R Scripting

Lab for units 5 and 6 - Functions, Object-oriented concepts, graphics
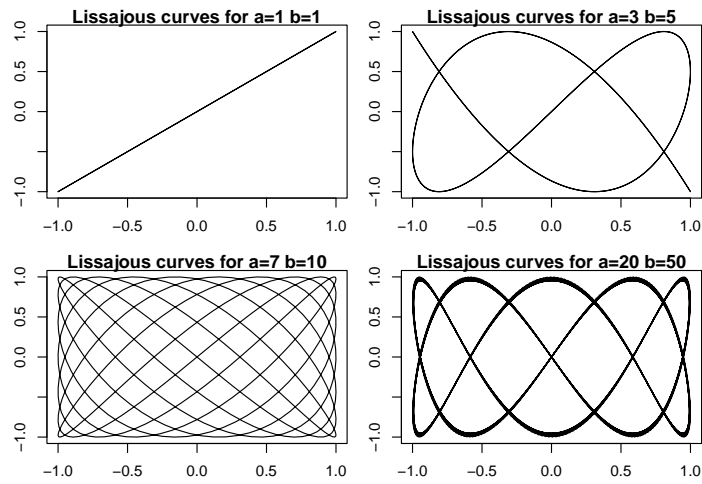
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Please solve the following problems!

1. Write a function that can be used to plot the so-called *Lissajous curves* that are defined as follows:

$$z(x) = \begin{pmatrix} sin(ax) \\ sin(bx) \end{pmatrix}$$

You can see some examplary Lissajous curves below.

   a) You can graph the figures by plotting z1 vs. z2 (= x- and y-coordinates) and connecting the points for $x[-\pi, \pi]$. The plot should also contain a title that shows the a- and b-values used for the creation of the given plot. Generate some exemplary curves for various values of a and b.

   - Hint 1: First, you need to create sequence of points x between $-\pi$ and π that defines the resolution of the plot - the longer the sequence, the higher the resolution.
   - Hint 2: Use the two expressions given above to compute z1 and z2, given sequence x created before.

   b) Now, we want to give users the possibility to select the graphics system that produces the plot, i.e., that a plot is either generated using the base graphics system or `lattice`. In addition, it should also be possible to change the resolution using a function argument. Fix your function accordingly! Generate some exemplary curves for various settings again!

```r
lissajous <- function(a, b, res = 500, lat = FALSE) {
  x <- seq(-pi, pi, length = res)
  z1 <- sin(a * x)
  z2 <- sin(b * x)
  if (lat == FALSE) {
    plot(z1, z2, type = "l",
         main = paste0("Lissajous curves for a=",a, " b=", b))
  } else {
    xyplot(z2 ~ z1, type = "l",
           main = paste0("Lissajous curves for a=",a, " b=", b))
  }
}

par(mfrow = c(2, 2), mar = c(3, 2, 1, 1))
lissajous(1, 1)
lissajous(3, 5)
lissajous(7, 10)
lissajous(20, 50)
```

Lissajous curves for a=1 b=1 ... **Lissajous curves for a=3 b=5** ... **Lissajous curves for a=7 b=10** ... **Lissajous curves for a=20 b=50**

```r
par(mfrow = c(1, 1), mar = c(5, 4, 4, 2) + 0.1)
```