

# The `askmaps` package

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2013/12/04, version 0.1

## 1 Abstract

This package generates configurable American style Karnaugh maps for 2, 3, 4 and 5 variables as can be found in numerous books on digital design. Note that there are many ways to draw correct Karnaugh maps<sup>†</sup> and this packages creates only one version.

There are more packages and examples that produce Karnaugh maps. A highly recommendable package is written by Andreas W. Wieland<sup>‡</sup>. However, this package creates maps that are frequently found in dutch textbooks<sup>§</sup> but not in American textbooks.

## 2 Overview

After `\usepackage{askmaps}`, four new commands are loaded to draw Karnaugh maps using the `picture` environment:

|                         |                                     |
|-------------------------|-------------------------------------|
| <code>\askmapii</code>  | draws a two-variable Karnaugh map   |
| <code>\askmapiii</code> | draws a three-variable Karnaugh map |
| <code>\askmapiv</code>  | draws a four-variable Karnaugh map  |
| <code>\askmapv</code>   | draws a five-variable Karnaugh map  |

These commands have five parameters which have the same meaning for each commands. This will be explained in section 3. As can be seen later on, much of the parameters can include typesetting commands such as coloring and math notation.

The new dimension `\askmapunitlength` is available and specifies the length of the squares. It defaults to 1 cm (about 0.4 in) which is a good value for 12 pt font size.

The global definitions `\askmapsversion` and `\askmapsdate` will render to the current version and date respectively.

The command `\askmap` provides drop-in replacement for the `\karnaughmap` command available in the `kvdocs` package (although it is not really a package) and internally calls one of the four commands, but there are some drawbacks on using this command.

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†E.g., a four-variable Karnaugh map can be drawn in 384 different and correct ways

‡See <http://www.ctan.org/tex-archive/macros/latex/contrib/karnaugh>

§E.g. Digitale Techniek, A.P. Thijssen

### 3 Outline

All four functions take the form `\askmap<romannumber>{#1}{#2}{#3}{#4}{#5}` where `<romannumber>` is one of `ii`, `iii`, `iv` or `v` and the parameters `#1` to `#5` have the following meaning:

- `#1` is the function output variable.
- `#2` is a list of function input variables.
- `#3` contains a list of options, see table below.
- `#4` is a list of function values.
- `#5` can be used to display user defined picture commands.

If a parameter contains fewer elements than needed, you will get empty spaces in the Karnaugh map. If a parameter contains more elements than needed, all elements in excess are not printed. In both situations, you will not be notified.

The third parameter contains a list of options as explained below.

- `i` index numbers are printed in the lower left corner of each square.
- `I` no index numbers are printed (default).
- `f` function output variable is printed at the upper right corner of the Karnaugh map together with a small line extending from the square to the function name (default).
- `F` no function output variable is printed.
- `b` bit combinations of the function input variables are printed on top of the columns and at the right of the the rows (default).
- `B` bit combinations are not printed.
- `c` shortcut for `ifb`.
- `C` shortcut for `IFB`.

Options are evaluated from left to right, so a combination of `iI` will yield in no index numbers being printed. Please note that macros are not expanded to a list of tokens but to one token.

If you look at American style Karnaugh maps, you will see that the function output variable usually isn't printed with the map, but is printed below the map (if it is printed at all). This behavior can be simulated by using the `F` option, in which case the first parameter (the function output variable) may be left unused.

### 4 Use

Let's say we have the following truth table for a function `S` with two variables `a` and `b` and the function values `1`, `0`, `1` and `1` respectively.

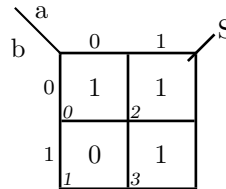
**Table 1:** *Truth table*

| a | b | S |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

Using the command

```
\askmapii{S}{ab}{i}{1011}{}
```

will produce the two-variable Karnaugh map as presented in figure 1.



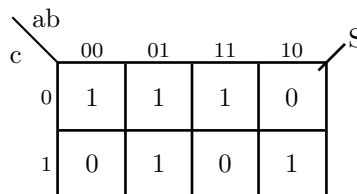
**Figure 1:** *Karnaughmap for two variables*

As you can see, the function output variable is printed top right of the Karnaugh map, with a small line from the variable to the top right square. The most significant function input variable is printed on the top left just above the small line extending from the top left square. The least significant function input variable is printed just below that line. The bit combinations for the most significant function input variable is printed on top of the columns, the bit combinations of the least significant function input variable is printed on the left of the rows. You can see how the function values are placed in the squares by observing the small index numbers in the lower left corners of the squares.

The command

```
\askmapiii{S}{abc}{10110110}{}
```

will produce a three-variable Karnaugh map as presented in figure 2. In this case, the index numbers are not printed.



