# A guide to **figure layout** in R

This document provides an overview of methods for controlling the size and position of figures. See the R documentation on the `par()` and `layout()` functions for more details.

Code for all examples is provided in the accompanying script.

Definitions of regions

R defines three regions of the graphical output: the *plot region*, *figure region*, and *device region*.The plot region is bounded by the *plot border*. The figure region is bounded by the *figure border*, and the device region is bounded by the *outer border*.
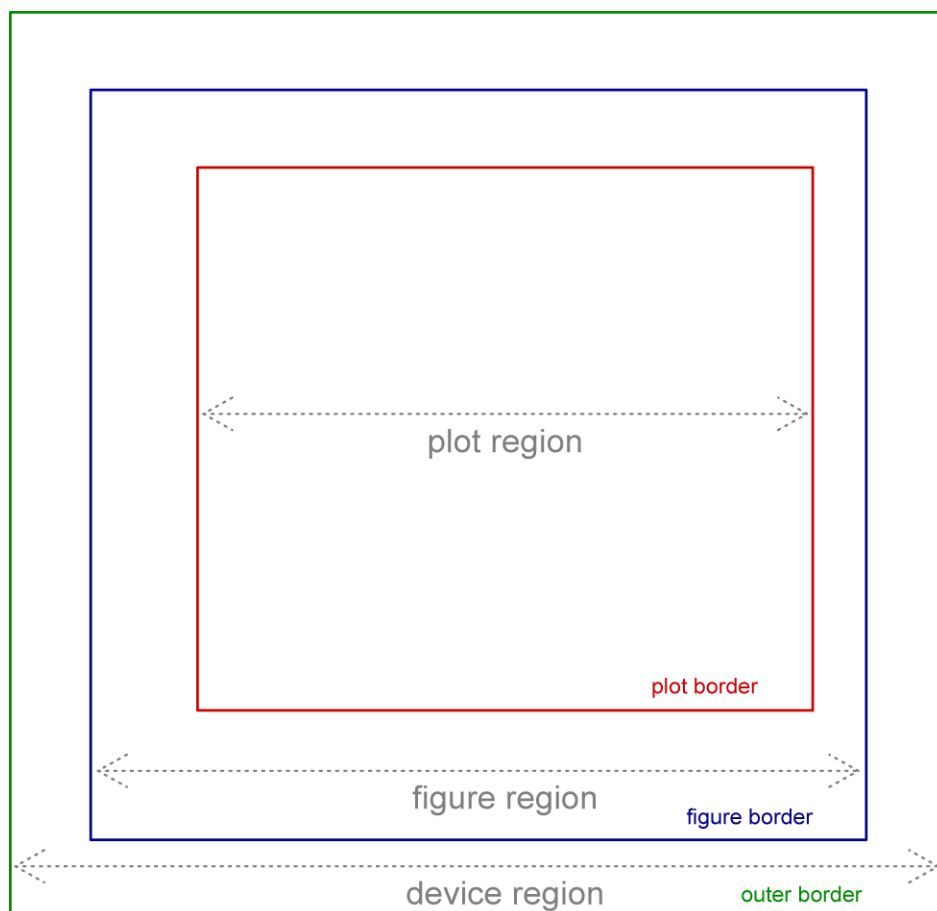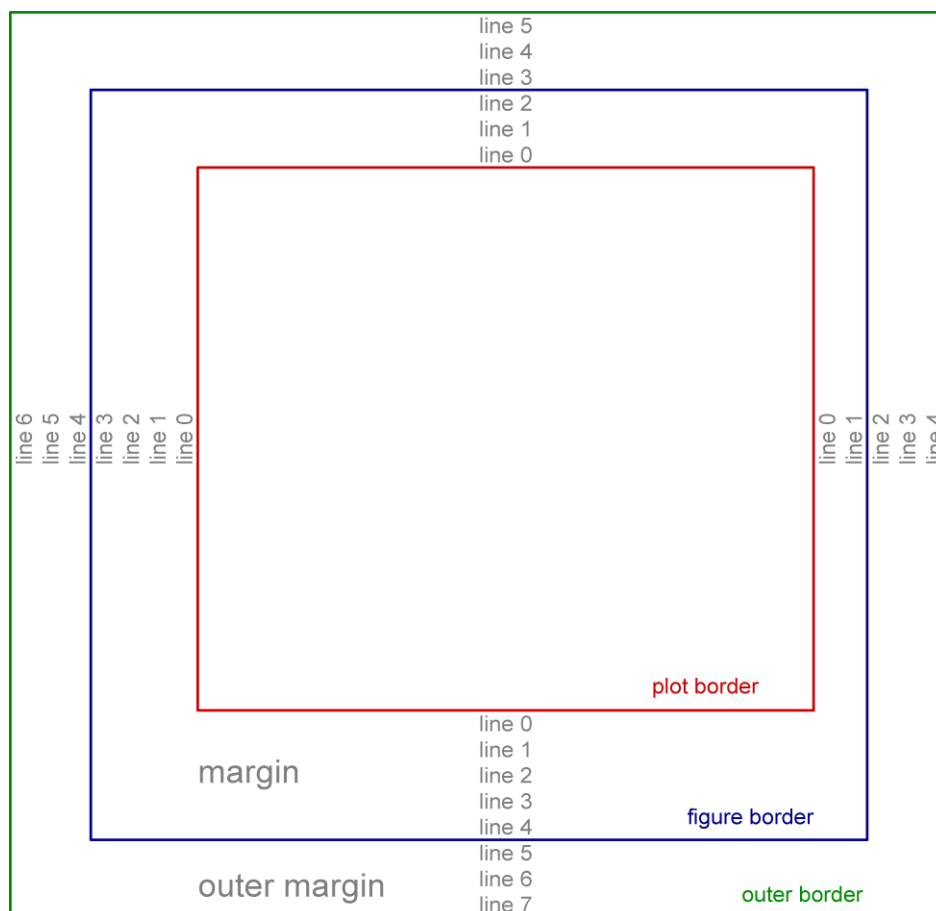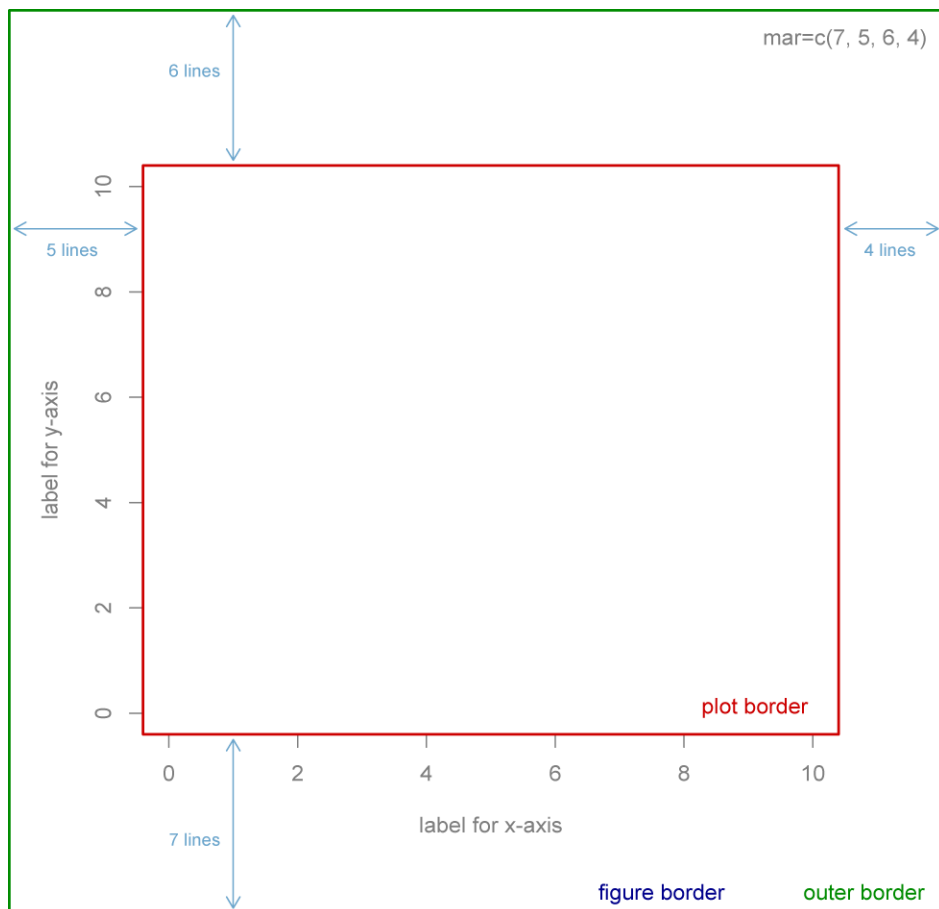
Setting margins
and outer margins

