

Production of solution sheets in $\text{\LaTeX} 2_{\epsilon}$

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1 Introduction

This package is a modification of the author's previous style option `answers`, which has been in use for a few years, and was based upon the `\TeXbook` idea of binding solutions to exercises. I have taken the opportunity with this revision to alter the format of the solutions, so that they are now presented as `\LaTeX` environments rather than being started with a command and ended with the end of the surrounding environment, a wholly un-`\LaTeXy` way of doing things!

The other main change is that several file handles are allowed to be active at once. This allows some solutions in a book (for instance) to go to the appendices, and some to go to a separate file, to be printed and handed to the students as the course progresses. Moreover, the actual physical files opened with each file handle can now be varied in the same job, allowing many different files to be created according to the same format. Thus, for instance, each chapter of a book could create its own solution file, allowing the user to use `\include` on both chapters and solutions.

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Finally, any number of solution-types may now be bound to any file, not just the two old ones, solution and hint. The format of each solution type is under the complete control of the user.

2 The documentation driver file

This is the driver file that produces this documentation. We use the document class provided by the L^AT_EX 2_ε distribution for producing the documentation.

```
1 \*driver
2 \documentclass{ltxdoc}
3 \RecordChanges
4 \begin{document}
5   \DocInput{answers.dtx}
6   \PrintIndex
7   \PrintChanges
8 \end{document}
9 \</driver
```

3 User interface

The package needs to be included with the command

```
\usepackage[nosolutionfiles]{answers}
```

If the optional argument is given, solutions appear at that point in the text, rather than being written to external files. This allows a demonstrator's version to be produced.

`\Newassociation` After that, there should be several declarations of the form

```
\Newassociation{xxx}{yyy}{zzz}
```

where `xxx` is an environment in the document, and `yyy` is an environment which will surround the contents of `xxx` when it is written to symbolic file handle `zzz`. The names `xxx`, `yyy` and `zzz` should consist of letters only, not numbers, punctuation or spaces.

`\solutionextension` By default, output will go to `zzz.tex` if `zzz` is open. The command `\solutionextension` can be redefined to change `tex` to some other extension. Alternatively, the output filename can be changed as an optional parameter to `\Opensolutionfile`, and each `\Opensolutionfile` on the same handle can use a different physical file. By default, `\solutionpoint` is added before `\solutionextension`. Redefine it to remove it. (It has the obvious default value of a period.)

`\Opensolutionfile` At some point the user types

```
\Closesolutionfile      \Opensolutionfile{zzz}
```

```

...
\Closesolutionfile{zzz}

```

to create a file of solutions written by environments `xxx` to environments `yyy`. If this construction is used several times, then several files of solutions will be created. The user may wish these files to have different names. If the form `\Opensolutionfile{zzz}[www]`, then `www.tex` is used as actual file output name rather than `zzz.tex`. This allows file handle `zzz` to create many files `www.tex`, say one for each chapter of a book, or one for each problem sheet. These could then be processed using `\include` commands. The same value of `\solutionextension` is used for the optional argument as for the main argument. The name `www` should follow the usual file naming conventions.

\Writetofile In addition, material can be written directly to a file by means of `\Writetofile`. Its first argument is the file handle `zzz` and its second is the line of text to be written. It is most important to remember that any control words in the line to be written should be preceded by `\protect`, otherwise the primitive TeX `\write` command will expand them. Also, as the argument is read in TeX' usual way before being written, any trailing spaces after a control word will disappear unless precautions are taken. Thus, to write `\xx yyy` to the file, the user can type `\protect\xx\space yyy`.

Filesave Alternatively, a block of text can be saved to file handle `zzz` by means of

```

\begin{Filesave}{zzz}
...
\end{Filesave}

```

around it once, `zzz` has been opened. The restrictions that apply to `\Writetofile` above do not apply to this environment.

\Readsolutionfile One of the generated files can be read using

```

\Readsolutionfile{zzz}

```

provided the file has not been closed and re-opened. Alternatively, simply `\input` or `\include` it if preferred.

None of the file operations should have any effect if the file handle `zzz` has not been opened, or if `nosolutionfiles` is specified.

4 A simple example

Here is a straightforward example to illustrate how these macros are used.

```

10 <*ex1>
11 \documentclass[12pt,a4paper]{article}
12 \usepackage{answers}
13 \Newassociation{sol}{Solution}{ans}
14 \newtheorem{ex}{Exercise}

```

```

15 \begin{document}
16 \Opensolutionfile{ans}[ans1]
17 \section{Problems}
18 \begin{ex}
19   First exercise
20   \begin{sol}
21     First solution.
22   \end{sol}
23 \end{ex}
24 \begin{ex}
25   Second exercise
26   \begin{sol}
27     Second solution.
28   \end{sol}
29 \end{ex}
30 \Closesolutionfile{ans}
31 \section{Solutions}
32 \input{ans1}
33 \end{document}
34 </ex1>

```

5 A complicated example

The following is an (over-complicated) example of the use of package `answers`. It uses some of the refinements described later.

```

35 <*ex2>
36 \documentclass[12pt,a4paper]{article}
37 \usepackage{answers}%\usepackage[nosolutionfiles]{answers}

