   }
181 \def\FVE@solution{
182   \endgroup\@sphack
183   \immediate\write\solutionstream{\string\end{exsol@solution}}
184 }
185 \DefineVerbatimEnvironment{solution}{solution}{}

```

exsol@solution The `exsol@solution` environment is an internal macro used to typeset your solutions. Do not use it directly. Use the proper environment `solution` instead.

```

186 \newenvironment{exsol@solution}[1]
187 {%
188   \ifthenelse{\boolean{exsol@minipage}}{\begin{minipage}[t]{\textwidth}}{}%
189   \ifthenelse{\boolean{exsol@exerciseaslist}}
190   {\begin{list}}%
191   {%

```



```

192     }%
193     {%
194         \setlength{\topsep}{\exsolexercisetopbottomsep}%
195         \setlength{\leftmargin}{\exsolexercisefleftmargin}%
196         \setlength{\rightmargin}{\exsolexerciserightmargin}%
197         \setlength{\listparindent}{\exsolexerciseparindent}%
198         \setlength{\itemindent}{\exsolexerciseitemindent}%
199         \setlength{\parsep}{\exsolexerciseparsep}
200         \setlength{\labelsep}{\exsolexerciselabelsep}
201         \setlength{\labelwidth}{\exsolexerciselabelwidth}
202         \item[\ifexsol@nolabels #1:\else%
203             \solutionname{} \@ifmtarg{#1}{~}#1:\fi]
204     }%
205     {\ifexsol@nolabels #1:\else%
206         \subparagraph{\solutionname{} \@ifmtarg{#1}{~}#1:\fi}
207     }
208     {%
209         \ifthenelse{\boolean{exsol@exerciseaslist}}{%
210             {\end{list}}}%
211         \ifthenelse{\boolean{exsol@minipage}}{\end{minipage}}{\par}%
212     }

```

exercises The `exercises` environment helps typesetting your exercises to stand out from the rest of the text. You may use it at the end of a chapter, or just to group some exercises in the text.

```

213 \define@key{exercises}{columns}{\renewcommand\columncount{#1}}
214 \define@key{exercises}{exsubrule}{\renewcommand\exsubrule{#1}}
215 \define@key{exercises}{solsubrule}{\renewcommand\solsubrule{#1}}
216 \define@key{exercises}{subrule}{\renewcommand\exsubrule{#1}\renewcommand\solsubrule{#1}}
217 \newenvironment{exercises}[1] []
218 {%
219     \newcommand\columncount{1}% default
220     \newcommand\exsubrule{}% default
221     \newcommand\solsubrule{}% default
222     \setkeys{exercises}{#1}%
223     \exercisefontsize\rule{.25\linewidth}{0.15mm}%
224     \vspace*{-1.5\baselineskip}%
225     \paragraph{\exercisename}~\*
226     \ifthenelse{\columncount > 1}{\begin{multicols}{\columncount}}{}%
227 }%
228 {
229     \ifthenelse{\columncount > 1}{\end{multicols}}{\relax%
230     \vspace*{-\baselineskip}\vspace*{\exsolexercisesbelowskip}%
231     \exsubrule\par}

```

exerciseries The `exerciseries` environment helps typesetting your exercises in series.

```

232 \define@key{exerciseries}{columns}{\renewcommand\columncount{#1}}
233 \define@key{exerciseries}{exsubrule}{\renewcommand\exsubrule{#1}}
234 \define@key{exerciseries}{solsubrule}{\renewcommand\solsubrule{#1}}
235 \define@key{exerciseries}{subrule}{\renewcommand\exsubrule{#1}\renewcommand\solsubrule{#1}}
236 \newenvironment{exerciseries}[2] []

```

