The sudoku package*

Paul Abraham
paul.abraham@linuxdirect.org

March 25, 2006

1 Introduction

The sudoku package allows the user to typeset sudoku[1] puzzles.

A sudoku puzzle is a 9×9 grid where some of the squares in the grid contain numbers. The rules are simple: every column can only contain the digits 1 to 9, every row can only contain the digits 1 to 9 and every 3×3 box can only contain the digits 1 to 9.

The puzzle derives its name from the Japanese *Su*, meaning number, and *Doku* meaning singular or solitary.

More information, including help and example puzzles, can be found at `www.sudoku.org.uk`. This site also has blank sudoku grids (or worksheets), but you will not need to print them from there if you have this package installed.

2 Acknowledgements

I want to thank Morten Høgholm who took my first attempt at creating a sudoku environment in LaTeX and corrected all my mistakes. He then gave me the help and encouragement to publish it as a package.

3 Usage

`\sudokuformat` This macro contains the formatting information for each number in the grid. The default value is `\Huge\sffamily`, which gives correctly sized numbers for the default grid size, but it can be changed with `\renewcommand*\sudokuformat[1]{\⟨font⟩#1}`.

---

*This document corresponds to sudoku v1.0.1, dated 2006/03/25.

[1] I have seen Sudoku written as Sudoku (one word) and Su Doku (two words). I don't know which of them (if either) is more correct than the other. I am just using one word.

`\sudokusize`	This length contains the size of the grid, defaulting to `10cm`. It can be changed with `\setlength\sudokusize{`⟨*size*⟩`}`.
`\sudokuthickline`	This length determines the thickness of the thick lines and defaults to `2pt`. It can be changed with `\setlength\sudokuthickline{`⟨*size*⟩`}`.
`\sudokuthinline`	This length determines the thickness of the thin lines and defaults to `0.4pt`. It can be changed with It can be changed with `\setlength\sudokuthinline{`⟨*size*⟩`}`.
`sudoku-block`	This environment draws the sudoku grid. The contents of each cell in the grid are delimited by the vertical bar (`|`) character.
`sudoku`	This environment starts a `center` environment, then uses the `sudoku-block` environment to draw the grid.

4 Examples

This should be a relatively easy puzzle to solve.

```
\begin{sudoku}
|2|5| | |3| |9| |1|.
| |1| | | |4| | | |.
|4| |7| | | |2| |8|.
| | |5|2| | | | | |.
| | | | |9|8|1| | |.
| |4| | | |3| | | |.
| | | |3|6| | |7|2|.
| |7| | | | | | |3|.
|9| |3| | | |6| |4|.
\end{sudoku}
```

The output is shown in figure 1. The solution is shown in figure 3.

This is a bit more difficult.

```
\begin{sudoku}
| |2| | |3| |9| |7|.
| |1| | | | | | | |.
|4| |7| | | |2| |8|.
| | |5|2| | | |9| |.
| | | |1|8| |7| | |.
| |4| | | |3| | | |.
| | | | |6| | |7|1|.
| |7| | | | | | | |.
|9| |3| |2| |6| |5|.
\end{sudoku}
```

The output is shown in figure 2. The solution is shown in figure 4.

2	5			3		9		1
	1				4			
4		7				2		8
		5	2					
				9	8	1		
	4				3			
			3	6			7	2
	7							3
9		3				6		4

Figure 1: Easy puzzle

This code will create the same grid inline:

```
\renewcommand*\sudokuformat[1]{\sffamily#1}
\setlength\sudokusize{5cm}
Easy Sudoku Puzzle
\begin{sudoku-block}
|2|5| | |3| |9| |1|.
| |1| | | |4| | | |.
|4| |7| | | |2| |8|.
| | |5|2| | | | | |.
| | | | |9|8|1| | |.
| |4| | | |3| | | |.
| | | |3|6| | |7|2|.
| |7| | | | | | |3|.
|9| |3| | | |6| |4|.
\end{sudoku-block}
```

	2			3		9		7
	1							
4		7				2		8
		5	2				9	
			1	8		7		
	4				3			
				6			7	1
	7							
9		3		2		6		5