**Figure 2:** *Karnaugh map for three variables*

Let's draw a Karnaugh map for a logic function with four inputs and one output. The output will become logic 1 if three or four inputs are logic 1, otherwise the output is logic 0. (Of course you can set up a truth table first; this is left as an exercise to the reader). The command

```
\askmapiv{S}{abcd}{0000000100010111}{}
```

will produce a four-variable Karnaugh map for the given logic function and is presented in figure 3.

|    |    |    |    |    |   |
|----|----|----|----|----|---|
|    | ab |    |    |    |   |
|    | 00 | 01 | 11 | 10 | S |
| dc | 00 | 0  | 0  | 0  | 0 |
|    | 01 | 0  | 0  | 1  | 0 |
|    | 11 | 0  | 1  | 1  | 1 |
|    | 10 | 0  | 0  | 1  | 0 |

**Figure 3:** Karnaugh map for four variables

Using the command

```
\askmapv{S}{abcde}{00101101010010111011110011101011}
```

will produce a five-variable Karnaugh map as shown in figure 4.

|    |     |     |     |     |     |     |     |     |   |
|----|-----|-----|-----|-----|-----|-----|-----|-----|---|
|    | abc |     |     |     |     |     |     |     |   |
|    | 000 | 001 | 011 | 010 | 110 | 111 | 101 | 100 | S |
| de | 00  | 0   | 1   | 1   | 0   | 1   | 1   | 1   | 1 |
|    | 01  | 0   | 1   | 0   | 1   | 1   | 0   | 1   | 0 |
|    | 11  | 0   | 1   | 1   | 0   | 0   | 1   | 0   | 1 |
|    | 10  | 1   | 0   | 1   | 0   | 1   | 1   | 0   | 1 |

**Figure 4:** Karnaugh map for five variables

Of course you can do a lot more with the parameters of the commands. You can use inline math to produce sophisticated variable names, you can use coloring for the function values. However, please note that the second and fourth parameter act as a list of tokens, so you have to use braces to separate the tokens in the lists if they consists of multiple characters. A list of tokens such as

```
{abcd}
```

will yield a, b, c and d as separate tokens, but

```
_${m_0}${m_1}${m_0}${m_1}$
```

will not work. You have to write

```
{{${m_0}$}${m_1}$}${m_0}$}${m_1}$}
```

The fifth parameter can be used to supply user created picture commands such as dashed rectangles or ovals to emphasize the simplifications in the function. Note that the origin of the picture (0,0) is at the lower left corner of the lower left square. Section 5 shows some examples.

The size of the indexes is scriptsize, the size of the bit combinations on the edges of the Karnaugh maps is footnotesize. All other text is in normalsize. Note that there are no commands to change the font sizes in the Karnaugh diagrams.

The command `\askmap` provides a drop-in replacement for the command `\karnaughmap` from the Karnaugh package. The command

```
\askmap{4}{F}{abcd}{0100101010100011}{}
```

produces the Karnaugh map in figure 5.

|    |    |    |    |    |   |
|----|----|----|----|----|---|
|    | ab |    |    |    |   |
|    | 00 | 01 | 11 | 10 |   |
| cd | 00 | 01 | 11 | 10 | F |
|    | 0  | 1  | 0  | 1  |   |
|    | 1  | 0  | 0  | 0  |   |
|    | 0  | 0  | 1  | 0  |   |
|    | 0  | 1  | 1  | 1  |   |

**Figure 5:** *Karnaugh map using drop-in replacement*

Only Karnaugh maps of two to five variables are supported, any other number will trigger a warning. Please note that the `\kvindex`, `\kvindexsize` and `\kvcontentsize` commands are not supported.

## 5 Examples

The Karnaugh maps for two variables: plain, with indexes, without function output variable.

```
\askmapii{S}{ab}{}{1010}{}
\askmapii{S}{ab}{i}{1110}{}
\askmapii{S}{ab}{F}{1110}{}
```

|   |   |   |   |   |
|---|---|---|---|---|
|   |   | a |   |   |
|   |   | 0 | 1 | S |
| b | 0 | 1 | 1 |   |
|   | 1 | 0 | 0 |   |

|   |   |          |          |          |
|---|---|----------|----------|----------|
|   |   | a        |          |          |
|   |   | 0        | 1        | S        |
| b | 0 | 1        | 1        |          |
|   | 1 | 1        | 0        |          |
|   |   | <i>0</i> | <i>2</i> | <i>3</i> |

|   |   |   |   |  |
|---|---|---|---|--|
|   |   | a |   |  |
|   |   | 0 | 1 |  |
| b | 0 | 1 | 1 |  |
|   | 1 | 1 | 0 |  |

The Karnaugh maps for three variables: plain, with indexes but without function output variable.

```
\askmapiii{S}{abc}{}{00111010}{}
\askmapiii{F}{xyz}{iF}{11111010}{}
```

|   |   |    |    |    |    |   |  |
|---|---|----|----|----|----|---|--|
|   |   | ab |    |    |    |   |  |
|   |   | 00 | 01 | 11 | 10 | S |  |
| c | 0 | 0  | 1  | 1  | 1  |   |  |
|   | 1 | 0  | 1  | 0  | 0  |   |  |

|   |   |          |          |          |          |  |  |
|---|---|----------|----------|----------|----------|--|--|
|   |   | xy       |          |          |          |  |  |
|   |   | 00       | 01       | 11       | 10       |  |  |
| z | 0 | 1        | 1        | 1        | 1        |  |  |
|   | 1 | 1        | 1        | 0        | 0        |  |  |
|   |   | <i>0</i> | <i>2</i> | <i>6</i> | <i>4</i> |  |  |
|   |   | <i>1</i> | <i>3</i> | <i>7</i> | <i>5</i> |  |  |

The Karnaugh maps for four variables: without function output variable, with indexes.

