Lab Nr. 11, Probability and Statistics

Hypothesis and Significance Tests For the Mean and Variance of a Population

Write MATLAB routines that perform a left-, right- or two-tailed test for the following:
- the mean of a population, given a sample from a normal population or a large sample and known σ;
- the mean of a population, given a sample from a normal population;
- the variance of a population.

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).

Applications

1. In a study of the size of various computer systems, the random variable X, the number of files stored, is considered. If a computer system cannot store at least 9 files, on average, it does not meet the efficiency standard and has to be replaced. Past experience indicates that $\sigma = 5$. 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 1., Lab nr. 9).
a. At the 5% significance level, does the data suggest that the standard is met? What about at 1%?
b. At the same significance level, does the assumption on σ seem to be correct?

2. A fitness center purchases energy bars, but only if their average weight does not exceed 99.4 grams. A random sample of 20 yields the following data:

$$X = \begin{pmatrix} 99.8 & 99.9 & 98.0 & 100.1 & 100.5 & 100.0 & 100.2 \\ 2 & 5 & 3 & 4 & 2 & 2 & 2 \end{pmatrix}$$

(the data from Problem 2., Lab nr. 9).
Assume the weights of the energy bars are approximately normally distributed. At the 5% significance level, does the data suggest that the center will accept these energy bars? What about at 1%?