The areas between the plot border and figure border are called the *margins*. The *outer margins* are the regions between the figure border and outer border.

The `mar` argument of the `par()` function sets margins in units of lines, as shown in the figure below. The `mai` argument sets margins in units of inches. For both functions, the margins are specified as a vector of four values, corresponding to the bottom, left, top, and right sides.
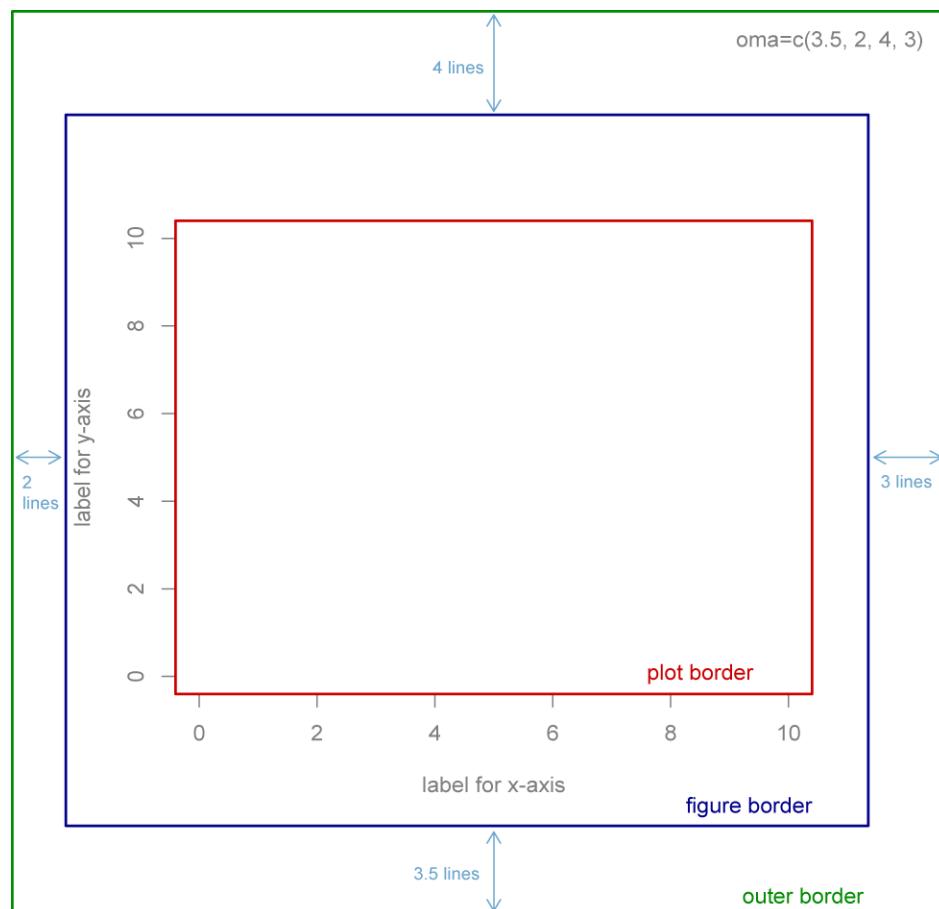
The outer margins are set with the argument `oma` (in units of lines) or `omi` (in inches).
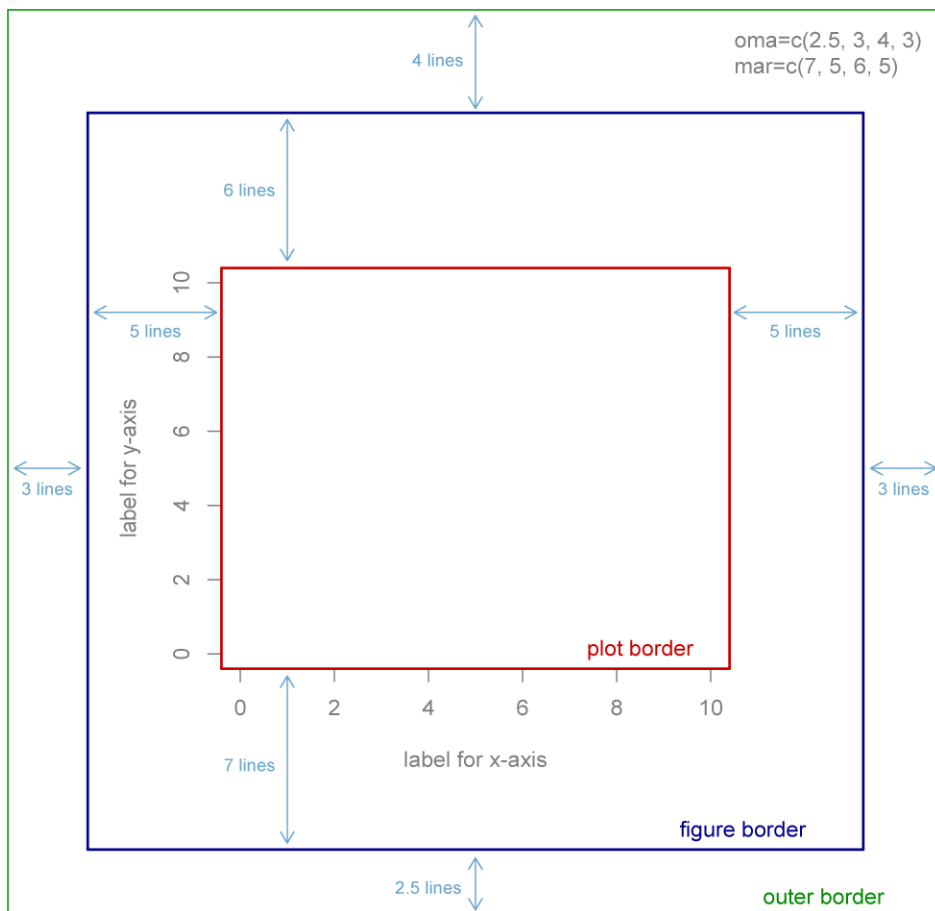

This figure created using
```
par(mar=c(5, 4, 3, 2))
par(oma=c(3, 3, 3, 3))
```
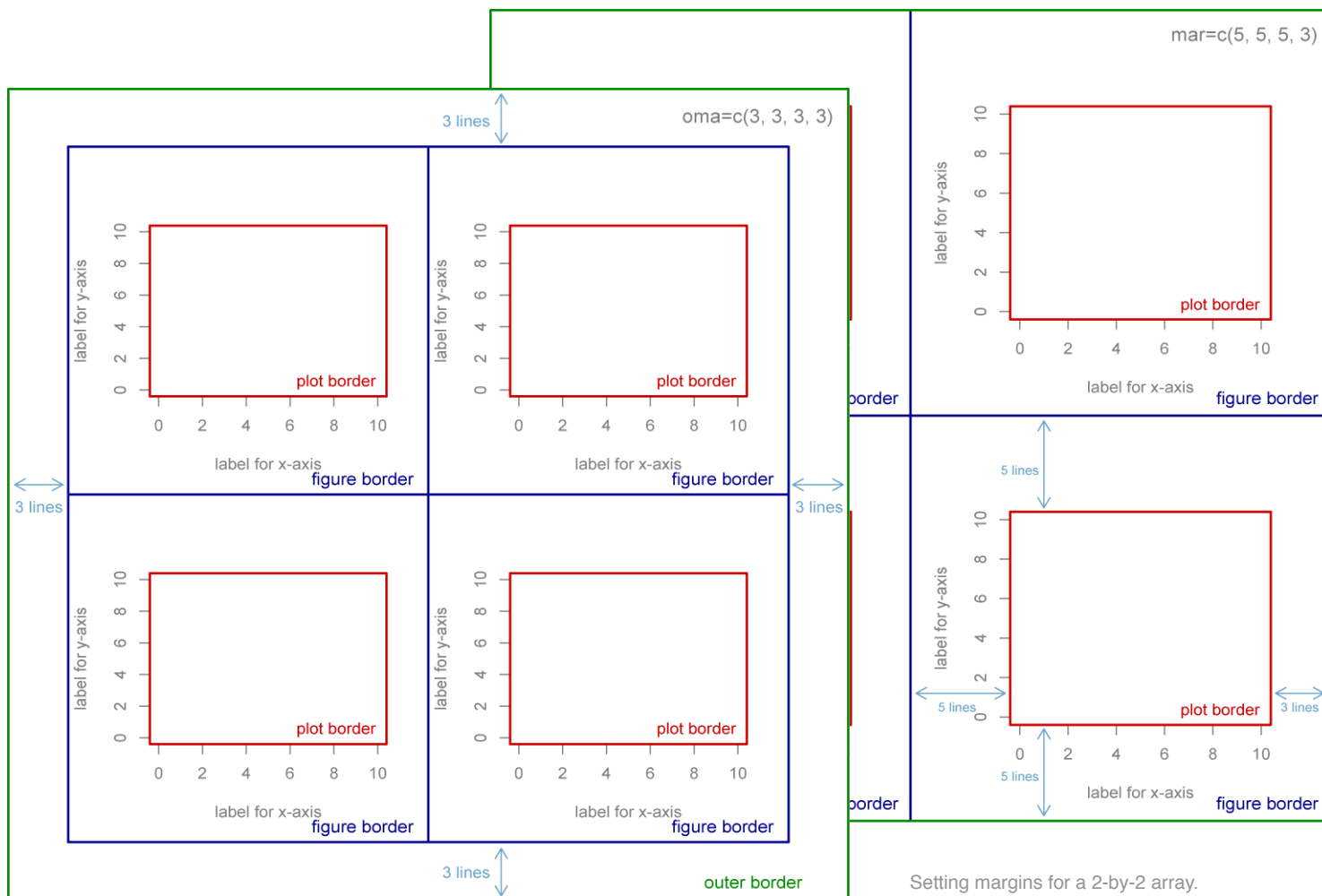
mar=c(7, 5, 6, 4)