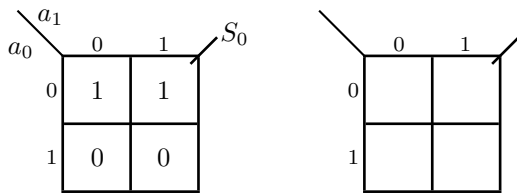
```
\askmapiv{f}{wxyz}{F}{1110001101000101}{}
\askmapiv{S}{abcd}{i}{1100100100011101}{}
```

|    |    |    |    |    |    |  |  |
|----|----|----|----|----|----|--|--|
|    |    | wx |    |    |    |  |  |
|    |    | 00 | 01 | 11 | 10 |  |  |
| yz | 00 | 1  | 0  | 0  | 0  |  |  |
|    | 01 | 1  | 0  | 1  | 1  |  |  |
|    | 11 | 0  | 1  | 1  | 0  |  |  |
|    | 10 | 1  | 1  | 0  | 0  |  |  |

|    |    |          |          |           |           |   |  |
|----|----|----------|----------|-----------|-----------|---|--|
|    |    | ab       |          |           |           |   |  |
|    |    | 00       | 01       | 11        | 10        | S |  |
| cd | 00 | 1        | 1        | 1         | 0         |   |  |
|    | 01 | 1        | 0        | 1         | 0         |   |  |
|    | 11 | 0        | 1        | 1         | 1         |   |  |
|    | 10 | 0        | 0        | 0         | 0         |   |  |
|    |    | <i>0</i> | <i>4</i> | <i>12</i> | <i>8</i>  |   |  |
|    |    | <i>1</i> | <i>5</i> | <i>13</i> | <i>9</i>  |   |  |
|    |    | <i>3</i> | <i>7</i> | <i>15</i> | <i>11</i> |   |  |
|    |    | <i>2</i> | <i>6</i> | <i>14</i> | <i>10</i> |   |  |

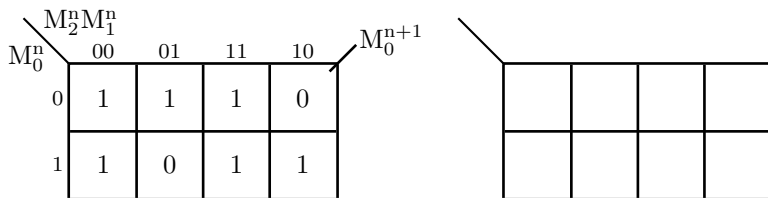
You can also do math things by using the known \$ signs... and you can make an empty map for your exams...

```
\askmapiii{\$S_0\$}{\{\$a_1\$}{\$a_0\$}}{\{1010\}}
\askmapiii{}{}{}{}
```



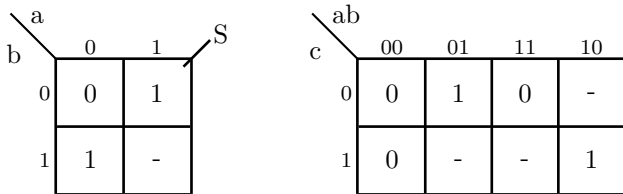
You can do the math thing in roman font... and of course you can make a *really* empty map for your exams...

```
\begin{verbatim}
\askmapiiii{\mathrm{M}^{n+1}_0}{\{\mathrm{M}^n_2\}{\mathrm{M}^n_1\}}
{\mathrm{M}^n_0}{\{11100111\}}
\askmapiiii{}{BF}{}{}
```



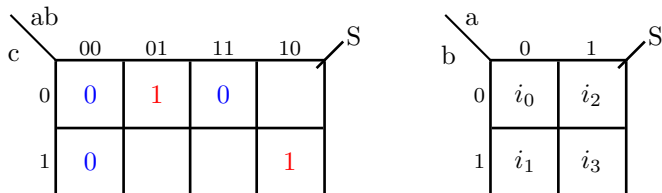
You can do things with don't cares...

```
\askmapiii{S}{ab}{\{011-\}}
\askmapiiii{S}{abc}{F}{\{001--10-\}}
```



You can use colors and empty function values and variables as values too...

```
\askmapiiii{S}{abc}{\{\color{blue}{0}\color{blue}{0}\color{red}{1}\}}
{\color{red}{1}\color{blue}{0}\}}
\askmapiii{S}{ab}{\{\$i_0\$}{\$i_1\$}{\$i_2\$}{\$i_3\$}}
```

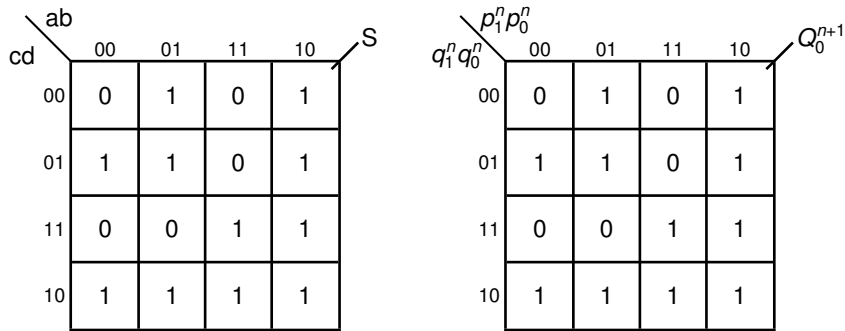


You can set the font to something else ... and use sans math font ...

```

{\fontfamily{phv}\selectfont%
\askmapiv{S}{abcd}{0110111011110011}{}%
}
{\fontfamily{phv}\selectfont\sansmath
\askmapiv{$Q^{n+1}_0$}{$p^n_{-1}$}{$p^n_{-0}$}{$q^n_{-1}$}{$q^n_{-0}$}}
{0110111011110011}{}%
}

