

# Lab. 3: Chapters 3,4 with R and practical distributional theory continued.

R and distributions. No distributional knowledge assumed before lab. You can learn all from the exemplar file Lab 3.R. Consult the R code and run it – go through the comments and understand what is happening.

## Objectives:

- Learn how to use densities (these are for continuous variables)
- Calculate probabilities using p-stem
- Plot areas and curves for the Normal distribution.
- Create a cool function that makes a plot and command line output.
- Use ggplot (package: ggplot2)

## Output:

- Make an Rmd document for this lab
- At the conclusion render into the 3 file types
- Upload the 4 files to the server.

## Tasks:

1. If  $X \sim N(\mu = 10, \sigma = 4)$ 
  - a. find  $P(X \leq 8)$
  - b. find  $P(X \geq 11)$
  - c. find  $P(8 \leq X < 14)$
  - d. find  $P(X > 10)$
2. In task 1 make a plot of the Normal and shade the area that represents the probability for each of a.- d. using Base R functions
3. In task 2 add the numerical value of the probability to the plots ( 4 dec places).
4. An R function is made by using the syntax

Myfunction = function(x, ...) { ... } see Lab3.R for more on this.

5. Now make a function called mynormplot() that will do the following:
  - a. Calculate a probability of the form  $P(a \leq X \leq b)$  where  $X \sim N(\mu, \sigma)$
  - b. Make a plot of the normal curve within a suitable range.
  - c. Shade the area of interest – make it “Blue”
  - d. Place the probability (which is the area) on the graph – use 6 dec places.
  - e. The plot should have your name on it.
  - f. There should be command line output in the form a list that contains the mean of the normal, the standard deviation and the probability calculated to 6 dec places.
  - g. Now use your function to calculate  $P(7 \leq X \leq 10)$ , where  $X \sim N(8,5)$  – all output should be included.

6. Write down the formula for a Normal density as a mathematical expression – use Latex  $X \sim N(\mu, \sigma)$
7. Now use ggplot to create the following plot: Put your name on it!