6 lines

10

5 lines   4 lines

8

label for y-axis

6

4

2

0

plot border

0   2   4   6   8   10

label for x-axis

7 lines

figure border   outer border

Outer margins are zero by default, making the figure border and the outer border coincident.

oma=c(3.5, 2, 4, 3)

4 lines

10

8

label for y-axis

6

2
lines   3 lines

4

2

0

plot border

0   2   4   6   8   10

label for x-axis

figure border

3.5 lines

outer border

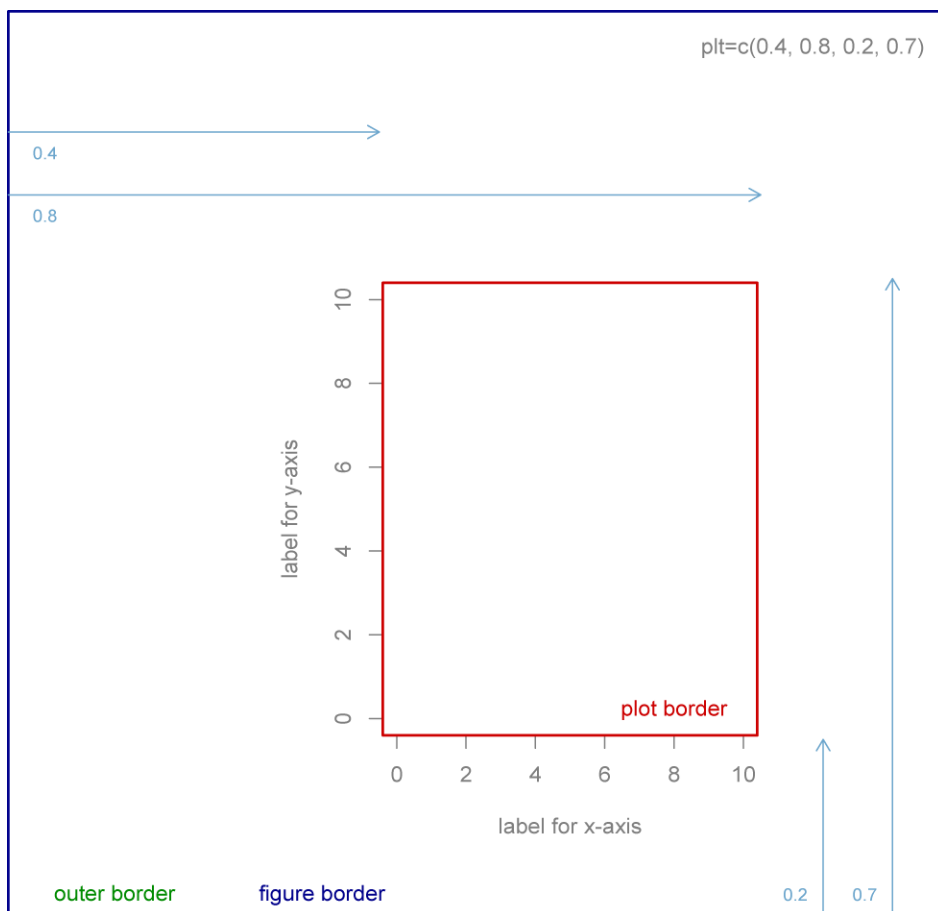This example sets only the outer margins. Default values of the margins are c(5.1, 4.1, 4.1, 2.1) lines.

oma=c(2.5, 3, 4, 3)
mar=c(7, 5, 6, 5)

4 lines

6 lines

5 lines

10

8

5 lines

6

label for y-axis

4

3 lines

3 lines

2

0

plot border

0   2   4   6   8   10

label for x-axis

7 lines

figure border

2.5 lines

outer border

An example of setting both margins and outer margins.

mar=c(5, 5, 5, 3)

3 lines

oma=c(3, 3, 3, 3)

10

8

6

label for y-axis

4

label for y-axis

10   8   6   4   2   0

plot border

label for y-axis

10   8   6   4   2   0

plot border

2

0

plot border

0   2   4   6   8   10

0   2   4   6   8   10

label for x-axis

0   2   4   6   8   10

label for x-axis

figure border

label for x-axis

figure border

border

label for x-axis

figure border

3 lines

3 lines

5 lines

label for y-axis

10   8   6   4   2   0

plot border

label for y-axis

10   8   6   4   2   0

plot border

5 lines

3 lines

0   2   4   6   8   10

label for x-axis

0   2   4   6   8   10

label for x-axis

figure border

figure border

5 lines

border

outer border

3 lines

Setting margins for a 2-by-2 array.

