

PROBLEMS FOR EXERCISES IN RANDOM PHENOMENA COURSE - 6TH SET

1. Flow time of certain product has been measured in a workshop for ten selected pieces. The resulting values were (in minutes): 17, 21, 14, 23, 20, 24, 19, 19, 25 and 18. It is assumed that the flow time of the studied product is normally distributed. Determine point estimators of mean and standard deviation of the flow time. R: $\mu = 20$ min, $\sigma = 3.37$ min
2. We assume that the standard deviation of the flow time is 3.4 min.
 - (a) Based on the measurements in the above problem estimate the confidence interval on mean of the flow time. R: $17.89 \text{ min} \leq \mu \leq 22.11 \text{ min}$ at $\alpha = 0.05$
 - (b) What should be the sample size to have the error of confidence interval estimation below 1 min? R: $n \geq 45$ at $\alpha = 0.05$.
3. We assume that the standard deviation of the flow time is not known. Based on the measurements in the problem 1 estimate the confidence intervals on mean and on standard deviation of the flow time. R: $17.59 \text{ min} \leq \mu \leq 22.41 \text{ min}$ and $2.32 \text{ min} \leq \sigma \leq 6.15 \text{ min}$ at $\alpha = 0.05$
4. Using the spot welding machine 100 spots are welded among which 42 weld spots are defective.
 - (a) Determine point estimator and the confidence interval on the proportion of the defective weld spots. R: $p = 0.42$ and $0.32 \leq p \leq 0.52$ at $\alpha = 0.05$.
 - (b) What should be the sample size to have the error of confidence interval estimation below 0.05? R: $n \geq 375$ at $\alpha = 0.05$.
5. In turning of the product the technology requires a successive application of two different turning inserts. From a sample of 40 inserts of type A and 50 inserts of type B it is found that the insert A can remove on average 1000 mm^3 of material with standard deviation of 150 mm^3 before it must be replaced, while the insert B can remove on average 1400 mm^3 of material with standard deviation of 200 mm^3 . Estimate the confidence interval on the average of the total volume of material removed using the randomly selected inserts of type A and B. R: $2328 \text{ mm}^3 \leq \mu_A + \mu_B \leq 2472 \text{ mm}^3$
6. Steel rollers are manufactured by extrusion through dies A and B. On a sample of fifteen rollers extruded through the die A an average diameter of 28.7 mm with standard deviation of 0.45 mm is determined while on a sample of twelve rollers extruded through the die B an average diameter of 27.9 mm with standard deviation of 0.50 mm is determined. Estimate the confidence interval on the difference of the average roller diameters. Assume that both diameters of the extruded rollers are normally distributed. R: $0.423 \text{ mm} \leq \mu_A - \mu_B \leq 1.177 \text{ mm}$ at $\alpha = 0.05$

NOTE: To solve the problems, tabulated normal, Student and χ^2 probability distributions are required (Tables A.1–3 in the textbook *Opis naključnih pojavov*).