```

237 {
238   \refstepcounter{exerciseries}%
239   \newcommand\columncount{1} % default
240   \newcommand\exsubrule{} % default
241   \newcommand\solsubrule{} % default
242   \setkeys{exerciseries}{#1}%
243   \paragraph{\seriesname~\theexerciseries:~#2}~\par
244   \ifthenelse{\columncount > 1}{\begin{multicols}{\columncount}}{}
245     \immediate\write\solutionstream{\string\begin\string{solutionseries\string}%
246       \string[#1\string]\string{#2\string}\string{\theexerciseries\string}}
247   }
248   {
249     \ifthenelse{\columncount > 1}{\end{multicols}}{}~\relax
250   \exsubrule\par
251   \immediate\write\solutionstream{\string\end\string{solutionseries\string}}
252 }

```

solutionseries The `solutionseries` environment helps typesetting your solutions in series. You don't need to use this function explicitly. The package does this for you.

```

253 \newenvironment{solutionseries}[3] []
254 {
255   \newcommand\columncount{1} % default
256   \newcommand\exsubrule{} % default
257   \newcommand\solsubrule{} % default
258   \setkeys{exerciseries}{#1}%
259   \paragraph{\seriesname~#3\ifexsol@usesolutionserieslabels: #2\fi}~\par
260   \ifthenelse{\columncount > 1}{\begin{multicols}{\columncount}}{}
261 }
262 {
263   \ifthenelse{\columncount > 1}{\end{multicols}}{}
264   \solsubrule\par
265 }

```

informulacollection The `informulacollection` environment is used to write its contents to the formula collection stream and load back into the main text for typesetting. The code is almost literally taken from the `fancyvrb` package.

```

266 \def\informulacollection{\FV@Environment}{informulacollection}
267 \def\FVB@informulacollection{%
268   \immediate\openout\formulastream=\jobname.for.tex
269   %\typeout{Writing formula to \jobname.for.tex and \jobname.fc.tex}
270   \@bsphack
271   \begingroup
272     \FV@UseKeyValues
273     \FV@DefineWhiteSpace
274     \def\FV@Space{\space}%
275     \FV@DefineTabOut
276     \let\FV@ProcessLine\GPFORCOL@write@detok %
277     \relax
278     \let\FV@FontScanPrep\relax
279     \let\@noligs\relax
280     \FV@Scan

```

```

281 }
282 \def\FVE@informulacollection{
283   \endgroup\@esphack
284   \immediate\closeout\formulastream
285   \input{\jobname.for.tex}
286 }
287 \DefineVerbatimEnvironment{informulacollection}{informulacollection}{}

```

`informulacollectiononly` The `informulacollectiononly` environment is used to write its contents to the formula collection stream *without* loading it back into the main text for typesetting. The code is almost literally taken from the `fancyvrb` package.

```

288 \def\informulacollectiononly{\FV@Environment{}{informulacollectiononly}}
289 \def\FVB@informulacollectiononly{%
290   %\typeout{Writing special to \jobname.fc.tex}
291   \@bsphack
292   \begingroup
293     \FV@UseKeyValues
294     \FV@DefineWhiteSpace
295     \def\FV@Space{\space}%
296     \FV@DefineTabOut
297     \let\FV@ProcessLine\GPFORCOLONLY@write@detok %
298     \relax
299     \let\FV@FontScanPrep\relax
300     \let\@noligs\relax
301     \FV@Scan
302   }
303 \def\FVE@informulacollectiononly{
304   \endgroup\@esphack
305 }
306 \DefineVerbatimEnvironment{informulacollectiononly}{informulacollectiononly}{}

```

5.1 Some Babel provisions

```

307 \newcommand{\exercisename}{Exercise}
308 \newcommand{\exercisename}{Exercises}
309 \newcommand{\solutionname}{Solution}
310 \newcommand{\solutionsname}{Solutions}
311 \newcommand{\seriesname}{Series}

```

You may redefine these macros, but to help you out a little bit, we provide with some basic Babel auxiliaries. If you're a true polyglot and are willing to help me out by providing translations for other languages, I'm very willing to incorporate them into the code.

