Solutions to lab 3

Bob Douma

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Exercise 1.1: Calculate the logarithm of the sequence 1:10, using first a for loop and then without a for loop.

```
for (i in 1:10){
  a = log(i)
  print(a) # to show what you have done
}
```

```
## [1] 0
## [1] 0.6931472
## [1] 1.098612
## [1] 1.386294
## [1] 1.609438
## [1] 1.791759
## [1] 1.94591
## [1] 2.079442
## [1] 2.197225
## [1] 2.302585
```

```
log(1:10)
```

```
##  [1] 0.0000000 0.6931472 1.0986123 1.3862944 1.6094379 1.7917595 1.9459101
##  [8] 2.0794415 2.1972246 2.3025851
```

Exercise 2.1: Given some data created from the following code `c(25,1,10,89, NA, NA)`, calculate the mean value and the standard error of this mean ($s.e.m. = \sigma/\sqrt{n}$, where σ is the standard deviation and n is the amount of data) by ignoring missing values.

```
a = c(25,1,10,89, NA, NA)
mean(a,na.rm=T)
```

```
## [1] 31.25
```

```
sd(a,na.rm=T)/length(na.omit(a))
```

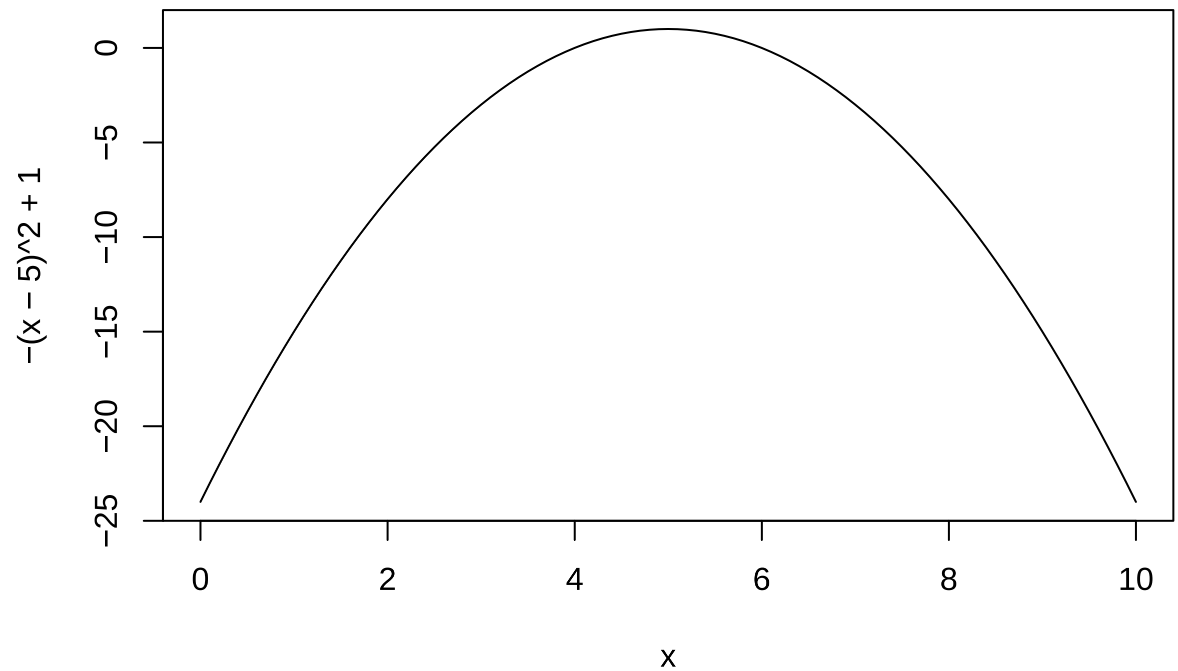
```
## [1] 9.93809
```

Exercise 3.1: Build a function to calculate the standard deviation ($\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i-\bar{x})^2}{n-1}}$). Test your function with some data that includes missing values.

```
sigma.self = function(x,na.rm=F){
  mean = mean(x,na.rm=na.rm)
  n = length(ifelse(na.rm,na.omit(x),x))
  sd = sqrt(sum((x-mean)^2,na.rm=na.rm)/(n-1))
  return(sd)
}
```

