Seminar 5

Parametric Problems with One Random Sample from a Normal Distribution

Task 1
From a population of pigs of the same age and breed, 6 pigs were selected and given the same feeding diet for half a year. Average daily weight gains were: $62, 54, 55, 60, 53$ and 58 (see the R script). It is known from previous experiments that such gains have a **normal distribution** in the population. With a risk of 5%:

a) find the lower estimate of the mean μ (left-sided CI),

b) find the interval estimate of the standard deviation σ (two-sided CI),

c) test the hypothesis: $H_0 : \mu = 61$, $H_1 : \mu \neq 61$ (σ is still an **unknown** value). Use the built-in R function `t.test()`.

Task 2
Work with the dataset `Pigs.csv` containing the weight gains of different pig siblings from the same litters. We have observed 2 siblings in the total number of 6 litters. One of the siblings received feeding diet 1 and the other feeding diet 2 (the choice of diets in the pair was random). Which of the diets seems better?

a) Construct a 95% confidence interval for $\mu = \mu_1 - \mu_2$.

b) At the 0.05 significance level test the hypothesis that the two feeding diets have the same effect. Interpret the p-value obtained by the built-in function `t.test()`.

In both tasks use the built-in R function `t.test()`.

Task 3
A milk producer has an interest in maintaining an upper limit on the variability of the fat content (expressed as a percentage) of its milk. If the expected fat content is μ%, then the actual fat content of a carton of milk should not deviate too much from this value. For a milk producer, a variance of no more than $\sigma^2 = 0.1$% fat in the milk is acceptable. We randomly selected 20 cartons of milk and measured the percentages of fat content in the milk, which are in the `Milk.csv` data file.

(a) Use the critical region to test at level $\alpha = 0.05$ the hypothesis $H_0 : \sigma^2 \leq 0.1$, against the right-tailed alternative $H_1 : \sigma^2 > 0.1$.

(b) Test the same hypothesis using confidence intervals.

You need to check normality (for now at least with a histogram).