```

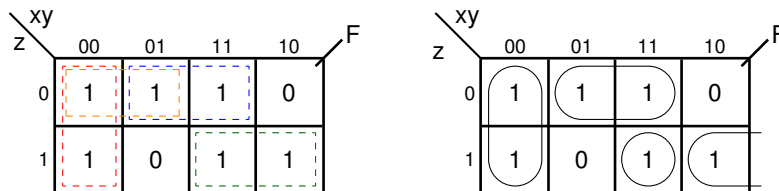


You can use the last parameter to create to your own picture commands. Note that the origin of the picture (0,0) is at the lower left corner of the lower left square. It is also possible to use `\raisebox` in conjunction with horizontal spacing to adjust the placing of the left (least significant) variable(s).

```

{\fontfamily{phv}\selectfont\sansmath
\askmapiii{F}{xy{\raisebox{2ex}{\ z}}}{11100111}{% raise Z input
\color{red}\put(0.1,0.1){\dashbox{0.1}(0.8,1.8)}{}}%
\color{blue}\put(1.1,1.1){\dashbox{0.1}(1.8,0.8)}{}}%
\color{darkgreen}\put(2.1,0.1){\dashbox{0.1}(1.8,0.8)}{}}%
\color{orange}\put(0.15,1.15){\dashbox{0.1}(1.7,0.7)}{}}%
}}%
{\fontfamily{phv}\selectfont\sansmath
\askmapiii{F}{xyz}{11100111}{%
\put(0.5,1.0){\oval(0.8,1.8)}%
\put(2.0,1.5){\oval(1.8,0.8)}%
\put(2.5,0.5){\oval(0.8,0.8)}% circle
\put(3.5,0.5){\oval(0.8,0.8)[1]}% these three create
\put(3.5,0.9){\line(1,0){0.6}}% a oval open to the left
\put(3.5,0.1){\line(1,0){0.6}}%
}}%

```



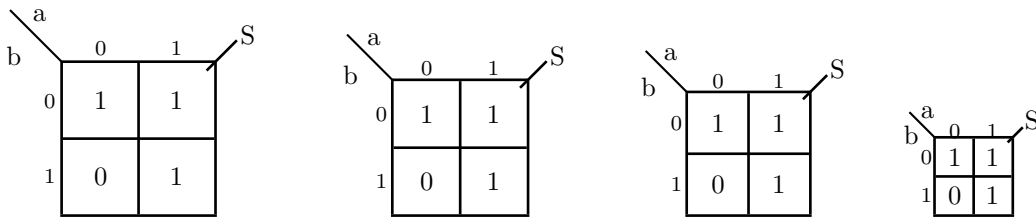


You can set the length of the squares, but please note that this will also affect the rendering of the text...

```

\askmapunitlength=1cm
\askmapii{S}{ab}{1011}{}
\askmapunitlength=0.88cm
\askmapii{S}{ab}{1011}{}
\askmapunitlength=0.8cm
\askmapii{S}{ab}{1011}{}
\askmapunitlength=0.5cm
\askmapii{S}{ab}{1011}{}

```

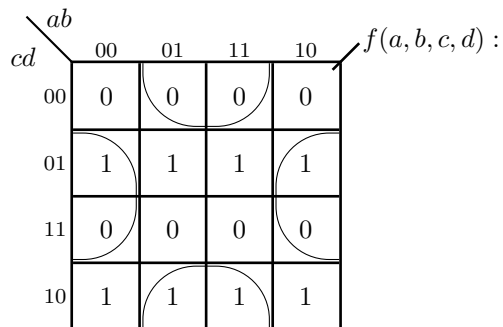


An example directly from the Karnaugh package:

```

\askmap{4}{f(a,b,c,d):$}{{a$}{b$}{c$}{d$}}%
{0110011001100110}%
f%
\put(0,2){\oval(1.9,1.9)[r]}
\put(4,2){\oval(1.9,1.9)[l]}
\put(2,0){\oval(1.9,1.9)[t]}
\put(2,4){\oval(1.9,1.9)[b]}
}

```



but please note that the ovals do not cover the logic 1's in the Karnaughmap because the function values are placed differently.

