# Lab Nr. 6, Probability and Statistics

## Hypothesis and significance testing for means and variances

**For all these problems, find the rejection region, the value of the test statistic and the $P$-value of the test. (Include (many!!) comments to make it clear what $H_0$ and $H_1$ are and also to interpret your results in words).**

**1.** In a study of the efficiency of various large computer storage systems, the random variable $X$, the number of (medium-sized) files (in **millions**) that can be stored is considered. If the storage system cannot store at least 8.5 millions (medium-sized) files, on average, it does not meet the efficiency standard and has to be improved. These data are obtained:

| | | | | | |
|---|---|---|---|---|---|
| 7 | 7 | 4 | 5 | 9 | 9 |
| 4 | 12 | 8 | 1 | 8 | 7 |
| 3 | 13 | 2 | 1 | 17 | 7 |
| 12 | 5 | 6 | 2 | 1 | 13 |
| 14 | 10 | 2 | 4 | 9 | 11 |
| 3 | 5 | 12 | 6 | 10 | 7 |

(the data from Problem B.1., Lab nr. 5).
**a.** Assuming that past experience indicates that $\sigma = 5$, at the 5% significance level, does the data suggest that the standard is met? What about at 1%?
**b.** Without the assumption on $\sigma$, does the data suggest that, on average, the number of files stored exceeds 5.5? (same significance level)

**2.** It is thought that the gas mileage obtained by a particular model of automobile will be higher if unleaded premium gasoline is used in the vehicle rather than regular unleaded gasoline. To gather evidence in this matter, 10 cars are randomly selected from the assembly line and tested using a specified brand of premium gasoline; 10 others are randomly selected and tested using the brand's regular gasoline. Tests are conducted under identical controlled conditions and gas mileages for both types of gas are assumed independent and (approximately) normally distributed. These data result:

| **Premium** | | **Regular** | |
|---|---|---|---|
| 22.4 | 21.7 | 17.7 | 14.8 |
| 24.5 | 23.4 | 19.6 | 19.6 |
| 21.6 | 23.3 | 12.1 | 14.8 |
| 22.4 | 21.6 | 15.4 | 12.6 |
| 24.8 | 20.0 | 14.0 | 12.2 |

(the data from Problem B.2., Lab nr. 5).
**a.** At the 5% significance level, is there evidence that the variances of the two populations are equal?
**b.** Based on the result in part **a.**, at the same significance level, does gas mileage seem to be higher, on average, when premium gasoline is used?