Specifying a position within the device region

plt=c(0.4, 0.8, 0.2, 0.7)

0.4

0.8

label for y-axis

10

8

6

4

2

0

plot border

0   2   4   6   8   10

label for x-axis

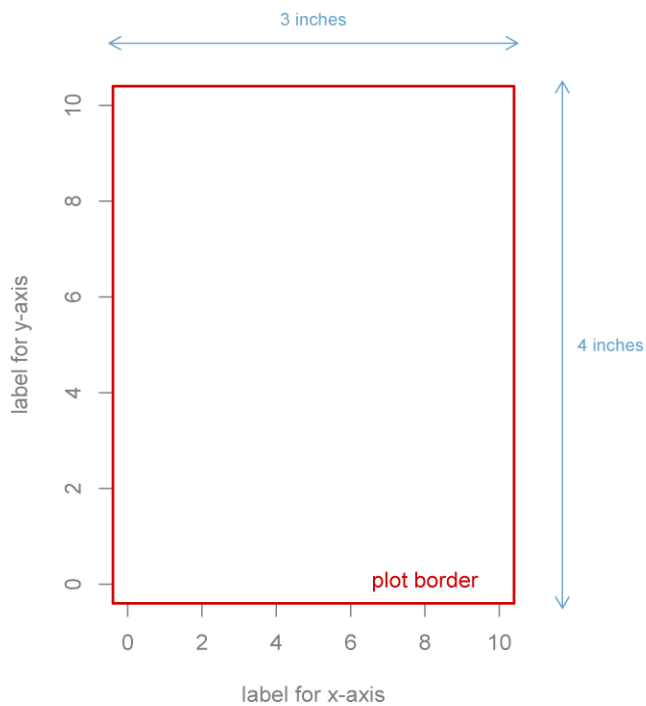outer border   figure border   0.2   0.7

The plt argument of the par() function defiines both the position and size of the plot region. The argument takes a vector of four values in normalized device coordinates (ranging from 0 to 1) that give the positions of the left, right, bottom, and top sides of the plot border.

The fig argument of the par() function sets the position and size of the figure region using normalized device coordinates.

fig=c(0.4, 0.8, 0.2, 0.7)

0.4

0.8

label for y-axis

10

8

6

4

2

0

plot border

0   2   4   6   8   10

label for x-axis

figure border

outer border   0.2   0.7
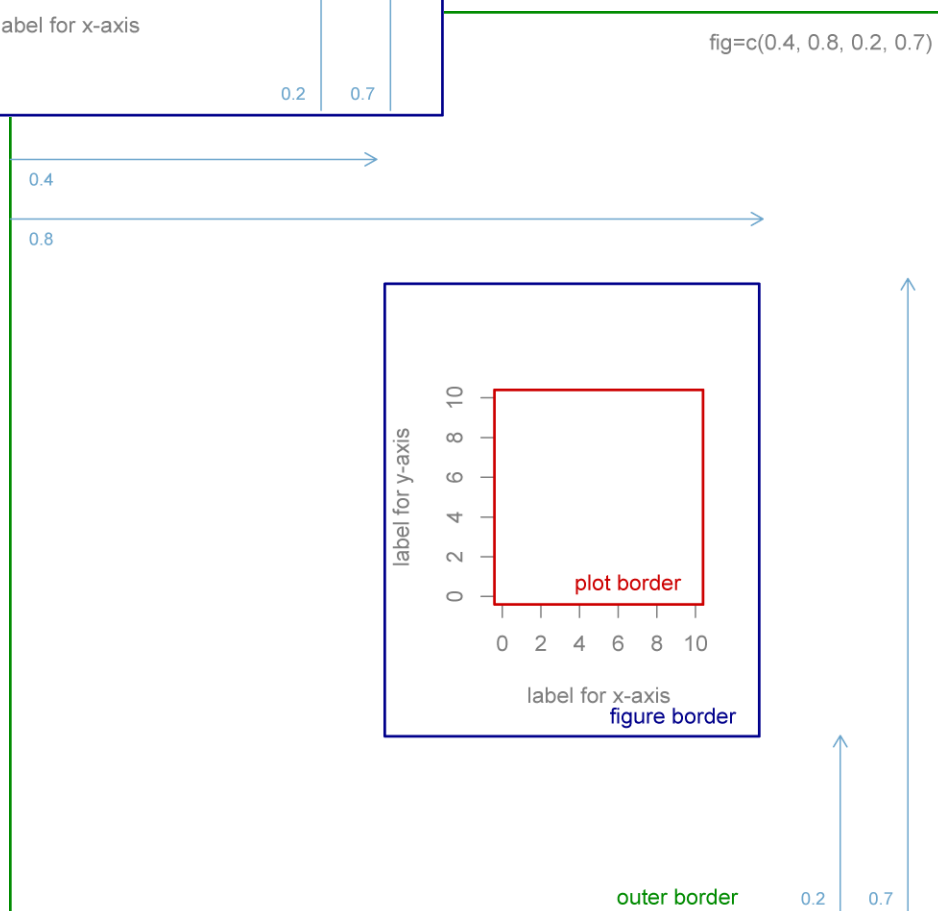
Setting dimensions
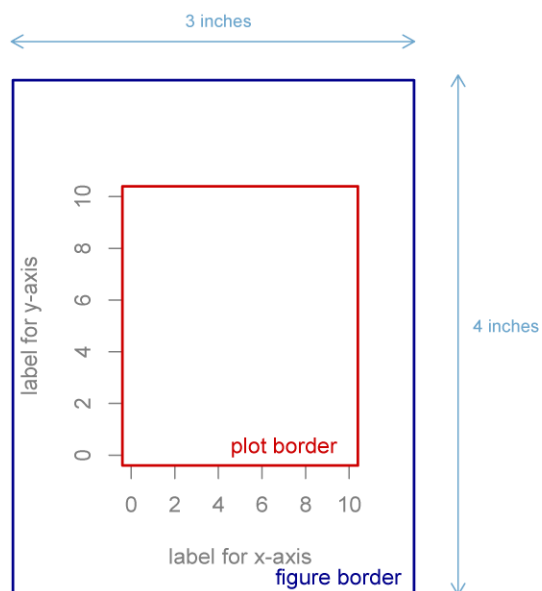