## 6 The source code

The source code is pretty straight forward. It uses a lot of picture primitives for drawing the maps. The package uses three macros for processing variable-length parameters, which were completely reused from the karnaugh package.

```
1 %%
2 %% askmaps.sty
3 %%
4 %% American Style K-maps (2, 3, 4 and 5 variables)
5 %%
6 %% (c)2013 Jesse op den Brouw, <J.E.J.opdenBrouw@hhs.nl>
7 %%
8 %% LPPL LaTeX Public Project License
9 %%
10 \NeedsTeXFormat{LaTeX2e}[1994/06/01]
11 %% Version and date
12 \gdef\askmapsversion{0.1}
13 \gdef\askmapsdate{2013/12/04}
14 %
15 \ProvidesPackage{askmaps}[\askmapsdate\space Version \askmapsversion\space
16 LaTeX package for drawing American Style Karnaugh maps]
17
18 %% This package provides 2, 3, 4 and 5 variable Karnaugh maps that can
19 %% be found in numerous american text books on digital design. Note
20 %% that it is possible to draw many different K-maps that are all
21 %% legitimate as long as a square (minterm) differs only in one
22 %% literal with its adjacent squares.
23 %% This package draws K-maps where the most significant input variables
24 %% are placed on top of the columns and the least significant variables
25 %% are placed left of the rows. Such K-maps can be found in the text books:
26 %% Design of Logic Systems, 2nd, Lewin & Protheroe
27 %% Digital System Design with VHDL, 2nd, Zwolinski
28
29 %% Packages needed
30 \RequirePackage{pict2e}
31
32 %% The macros \askmapargumentstring, \askmapgetchar and \askmapgetonechar are
33 %% needed to process the variable-length parameters in \askmapxxx:
34 %% These routine politely reused from karnaugh package
35 \def\askmapargumentstring#1{\gdef\askmapdummystring{#1}\noexpand\end}
36 \def\askmapgetchar{\expandafter\askmapgetonechar\askmapdummystring}
37 \def\askmapgetonechar#1#2\end{{#1}\gdef\askmapdummystring{#2\noexpand\end}}%
38
39 %% Dimension for length of one square
40 \newdimen\askmapunitlength
41 \askmapunitlength=10mm
42
43 %% Some use options
44 \newif\ifaskmap@opti% want indexes
45 \newif\ifaskmap@optf% want output function printed
46 \newif\ifaskmap@optb% want input variable bit combinations at columns and rows
47
48 %% We want bit combinations along with the columns and rows
49 %\askmap@optbtrue
50
51 %% Process user options
52 \def\askmap@processoptions#1{%
53   \askmap@optifalse\askmap@optftrue\askmap@optbtrue%
54   \@tfor\askmap@opt:=#1\do{%
55     \if i\askmap@opt\askmap@optittrue\fi%
```

```

56     \if I\askmap@opt\askmap@optifalse\fi%
57     \if f\askmap@opt\askmap@optftrue\fi%
58     \if F\askmap@opt\askmap@optffalse\fi%
59     \if b\askmap@opt\askmap@optbtrue\fi%
60     \if B\askmap@opt\askmap@optbfalse\fi%
61     \if c\askmap@opt\askmap@optittrue\askmap@optftrue\askmap@optbtrue\fi%
62     \if C\askmap@opt\askmap@optifalse\askmap@optffalse\askmap@optbfalse\fi%
63 }%
64 }%
65
66 %% Replacement for macros from karnaugh package
67 %% #1 = number of input variables
68 %% #2 = function output variable
69 %% #3 = function input variables
70 %% #4 = list of function values
71 %% #5 = user picture commands
72 \newcommand{\askmap}[5]{%
73 \if 2#1\relax
74   \askmapii{#2}{#3}{f}{#4}{#5}%
75 \else
76   \if 3#1\relax
77     \askmapiii{#2}{#3}{f}{#4}{#5}%
78   \else
79     \if 4#1\relax
80       \askmapiv{#2}{#3}{f}{#4}{#5}%
81     \else
82       \if 5#1\relax
83         \askmapv{#2}{#3}{f}{#4}{#5}%
84       \else
85         \PackageWarning{askmaps}{Sorry, no K-maps with #1 variables supported
86           by package askmaps!}
87       \fi%
88     \fi%
89   \fi%
90 }%
91
92 %% #1= output function variable
93 %% #2= 2 input variables
94 %% #3= options list
95 %% #4= 4 function values
96 %% #5= user defined picture commands
97 \newcommand{\askmapii}[5]{%
98 {\unitlength\askmapunitlength%
99 \askmap@processoptions{#3}%
100 \begin{picture}(4.4,3)(-1.2,0)%
101 \linethickness{1pt}%
102 \put(0,0){\framebox(2,2)}%
103 \put(1,0){\line(0,1){2}}%
104 \put(0,1){\line(1,0){2}}%
105 \ifaskmap@optf%
106 \put(2.35,2.25){#1}%
107 \put(1.9,1.9){\line(1,1){0.4}}%
108 \fi%
109 \askmapargumentstring{#2}%
110 \put(-0.4,2.55){\askmapgetchar}%
111 \put(-0.9,2.1){\makebox(0.5,0){\askmapgetchar}}%
112 \ifaskmap@opti%
113 \put(0.01,1.05){\scriptsize{\textsl{0}}}% a little bit to the edge because
114 \put(0.01,0.03){\scriptsize{\textsl{1}}}% the edge line is thick
115 \put(1.03,1.05){\scriptsize{\textsl{2}}}%
116 \put(1.03,0.03){\scriptsize{\textsl{3}}}%