```

312 \addto\captionsdutch{%
313   \renewcommand{\exercisename}{Oefening}%
314   \renewcommand{\exercisename}{Oefeningen}%
315   \renewcommand{\solutionname}{Oplossing}%
316   \renewcommand{\solutionsname}{Oplossingen}%
317   \renewcommand{\seriesname}{Reeks}%
318 }
319 \addto\captionsgerman{%

```

```

320 \renewcommand{\exercisename}{Aufgabe}%
321 \renewcommand{\exercisename}{Aufgaben}%
322 \renewcommand{\solutionname}{L"osung}%
323 \renewcommand{\solutionsname}{L"osungen}%
324 \renewcommand{\seriesname}{Serie}%
325 }
326 \addto\captionsgerman{%
327 \renewcommand{\exercisename}{Aufgabe}%
328 \renewcommand{\exercisename}{Aufgaben}%
329 \renewcommand{\solutionname}{L"osung}%
330 \renewcommand{\solutionsname}{L"osungen}%
331 \renewcommand{\seriesname}{Serie}%
332 }
333 \addto\captionsfrench{%
334 \renewcommand{\exercisename}{Exercice}%
335 \renewcommand{\exercisename}{Exercices}%
336 \renewcommand{\solutionname}{Solution}%
337 \renewcommand{\solutionsname}{Solutions}%
338 \renewcommand{\seriesname}{Serie}%
339 }
340 \addto\captionsofinnish{
341 \renewcommand{\exercisename}{Teht"av"a}%
342 \renewcommand{\exercisename}{Teht"avi"a}%
343 \renewcommand{\solutionname}{Ratkaisu}%
344 \renewcommand{\solutionsname}{Ratkaisut}%
345 \renewcommand{\seriesname}{Sarja}
346 }
347 \addto\captionsspanish{%
348 \renewcommand{\exercisename}{Ejercicio}%
349 \renewcommand{\exercisename}{Ejercicios}%
350 \renewcommand{\solutionname}{Soluci'on}%
351 \renewcommand{\solutionsname}{Soluciones}%
352 \renewcommand{\seriesname}{Serie}%
353 }

```

Now the final hack overloads the basic sectioning commands to make sure that they are copied into your solution book.

```

354 \newif\ifnoexinchapter
355 \noexinchapterfalse
356 \ifexsol@local
357 \else
358 \let\exsol@makechapterhead\@makechapterhead
359 \def\@makechapterhead#1{%
360 \exsol@makechapterhead{#1}
361 \ifnoexinchapter
362 \noexinchapterfalse
363 \else
364 \addtocounter{chapter}{-1}
365 \immediate\write\solutionstream{\string\setcounter{chapter}{\arabic{chapter}}}%
366 \string\chapter{#1}}%
367 \addtocounter{chapter}{1}
368 \fi
369 }

```

```

370 \ifdefined\frontmatter
371   \let\exsol@@frontmatter\frontmatter
372   \def\frontmatter{%
373     \immediate\write\solutionstream{\string\frontmatter}%
374     \exsol@@frontmatter
375   }
376 \fi
377 \ifdefined\mainmatter
378   \let\exsol@@mainmatter\mainmatter
379   \def\mainmatter{%
380     \immediate\write\solutionstream{\string\mainmatter}%
381     \exsol@@mainmatter
382   }
383 \fi
384 \ifdefined\backmatter
385   \let\exsol@@backmatter\backmatter
386   \def\backmatter{%
387     \immediate\write\solutionstream{\string\backmatter}%
388     \exsol@@backmatter
389   }
390 \fi
391 \ifdefined\appendix
392   \let\exsol@@appendix\appendix
393   \def\appendix{%
394     \immediate\write\solutionstream{\string\appendix}%
395     \exsol@@appendix
396   }
397 \fi
398 \fi

```

`\noexercisennextchapter` If you have chapters without exercises, you may want to leave them out of your solution book. You can do this by putting the `\noexercisennextchapter` macro before your chapter mark.