The `pin` argument of the `par()` function allows the dimensions of the plot region to be specified in inches.

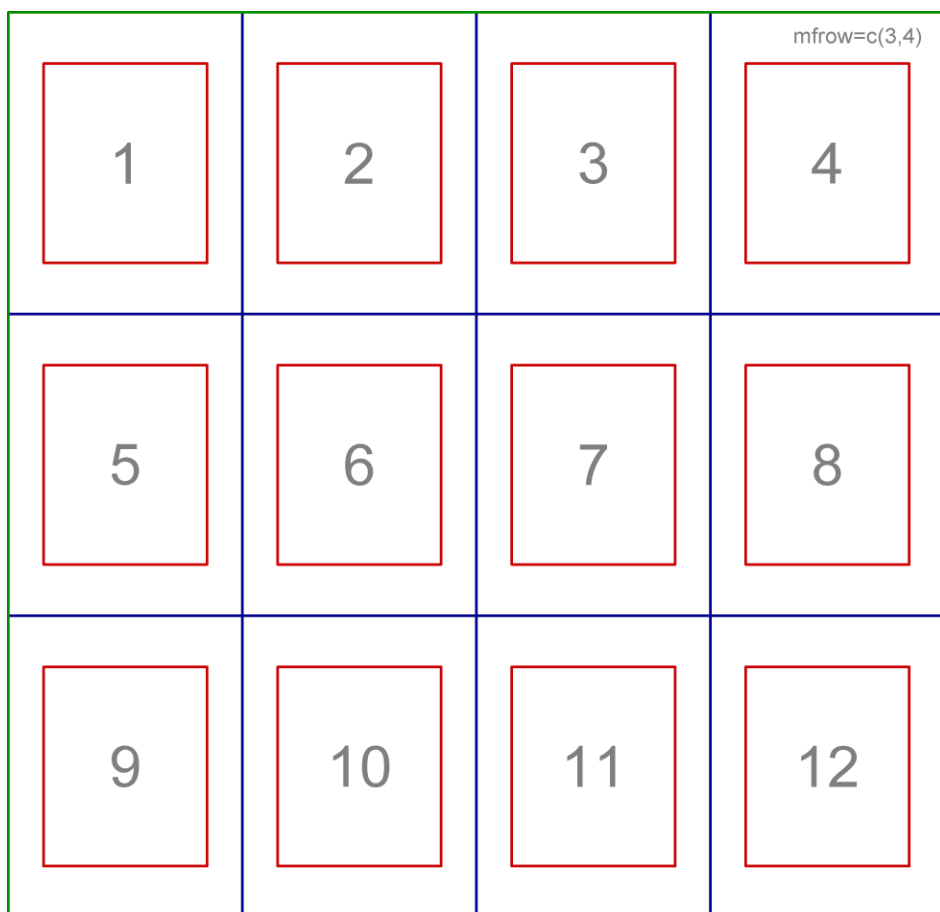The `fin` argument of the `par()` function allows the dimensions of the figure region to be specified in inches.