Exercise 4.1 *: Construct a curve that has a maximum at ($x = 5$, $y = 1$). Write the equation, draw the curve in `R`, and explain how you got there.

```r
# for example
curve(-(x-5)^2+1,from=0,to=10)
```



A quadratic functionh x^2 has a maximum. or minimum. This maximum/minimum is at $x = 0$. To shift the curve to have its maximum at $x = 5$, you need to subtract 5 from the x, i.e. $(x - 5)^2$. The maximum of this function is at $y = 0$, so one need to add 1 to the function, i.e. $(x - 5)^2 + 1$.

Below the solutions to Exercise 6 of Lab 3

1. The first step is to read in the data. The data is stored in different sheet of the file `shapes.xlsx`. Select a sheet, go to `file` and 'save as' and save the sheet as a comma-separated-file (.csv). Beware that if you are using a computer with dutch settings, you may run into problems for two reasons: First, the decimal character is a comma `,` in Dutch while a dot `.` in english. Second the default list separator is a semicolon `;` in Dutch while a `,` in English. Check the file that you saved to check the settings of your computer. If this is not correct; go to control panel; to region and language settings; to advanced settings and change the decimal character into a `.` and the list separator (lijstschijdingsteken) in to a `,`.

```r
setwd("D://...//...//...) # fill in location
shapes1 = read.csv(shapes1.csv)
```

2. After you have read in the data, you can make a plot, e.g. through `plot(shapes1$y~ shapes1$x)` for dataset 1. Multiple plots can be made through specifying `par(mfrow=c(3,2))`. This will setup the grid, after using `plot` six times, the grid will be filled with plots. Note that all the datasets are different in their specification of the header (names). You can take account of the header name through `header=TRUE` inside the `read.csv` function. Check the datafiles to make sure whether or not there are column headings.

3. Choosing appropriate deterministic functions

dataset 1 light response curve. There are a number of options of functions to choose from, depending on the level of sophistication: $\frac{ax}{(b+x)}$, $a(1-e^{(-bx)})$, $\frac{1}{2\theta}(\alpha I+p_{max}-\sqrt{(\alpha I+p_{max})^2-4\theta Ip_{max}})$ see page 98 of Bolker.

dataset 2 The dataset describes a functional response. Bolker mentions four of those $min(ax,s)$ $\frac{ax}{(b+x)}$, $\frac{ax^2}{(b^2+x^2)}$, $\frac{ax^2}{(b+cx+x^2)}$

dataset 3 Allometric relationships have the form ax^b

dataset 4 This could be logistic growth $n(t)=\frac{K}{1+(\frac{K}{n_0})e^{-rt}}$ or the gompertz function $f(x)=e^{-ae^{-bx}}$

dataset 5 What about a negative exponential? ae^{-bx} or a power function ax^b

dataset 6 Species reponse curves are curves that describe the probability of presence as a function of an environmental variable. A good candidate good be a unimodel response curve. You could take the equation of the normal distribution without the scaling constant: e.g. $ae^{\frac{-(x-\mu)^2}{2\sigma^2}}$

4. See the word file on blackboard "Bestiary of functions.docx"

5. Curves can be added to the plots through `curve`: e.g. `curve(2x+2x,from=0,to=20)`

dataset 1 Reasonable values for the first dataset assuming a michaelis menten relationship are a=25 and b=60. For the non-rectangular parabola one could choose values of theta = 0.7; a = 0.25; pmax = 25.

dataset 2 `curve(ifelse(x>27,18,(2/3)*x),add=T)`

`curve(20*x/(10+x),add=T)`

dataset 3 `curve(0.6*x^2,add=T)`

dataset 4 `K = 200; r = 0.2; N0=2; curve(K/(1+(K/N0)*exp(-r*x)),add=T)`

dataset 5
`curve(8*(exp(-0.75*x)),add=T)`

dataset 6 `mu = 5; b = 2; curve(exp(-(mu-x)^2/b)  ,add=T)`