```

399 \newcommand{\noexercisennextchapter}
400 {
401   \noexinchaptertrue
402 }

```

`\noexercisennextchapter` As an alternative you may just want to put this marker in your text to cause the printing of the sentence “No exercises in this chapter” in your solution book.

```

403 \newcommand{\noexercisennextchapter}
404 {
405   \immediate\write\solutionstream{No exercises in this chapter}
406 }

407 </package>

```

References

- [1] Timothy Van Zandt, Herbert Voß, Denis Girou, Sebastian Rahtz, Niall Mansfield The `fancyvrb` package. <http://ctan.org/pkg/fancyvrb>. online, accessed in January 2012.
- [2] The Comprehensive TeX Archive Network. <http://www.ctan.org>. online, accessed in January 2012.

Change History

v0.1	General: Initial version 1	Changed option <code>exerciselinlist</code> to <code>exercisearlist</code> 11
v0.2	General: Minor bug fixes based on first use by Paul Levrie 1	<code>exsol@exercise</code> : Changed implementation to allow for copying the exercises to the solutions file. 15
	Added option <code>exercisefont</code> 11	
	Fixed babel errors 19	v0.6
	Removed dash in counter when in document without sectioning commands 13	General: Prepared for CTAN publication 1
	<code>exercis</code> : Attempted to fix MiKTeX formatting problems 17	v0.7
	<code>exsol@exercise</code> : Attempted to fix MiKTeX formatting problems 15	General: Fixed UTF8 compatibility issues 1
v0.3	General: Minor bug fixes based on second use by Paul 1	Added detokenized writing 14
	<code>exercis</code> : Added some extra whitespace below <code>exercisename</code> 17	Added Finnish language support 19
	<code>exsol@exercise</code> : Fixed <code>labelsep</code> to avoid cluttered itemize environments 15	v0.8
v0.4	General: Allowed for non-list formatting of exercises (as default) 1	General: Fixed missing babel tag and running out of write handles 1
	Added option <code>exerciselinlist</code> 11	moved <code>newwrite</code> of exercise stream to this spot to avoid consuming all handles 13
	Changed name of option to <code>exercisefontsize</code> 11	v0.9
	<code>exsol@exercise</code> : Added option <code>exerciselinlist</code> such that default results in non list formatting of exercise 15	General: . Changed default behavior w.r.t. <code>minipage</code> -wrapping of exercises 11
v0.5	General: Added option to also send exercises to solutions file 1	Changed default behavior w.r.t. <code>minipage</code> -wrapping of exercises 1
	Added option <code>copyexercisinsolutions</code> 11	v0.91
		General: Corrected <code>minipage</code> dependence, made 1
		added user-accessible lengths 12
		v1.0
		General: First stable release 1
		Added congruence of <code>chaptercounter</code> of main document and <code>chaptercounter</code> of exercises document 20
		Added detokenized writing of formula and formula collection stream 14

v1.1	General: Bugfix release	1	Completed German language support (i.e. new spelling ngerman) support	19
	Corrected congruence of chaptercounter of main document and chapter counter of exercises document (taking into account alphanumeric chapters	20	exercises : Added multicolumn feature	17
v1.2	General: Implemented multicolumn option for exercises, introduced new options (local, nolabels), separate counter for exerciseries (only for use local mode), introduced local mode	1	v1.3 General: Correction of spacings and counters	1
	Added exerciseries environment	17	Added macro to suppress chapter in solution stream	20
	Added option local	11	Corrected counter in solutionstream	20
	Added option nolabels	11	exsol@exercise : Corrected formatting error in case of options exercisearlist	15
	Added series counter	13	v1.4 General: . Implemented option to display solutionserieslabels when option 'usersolutionserieslabels' is true	18
	Added solutionseries environment	18	. added 'usesolutionserieslabels' option	12
	Added Spanish language support	19	Allowed for adding exerciseries label in solutionseries using option 'usesolutionserieslabels'	1

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