3) Estimation and Confidence Intervals

Renato Valladares Panaro

Exercise 3.1

Draw 10 random samples of size $N = 5$ from the standard normal distribution ($\mu = 0$, $\sigma = 1$). Calculate the mean of each sample. Calculate the mean of all 10 means.

```
N = 5
# Create a matrix with NA
x <- matrix(NA, ncol = N, nrow = 10)
```

Plot the density function of the standard normal distribution. Draw the sample means and the mean of means into the plot.

Repeat the above computer experiment with $N = 25$.

Exercise 3.2

A producer gives the information that the content of a pharmaceutical substance in the tablets of some preparation A is normally distributed with an expectation of 500 mg and with a standard deviation of 10. To check this claim, the contents of 25 randomly chosen tablets are determined.

Random sample of 25 tablets:

```
N = 25
x = rnorm(n=N, mean=500, sd=10)
```

Draw a histogram of the data:

```
hist(x)
```

Determine a 95%-confidence interval for the expectation from the data:

```
alpha = 0.05
MEAN = mean(x)
s = sd(x)
SEM = s / sqrt(N)
Z = qnorm(1 - alpha / 2, 0, 1)
MEAN - Z * SEM ### Lower Bound
MEAN + Z * SEM ### Upper Bound
```

Given the confidence intervals, discuss with your neighbor whether you could trust the producer. Change

1. the sample size
2. the mean
3. the standard deviation
4. the level of confidence.

Discuss changes and results.