```

```

117 \fi%
118 \ifaskmap@optb%
119 \put(-0.6,1.5){\makebox(0.5,0)[r]{\footnotesize{0}}}%
120 \put(-0.6,0.5){\makebox(0.5,0)[r]{\footnotesize{1}}}%
121 \put(0.5,2.2){\makebox(0,0){\footnotesize{0}}}%
122 \put(1.5,2.2){\makebox(0,0){\footnotesize{1}}}%
123 \fi%
124 \askmapargumentstring{#4}%
125 \put(0.5,1.5){\makebox(0,0){\askmapgetchar}}%
126 \put(0.5,0.5){\makebox(0,0){\askmapgetchar}}%
127 \put(1.5,1.5){\makebox(0,0){\askmapgetchar}}%
128 \put(1.5,0.5){\makebox(0,0){\askmapgetchar}}%
129 \thicklines%
130 \put(0,2){\line(-1,1){0.70}}%
131 \thinlines%
132 #5%
133 \end{picture}%
134 }%
135 }% end \askmapii
136
137 %% #1= output function variable
138 %% #2= 3 input variables
139 %% #3= options list
140 %% #4= 8 function values
141 %% #5= user defined picture commands
142 \newcommand{\askmapiii}[5]{%
143 {\unitlength\askmapunitlength%
144 \askmap@processoptions{#3}%
145 \begin{picture}(6.4,3)(-1.2,0)%
146 \linethickness{1pt}%
147 \put(0,0){\framebox(4,2)}%
148 \multiput(1,0)(1,0){3}{\line(0,1){2}}%
149 \put(0,1){\line(1,0){4}}%
150 \ifaskmap@optf%
151 \put(4.35,2.25){#1}%
152 \put(3.9,1.9){\line(1,1){0.4}}%
153 \fi%
154 \askmapargumentstring{#2}%
155 \put(-0.4,2.55){\askmapgetchar\askmapgetchar}%
156 \put(-0.9,2.1){\makebox(0.5,0){\askmapgetchar}}%
157 \ifaskmap@opti%
158 \put(0.01,1.05){\scriptsize{\textsl{0}}}%
159 \put(0.01,0.03){\scriptsize{\textsl{1}}}%
160 \put(1.03,1.05){\scriptsize{\textsl{2}}}%
161 \put(1.03,0.03){\scriptsize{\textsl{3}}}%
162 \put(3.03,1.05){\scriptsize{\textsl{4}}}%
163 \put(3.03,0.03){\scriptsize{\textsl{5}}}%
164 \put(2.03,1.05){\scriptsize{\textsl{6}}}%
165 \put(2.03,0.03){\scriptsize{\textsl{7}}}%
166 \fi%
167 \askmapargumentstring{#4}%
168 \put(0.5,1.5){\makebox(0,0){\askmapgetchar}}%
169 \put(0.5,0.5){\makebox(0,0){\askmapgetchar}}%
170 \put(1.5,1.5){\makebox(0,0){\askmapgetchar}}%
171 \put(1.5,0.5){\makebox(0,0){\askmapgetchar}}%
172 \put(3.5,1.5){\makebox(0,0){\askmapgetchar}}%
173 \put(3.5,0.5){\makebox(0,0){\askmapgetchar}}%
174 \put(2.5,1.5){\makebox(0,0){\askmapgetchar}}%
175 \put(2.5,0.5){\makebox(0,0){\askmapgetchar}}%
176 \ifaskmap@optb%
177 \put(-0.6,1.5){\makebox(0.5,0)[r]{\footnotesize{0}}}%
178 \put(-0.6,0.5){\makebox(0.5,0)[r]{\footnotesize{1}}}%

