

List 7

Exercise 1. The nominal value of the closed-loop cooling water temperature in a power unit is 25°C. The water temperature was measured eight times and the following values were obtained [in °C]

19, 22, 28, 24, 26, 23, 23, 25.

At the significance level of 0.05, verify the hypothesis that the mean value of the cooling water temperature is optimal.

Exercise 2. The working time [in min] of the drone's battery has the normal distribution $N(\mu, 5)$. The batteries meet the assumed standard when they work for more than 140 minutes on average. For the 15 randomly selected drones, an average working time of 143 minutes was obtained. Can we say at the significance level of 0.05 that the batteries meet the assumed standard?

Exercise 3. The car tire manufacturer believes that more than 80% of potential customers will buy winter tires from November to March. A survey was conducted among 450 customers and 400 declared that they intend to buy winter tires for their cars. Do these data provide strong evidence? Infer at a significance level of 0.01.

Exercise 4. The wear of a certain friction part of the machine after one month of operation was measured on 10 randomly selected parts. The material loss was as follows (in μm):

59.0, 66.7, 69.7, 57.4, 74.9, 67.7, 78.9, 80.0, 70.8, 81.0.

At the significance level of 0.05, verify the hypothesis that the variance of wear of these parts of the machine is $40\mu\text{m}^2$.

Exercise 5. In a survey conducted by the social opinion research studio among 1,100 adult Poles, 1,090 respondents replied that they had not read any book last month. Others claimed to have read at least one book. On the basis of these data, at the level of 0.01, state whether the opinion that the percentage of Poles who have not read any book is greater than 90 is justified?

Exercise 6. Scientists have set a limit for truck exhaust emissions. The average permissible level of pollutants is 55 parts per million, and the standard deviation of the pollutants emitted by all registered trucks is 18 parts/m.

The inspection carried out 100 measurements of one car model. The mean of the sample was 60 parts/m, and the standard deviation was 20 parts/m. Assuming a significance level of 0.01, check whether these data are sufficient to check the company producing the tested car is breaking the law by emitting average pollution greater than the permissible one?

Exercise 7. It was assumed that the heat pump efficiency coefficient COP is satisfactory when its average value is at least 3.5 (which means that over 70% of the heat pump supplied comes from a natural heat source, and the rest comes from the compressor's operation). The potential buyer of the pump doubts and has made the finding that the coefficient of efficiency of the heat pump in his household is much less than 3.5. Over a period of time, the COP was measured on this farm, with the following results:

3.5 3.2 3.6 3.0 3.3 3.8 2.5 3.0 3.7 3.9.

Assuming that the variable describing the COP coefficient values is a random variable with a normal distribution and based on the above results (assuming the significance level of $\alpha = 0.01$) check whether the buyer's doubts are correct.