```

First an environment which contains problems and numbers them. This is based on a L^AT_EX theorem, but with a roman body rather than italic.

```

38 \newtheorem{Exc}{Exercise}
39 \newenvironment{Ex}{\begin{Exc}\normalfont}{\end{Exc}}

```

Three sorts of solution are written to two different files. File handle `test` will contain the solutions and hints that the students will see; `testtwo` contains the solutions to the problems which they will probably hand in, and so these must be formatted separately.

```

40 \Newassociation{solution}{Soln}{test}
41 \Newassociation{hint}{Hint}{test}
42 \Newassociation{Solution}{sSol}{testtwo}

```

Because we want to mark different types of problem in the master file of problems, we define the following.

```

43 \newcommand{\prehint}{~ [Hint]}
44 \newcommand{\presolution}{~ [Solution]}
45 \newcommand{\preSolution}{~ [Homework]}

```

We provide an extra parameter when we open file handle `test`; this is because we want to write a `\section` command to the solution file. This is merely an illustration here, but would be more relevant if the solution file were `\included`.

```
46 \newcommand{\Opentesthook}[2]{%
47   {\Writetofile{#1}{\protect\section{#1: #2}}}}
```

The default text produced when L^AT_EX meets the solution environments is here modified.

```
48 \renewcommand{\Solnlabel}[1]{\emph{Solution #1}}
49 \renewcommand{\Hintlabel}[1]{\emph{Hint #1}}
50 \renewcommand{\sSollabel}[1]{\emph{Solution to #1}}
51
52 \begin{document}
```

We open handle `test` as actual file `test1.tex`,

```
53 \Opensolutionfile{test}[ans2]{Solutions}
```

and write some text on it.

```
54 \Writetofile{test}{\protect\subsection{Some Solutions}}
```

Handle `testtwo` is opened as `testtwo.tex`.

```
55 \Opensolutionfile{testtwo}[ans2x]
56 \Writetofile{testtwo}{%
57   \protect\subsection{Extra Solutions}}
```

Now the problems.

```
58 \section{Exercises}
59 \begin{Ex}
60   An exercise with a solution.
61   \begin{solution}
62     This is a solution.
63     \relax{}
64   \end{solution}
65 \end{Ex}
66 \begin{Ex}
67   An exercise with a hint and a secret solution.
68   \begin{hint}
69     This is a hint.
70   \end{hint}
71   \begin{Solution}
72     This is a secret solution.
73   \end{Solution}
74 \end{Ex}
75 \begin{Ex}
76   An exercise with a hint.
77   \begin{hint}
78     This is a hint.
79   \end{hint}
80 \end{Ex}
```

We close the two solution files and immediately input their contents. We could have used `\include` here.

```

81 \Closesolutionfile{test}
82 \Readsolutionfile{test}
83 \clearpage
84 \Closesolutionfile{testtwo}
85 \Readsolutionfile{testtwo}
86 \end{document}
87 </ex2>

```

6 A further example

Here is an application to a situation not originally envisaged, suggested to the author by Martin Osborne. Here, the exercises and solutions are not numbered; they are *described*.

```

88 <*ex3>
89 \documentclass[12pt,a4paper]{article}
90 \usepackage{answers}
91 \newenvironment{Ex}[1]{\begin{trivlist}\item \emph{#1} %
92   \renewcommand{\Currentlabel}{#1}}{\end{trivlist}}
93 \Newassociation{solution}{Soln}{solutions}
94
95 \renewenvironment{Soln}[1]{\begin{trivlist}\item
96   Solution to \emph{#1} }\end{trivlist}}
97
98 \begin{document}
99 \section*{Problems}
100 \Opensolutionfile{solutions}[ans3]
101 \begin{Ex}{First exercise}
102   An exercise with a solution.
103   \begin{solution}
104     This is a solution.
105     \relax{}
106   \end{solution}
107 \end{Ex}
108 \begin{Ex}{Second exercise}
109   A second exercise with a solution.
110   \begin{solution}
111     This is another solution.
112   \end{solution}
113 \end{Ex}
114 \Closesolutionfile{solutions}
115 \section*{Solutions}
116 \Readsolutionfile{solutions}
117 \end{document}
118 </ex3>

```

Change History

2.0	General: First version for LaTeX2e	1	2.07	David Epstein.	1
2.02	General: Removed .drv file from installation	1	2.08	General: More examples added.	1
2.03	General: Allowed a file handle to open many files successively, using an optional parameter.	1	2.12	General: License change to LPPL	1
2.04	General: Option nosolutionfiles added to allow solutions to optionally follow problems for tutor's use. Several minor changes to aid flexibility	1	2.13	New maintainer	1
2.05	General: Better documentation of features added	1	2.14	General: Make hyperlinks to solutions work correctly	1
2.06	General: More documentation of features added, as suggested by	1	2.15	General: Use a protected write for creating output files	1
			2.16	General: Fix bug in last update	1
				General: Fix bug in last update	1