```

```

179 \put (0.5,2.2) {\makebox (0,0) {\footnotesize{00}}}%
180 \put (1.5,2.2) {\makebox (0,0) {\footnotesize{01}}}%
181 \put (2.5,2.2) {\makebox (0,0) {\footnotesize{11}}}%
182 \put (3.5,2.2) {\makebox (0,0) {\footnotesize{10}}}%
183 \fi%
184 \thicklines%
185 \put (0,2) {\line (-1,1) {0.70}}%
186 \thinlines%
187 #5%
188 \end{picture}%
189 }%
190 }% end \askmapiii
191
192 %% #1= output function variable
193 %% #2= 4 input variables
194 %% #3= options list
195 %% #4= 16 function values
196 %% #5= user defined picture commands
197 \newcommand{\askmapiv}[5]{%
198 {\unitlength\askmapunitlength%
199 \askmap@processoptions{#3}%
200 \begin{picture}(6.4,5) (-1.2,0)%
201 \linethickness{1pt}%
202 \put (0,0) {\framebox (4,4)}%
203 \multiput (1,0) (1,0) {3}{\line (0,1) {4}}%
204 \multiput (0,1) (0,1) {3}{\line (1,0) {4}}%
205 \ifaskmap@optf%
206 \put (4.35,4.25) {#1}%
207 \put (3.9,3.9) {\line (1,1) {0.4}}%
208 \fi%
209 \askmapargumentstring{#2}%
210 \put (-0.4,4.55) {\askmapgetchar\askmapgetchar}%
211 \put (-1.0,4.1) {\makebox (0.5,0) {\askmapgetchar\askmapgetchar}}%
212 \ifaskmap@opti%
213 \put (0.01,3.05) {\scriptsize{\textsl{0}}}%
214 \put (0.01,2.05) {\scriptsize{\textsl{1}}}%
215 \put (0.01,0.03) {\scriptsize{\textsl{2}}}%
216 \put (0.01,1.05) {\scriptsize{\textsl{3}}}%
217 \put (1.03,3.05) {\scriptsize{\textsl{4}}}%
218 \put (1.03,2.05) {\scriptsize{\textsl{5}}}%
219 \put (1.03,0.03) {\scriptsize{\textsl{6}}}%
220 \put (1.03,1.05) {\scriptsize{\textsl{7}}}%
221 \put (3.03,3.05) {\scriptsize{\textsl{8}}}%
222 \put (3.03,2.05) {\scriptsize{\textsl{9}}}%
223 \put (3.03,0.03) {\scriptsize{\textsl{10}}}%
224 \put (3.03,1.05) {\scriptsize{\textsl{11}}}%
225 \put (2.03,3.05) {\scriptsize{\textsl{12}}}%
226 \put (2.03,2.05) {\scriptsize{\textsl{13}}}%
227 \put (2.03,0.03) {\scriptsize{\textsl{14}}}%
228 \put (2.03,1.05) {\scriptsize{\textsl{15}}}%
229 \fi%
230 \askmapargumentstring{#4}%
231 \put (0.5,3.5) {\makebox (0,0) {\askmapgetchar}}%
232 \put (0.5,2.5) {\makebox (0,0) {\askmapgetchar}}%
233 \put (0.5,0.5) {\makebox (0,0) {\askmapgetchar}}%
234 \put (0.5,1.5) {\makebox (0,0) {\askmapgetchar}}%
235 \put (1.5,3.5) {\makebox (0,0) {\askmapgetchar}}%
236 \put (1.5,2.5) {\makebox (0,0) {\askmapgetchar}}%
237 \put (1.5,0.5) {\makebox (0,0) {\askmapgetchar}}%
238 \put (1.5,1.5) {\makebox (0,0) {\askmapgetchar}}%
239 \put (3.5,3.5) {\makebox (0,0) {\askmapgetchar}}%
240 \put (3.5,2.5) {\makebox (0,0) {\askmapgetchar}}%

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```

241 \put (3.5,0.5) {\makebox(0,0){\askmapgetchar}}%
242 \put (3.5,1.5) {\makebox(0,0){\askmapgetchar}}%
243 \put (2.5,3.5) {\makebox(0,0){\askmapgetchar}}%
244 \put (2.5,2.5) {\makebox(0,0){\askmapgetchar}}%
245 \put (2.5,0.5) {\makebox(0,0){\askmapgetchar}}%
246 \put (2.5,1.5) {\makebox(0,0){\askmapgetchar}}%
247 \ifaskmap@optb%
248 \put (-0.6,3.5) {\makebox(0.5,0)[r]{\footnotesize{00}}}%
249 \put (-0.6,2.5) {\makebox(0.5,0)[r]{\footnotesize{01}}}%
250 \put (-0.6,1.5) {\makebox(0.5,0)[r]{\footnotesize{11}}}%
251 \put (-0.6,0.5) {\makebox(0.5,0)[r]{\footnotesize{10}}}%
252 \put (0.5,4.2) {\makebox(0,0){\footnotesize{00}}}%
253 \put (1.5,4.2) {\makebox(0,0){\footnotesize{01}}}%
254 \put (2.5,4.2) {\makebox(0,0){\footnotesize{11}}}%
255 \put (3.5,4.2) {\makebox(0,0){\footnotesize{10}}}%
256 \fi
257 \thicklines%
258 \put (0,4) {\line(-1,1){0.70}}%
259 \thinlines%
260 #5%
261 \end{picture}%
262 }%
263 }% end \askmapiv
264
265 %% #1= output function variable
266 %% #2= 5 input variables
267 %% #3= options list
268 %% #4= 32 function values
269 %% #5= user defined picture commands
270 \newcommand{\askmapv}[5]{%
271 {\unitlength\askmapunitlength%
272 \askmap@processoptions{#3}%
273 \begin{picture}(10.4,5)(-1.2,0)%
274 \linethickness{1pt}%
275 \put (0,0) {\framebox(8,4)}%
276 \multiput (1,0) (1,0) {7} {\line(0,1){4}}%
277 \multiput (0,1) (0,1) {3} {\line(1,0){8}}%
278 \ifaskmap@optf%
279 \put (8.35,4.25) {#1}%
280 \put (7.9,3.9) {\line(1,1){0.4}}%
281 \fi%
282 \askmapargumentstring{#2}%
283 \put (-0.4,4.55) {\askmapgetchar\askmapgetchar\askmapgetchar}%
284 \put (-1.0,4.1) {\makebox(0.5,0){\askmapgetchar\askmapgetchar}}%
285 \ifaskmap@opti%
286 \put (0.01,3.05) {\scriptsize{\textsl{0}}}%