Figure 2: Difficult puzzle

5 Implementation

First initialise a couple of counters that keep track of where we are.

```
\newcounter{@sudoku@row}
\newcounter{@sudoku@col}

\newcommand*\@sudoku@separator[1]{%
        \stepcounter{@sudoku@col}%
        \ifx#1\@sudoku@separator
                \expandafter#1%
        \else
                \ifx.#1%
                        \setcounter{@sudoku@col}{-1}%
                        \addtocounter{@sudoku@row}{-1}%
                \else
                        \put(\value{@sudoku@col},\value{@sudoku@row})%
                        {\makebox(1,1){\sudokuformat{#1}}}%
                \fi
        \fi
}
```

```
\begingroup
        \catcode`\|=\active
        \gdef\@sudoku@activate{\let|=\@sudoku@separator}
\endgroup
```

Now we can draw the grid. Each 3×3 box has thicker borders than the rest of the grid. From version 1.0.1, the line thickness can be determined by changing `\sudokuthinline` and `\sudokuthickline`.

```
\newcommand*\@sudoku@grid{
```

First draw the thin lines.

```
        \linethickness{\sudokuthinline}%
        \multiput(0,0)(1,0){10}{\line(0,1){9}}%
        \multiput(0,0)(0,1){10}{\line(1,0){9}}
```

Now draw the thick lines.

```
        \linethickness{\sudokuthickline}%
        \multiput(0,0)(3,0){4}{\line(0,1){9}}%
        \multiput(0,0)(0,3){4}{\line(1,0){9}}
```

Finally try and fill in the four corners of the grid.

```
        \linethickness{0.5\sudokuthickline}%
        \put(0,0){\framebox(0,0){}}%
        \put(9,0){\framebox(0,0){}}%
        \put(0,9){\framebox(0,0){}}%
        \put(9,9){\framebox(0,0){}}
}
```

The default font is a huge, sans serif font.

```
\newcommand*\sudokuformat[1]{\Huge\sffamily#1}
```

The grid defaults to a 10 centimetre square.

```
\newdimen\sudokusize
\setlength\sudokusize{10cm}
```

Set line thicknesses to 0.4pt and 2pt for thin and thick lines.

```
\newdimen\sudokuthinline
\setlength\sudokuthinline{0.4pt}
\newdimen\sudokuthickline
\setlength\sudokuthickline{2pt}
```

Make the size of each square 1/9 of the size of sudoku grid.

```
\newenvironment{sudoku-block}{%
        \catcode`\|=\active
        \@sudoku@activate
        \setcounter{@sudoku@col}{-1}%
        \setcounter{@sudoku@row}{8}%
        \setlength\unitlength{.111111\sudokusize}%
        \begin{picture}(9,9)%
        \@sudoku@grid\@sudoku@grab@arguments
        }{\end{picture}}
```

As we change the `catcode` of `|` inside the environment, under normal TEX we can't just use such an environment as an argument of another command. This can be solved by using eTEX as engine for LATEX, which is what all the major distributions do currently.

```
 \begingroup
   \@ifundefined{eTeXversion}{\endgroup
     \def\@sudoku@grab@arguments#1{%
       \ifx#1\@sudoku@separator
         \expandafter#1%
       \else
          \PackageError{sudoku}{%
            Sudoku puzzles are not allowed in the arguments\MessageBreak
            of other commands}{%
            Either fix this in your source (possibly using the `lrbox'
            environment) or use an eTeX based LaTeX format}
        \fi
     }%
   }{\endgroup
     \def\@sudoku@grab@arguments#1.#2.#3.#4.#5.#6.#7.#8.#9.{%
       \scantokens{#1.#2.#3.#4.#5.#6.#7.#8.#9.}}%
   }
```

The `sudoku` environment simply calls the `sudoku-block` environment inside a `center` environment.

```
\newenvironment{sudoku}{%
        \begin{center}%
        \begin{sudoku-block}}{\end{sudoku-block}\end{center}}
```

2	5	8	7	3	6	9	4	1
6	1	9	8	2	4	3	5	7
4	3	7	9	1	5	2	6	8
3	9	5	2	7	1	4	8	6
7	6	2	4	9	8	1	3	5
8	4	1	6	5	3	7	2	9
1	8	4	3	6	9	5	7	2
5	7	6	1	4	2	8	9	3
9	2	3	5	8	7	6	1	4

Figure 3: Solution for easy puzzle

6	2	8	5	3	4	9	1	7
5	1	9	8	7	2	4	3	6
4	3	7	9	1	6	2	5	8
8	6	5	2	4	7	1	9	3
3	9	2	1	8	5	7	6	4
7	4	1	6	9	3	5	8	2
2	5	4	3	6	9	8	7	1
1	7	6	4	5	8	3	2	9
9	8	3	7	2	1	6	4	5

Figure 4: Solution for difficult puzzle