Setting up arrays
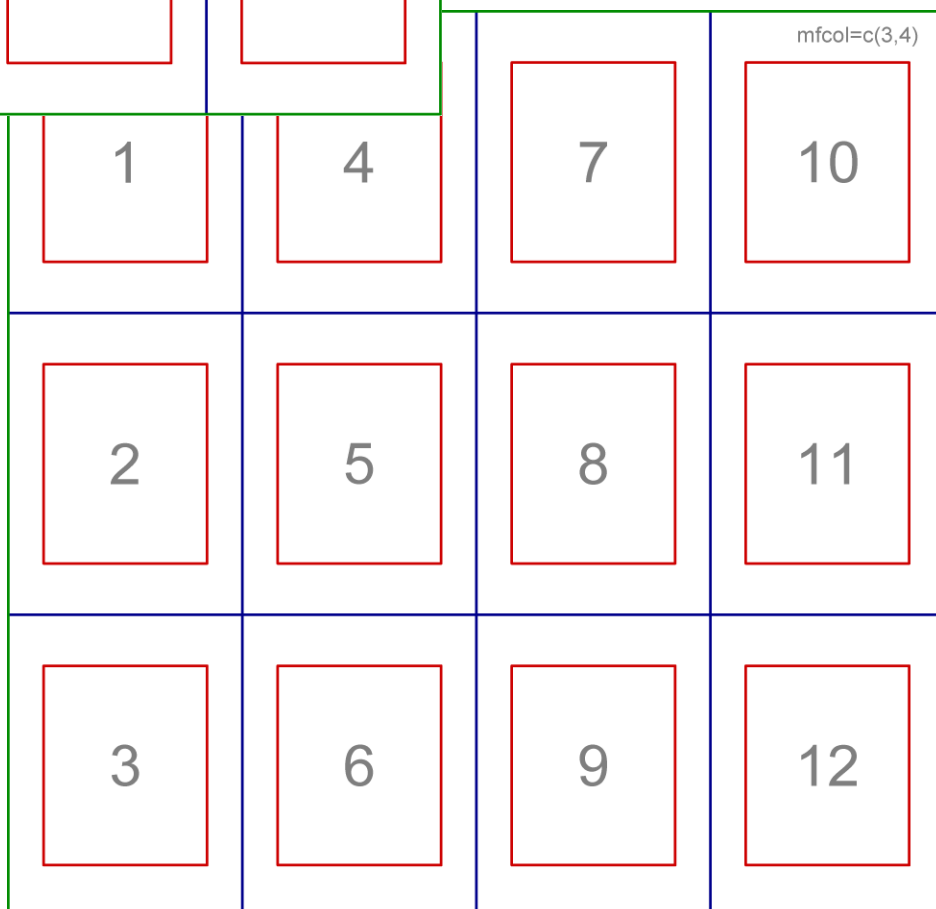

mfrow=c(3,4)

| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 |

The `mfrow` argument of the `par()` function sets up an array of figure regions. New plots will fill the array by rows.

The `mfcol` argument will fill the array by columns.

mfcol=c(3,4)

| 1 | 4 | 7 | 10 |
| 2 | 5 | 8 | 11 |
| 3 | 6 | 9 | 12 |

Drawing multiple figures at arbitrary locations

Multiple figures can be drawn in the same device region at arbitrary locations. To do this, specify the location of a plot using the `fig` argument, then draw that plot. Before drawing the next plot, issue the command `par(new=TRUE)`. The program will treat the window as if a new window was opened, and will not clear the current device window.
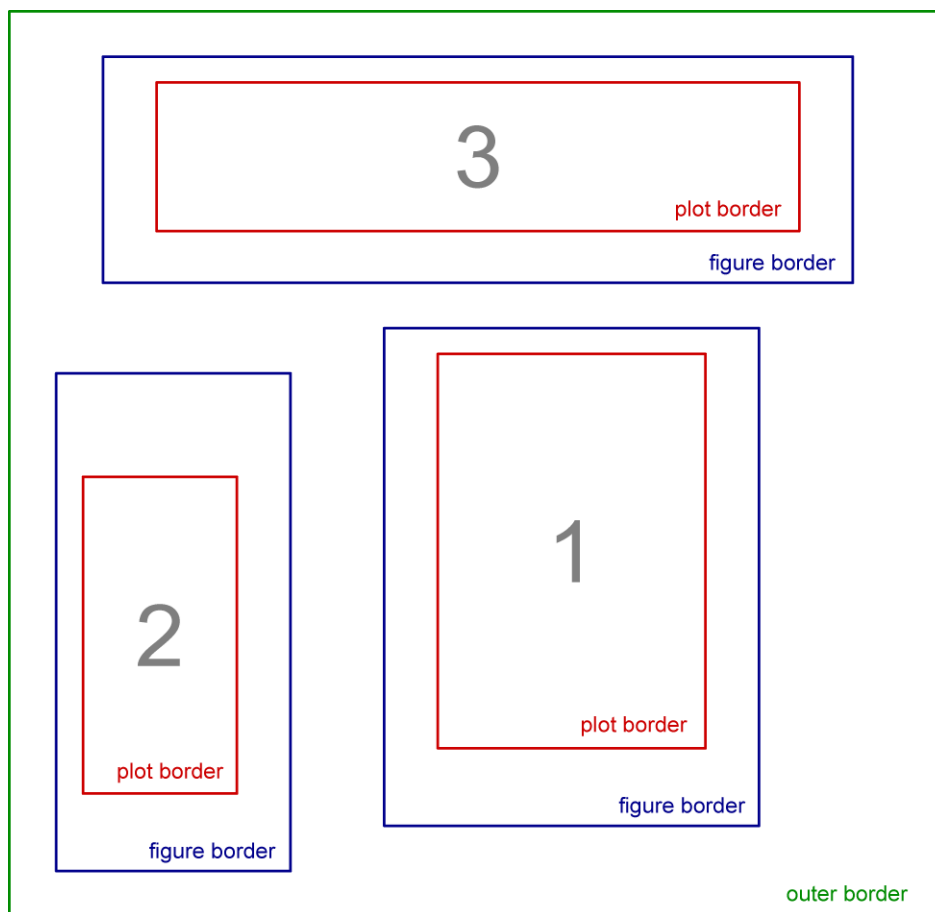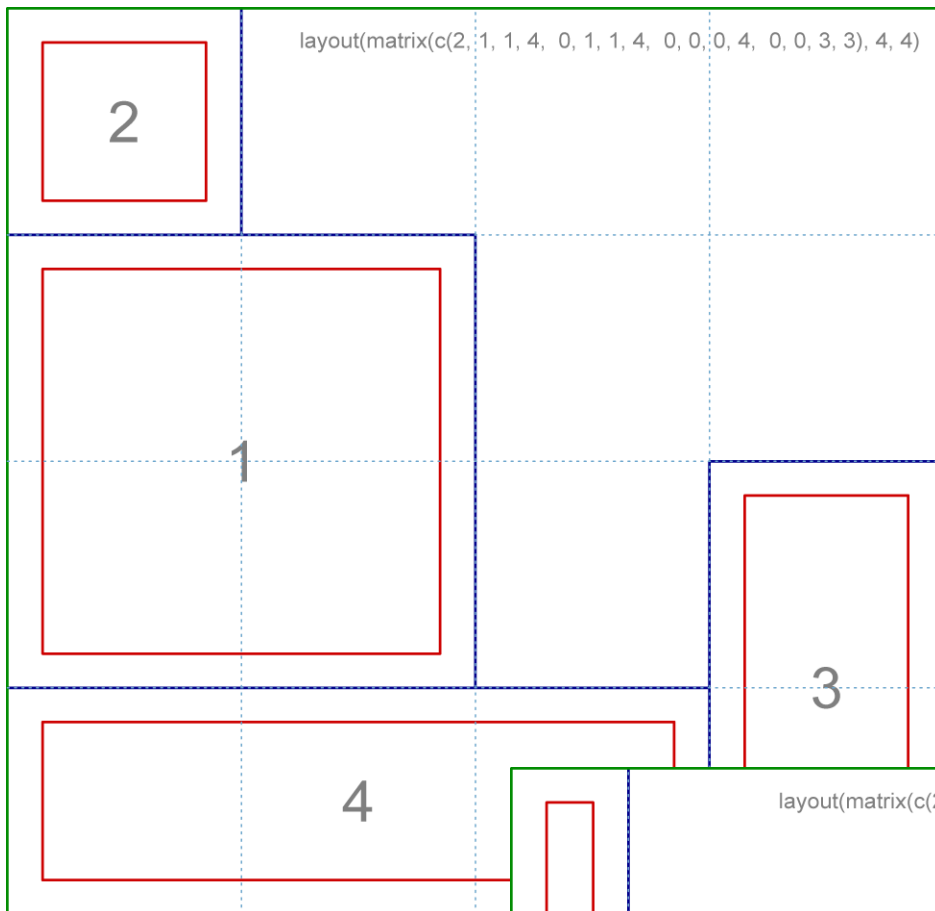
Selecting a square or maximal plotting region