287 \put (0.01,2.05) {\scriptsize{\textsl{1}}}%
288 \put (0.01,0.03) {\scriptsize{\textsl{2}}}%
289 \put (0.01,1.05) {\scriptsize{\textsl{3}}}%
290 \put (1.03,3.05) {\scriptsize{\textsl{4}}}%
291 \put (1.03,2.05) {\scriptsize{\textsl{5}}}%
292 \put (1.03,0.03) {\scriptsize{\textsl{6}}}%
293 \put (1.03,1.05) {\scriptsize{\textsl{7}}}%
294 \put (3.03,3.05) {\scriptsize{\textsl{8}}}%
295 \put (3.03,2.05) {\scriptsize{\textsl{9}}}%
296 \put (3.03,0.03) {\scriptsize{\textsl{10}}}%
297 \put (3.03,1.05) {\scriptsize{\textsl{11}}}%
298 \put (2.03,3.05) {\scriptsize{\textsl{12}}}%
299 \put (2.03,2.05) {\scriptsize{\textsl{13}}}%
300 \put (2.03,0.03) {\scriptsize{\textsl{14}}}%
301 \put (2.03,1.05) {\scriptsize{\textsl{15}}}%
302 \put (7.03,3.05) {\scriptsize{\textsl{16}}}%

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```

303 \put (7.03,2.05) {\scriptsize{\textsl{17}}}%
304 \put (7.03,0.03) {\scriptsize{\textsl{18}}}%
305 \put (7.03,1.05) {\scriptsize{\textsl{19}}}%
306 \put (6.03,3.05) {\scriptsize{\textsl{20}}}%
307 \put (6.03,2.05) {\scriptsize{\textsl{21}}}%
308 \put (6.03,0.03) {\scriptsize{\textsl{22}}}%
309 \put (6.03,1.05) {\scriptsize{\textsl{23}}}%
310 \put (4.03,3.05) {\scriptsize{\textsl{24}}}%
311 \put (4.03,2.05) {\scriptsize{\textsl{25}}}%
312 \put (4.03,0.03) {\scriptsize{\textsl{26}}}%
313 \put (4.03,1.05) {\scriptsize{\textsl{27}}}%
314 \put (5.03,3.05) {\scriptsize{\textsl{28}}}%
315 \put (5.03,2.05) {\scriptsize{\textsl{29}}}%
316 \put (5.03,0.03) {\scriptsize{\textsl{30}}}%
317 \put (5.03,1.05) {\scriptsize{\textsl{31}}}%
318 \fi%
319 \askmapargumentstring{#4}%
320 \put (0.5,3.5) {\makebox(0,0){\askmapgetchar}}%
321 \put (0.5,2.5) {\makebox(0,0){\askmapgetchar}}%
322 \put (0.5,0.5) {\makebox(0,0){\askmapgetchar}}%
323 \put (0.5,1.5) {\makebox(0,0){\askmapgetchar}}%
324 \put (1.5,3.5) {\makebox(0,0){\askmapgetchar}}%
325 \put (1.5,2.5) {\makebox(0,0){\askmapgetchar}}%
326 \put (1.5,0.5) {\makebox(0,0){\askmapgetchar}}%
327 \put (1.5,1.5) {\makebox(0,0){\askmapgetchar}}%
328 \put (3.5,3.5) {\makebox(0,0){\askmapgetchar}}%
329 \put (3.5,2.5) {\makebox(0,0){\askmapgetchar}}%
330 \put (3.5,0.5) {\makebox(0,0){\askmapgetchar}}%
331 \put (3.5,1.5) {\makebox(0,0){\askmapgetchar}}%
332 \put (2.5,3.5) {\makebox(0,0){\askmapgetchar}}%
333 \put (2.5,2.5) {\makebox(0,0){\askmapgetchar}}%
334 \put (2.5,0.5) {\makebox(0,0){\askmapgetchar}}%
335 \put (2.5,1.5) {\makebox(0,0){\askmapgetchar}}%
336 \put (7.5,3.5) {\makebox(0,0){\askmapgetchar}}%
337 \put (7.5,2.5) {\makebox(0,0){\askmapgetchar}}%
338 \put (7.5,0.5) {\makebox(0,0){\askmapgetchar}}%
339 \put (7.5,1.5) {\makebox(0,0){\askmapgetchar}}%
340 \put (6.5,3.5) {\makebox(0,0){\askmapgetchar}}%
341 \put (6.5,2.5) {\makebox(0,0){\askmapgetchar}}%
342 \put (6.5,0.5) {\makebox(0,0){\askmapgetchar}}%
343 \put (6.5,1.5) {\makebox(0,0){\askmapgetchar}}%
344 \put (4.5,3.5) {\makebox(0,0){\askmapgetchar}}%
345 \put (4.5,2.5) {\makebox(0,0){\askmapgetchar}}%
346 \put (4.5,0.5) {\makebox(0,0){\askmapgetchar}}%
347 \put (4.5,1.5) {\makebox(0,0){\askmapgetchar}}%
348 \put (5.5,3.5) {\makebox(0,0){\askmapgetchar}}%
349 \put (5.5,2.5) {\makebox(0,0){\askmapgetchar}}%
350 \put (5.5,0.5) {\makebox(0,0){\askmapgetchar}}%
351 \put (5.5,1.5) {\makebox(0,0){\askmapgetchar}}%
352 \ifaskmap@optb%
353 \put (-0.6,3.5) {\makebox(0.5,0)[r]{\footnotesize{00}}}%
354 \put (-0.6,2.5) {\makebox(0.5,0)[r]{\footnotesize{01}}}%
355 \put (-0.6,1.5) {\makebox(0.5,0)[r]{\footnotesize{11}}}%
356 \put (-0.6,0.5) {\makebox(0.5,0)[r]{\footnotesize{10}}}%
357 \put (0.5,4.2) {\makebox(0,0){\footnotesize{000}}}%
358 \put (1.5,4.2) {\makebox(0,0){\footnotesize{001}}}%
359 \put (2.5,4.2) {\makebox(0,0){\footnotesize{011}}}%
360 \put (3.5,4.2) {\makebox(0,0){\footnotesize{010}}}%
361 \put (4.5,4.2) {\makebox(0,0){\footnotesize{110}}}%
362 \put (5.5,4.2) {\makebox(0,0){\footnotesize{111}}}%
363 \put (6.5,4.2) {\makebox(0,0){\footnotesize{101}}}%
364 \put (7.5,4.2) {\makebox(0,0){\footnotesize{100}}}%

```

```
365 \fi%
366 \thicklines%
367 \put (0,4){\line(-1,1){0.70}}%
368 \thinlines%
369 #5%
370 \end{picture}%
371 }%
372 }% end \askmapv
373
374 \endinput
375 %%
376 %% End of file 'askmaps.sty'.
```

---

*askmaps.sty*