The `pty` argument of the `par()` function allows the plotting region to be constrained to a square. By default, the maximal plot region (determined by margin and dimension arguments) is used.

Plotting within a grid

layout(matrix(c(2, 1, 1, 4, 0, 1, 1, 4, 0, 0, 0, 4, 0, 0, 3, 3), 4, 4)
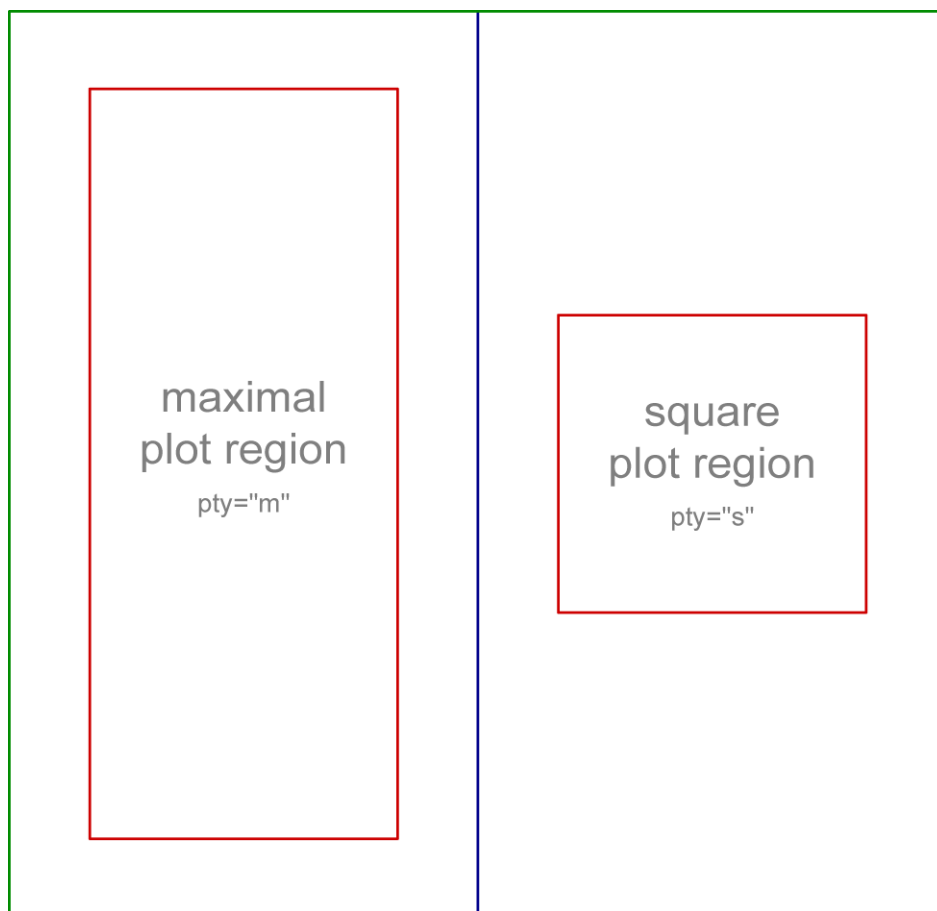
The `layout()` function accepts a matrix. The device region will be divided into the number of rows and columns in the matrix. The values of the matrix indicate the which figure (1, 2, 3, ...) is to occupy each grid region. A value of "0" indicates that the grid region should be left blank.

If the grid regions are not to be square, vectors of widths and heights can be specified.

layout(matrix(c(2, 1, 1, 4, 0, 1, 1, 4, 0, 0, 0, 4, 0, 0, 3, 3), 4, 4) widths=c(1, 3, 3, 1), heights=c(3, 1, 1, 3))