

1. Buyer agrees with manufacturer to buy a series of products if the average content of harmful substances in the product is less than 10 mg. It is assumed that the harmful substances content in the product is normally distributed. To verify the content of harmful substances, nine products in the series are randomly selected.
 - (a) The manufacturer offers a series of products that actually contains an average of 9 mg of harmful substances with the standard deviation of 2 mg. What is the risk of the manufacturer that the series is rejected? R: $P = 0.067$
 - (b) If the manufacturer offers a series of products that actually contains 12 mg of harmful substances with the standard deviation of 2 mg, what is the risk of the buyer to accept such a series? R: $P = 0.001$
2. The maximum permissible average mass of CO₂ in the exhaust of a particular type of car is 200 mg/kg. In a test of such a car making 50 measurements, the exhaust average is determined at 204 mg/kg of CO₂ with the standard deviation of 10 mg/kg. We assume that the mass of CO₂ in the exhaust is normally distributed.
 - (a) Can we claim that the vehicle being tested complies to the regulation about the average mass of CO₂ in the exhaust? R: No. $z = 2.83, p = 0.002$.
 - (b) Suppose that the true average mass of CO₂ in the exhaust of the tested vehicle is 204 mg/kg. What is the probability that the noncompliance with the regulation is not detected in the test? R: $\beta = 0.119$ at $\alpha = 0.05$
 - (c) Solve the problem again for a sample of ten exhaust measurements. R: Yes. $t = 1.27, p = 0.118, \beta = 0.688$
3. In polishing of magnetic heads with diamond abrasive either monocrystalline or polycrystalline diamonds can be used. Using the monocrystalline diamonds on a sample of ten magnetic heads we achieved an average roughness of 42 nm with standard deviation of 4 nm, while using the polycrystalline diamonds on the same size of the sample the average roughness was 44 nm with standard deviation of 3 nm. We assume that the roughness of the magnetic heads is normally distributed.
 - (a) Can we claim that the same roughness results in both cases? R: Yes. $t = -1.27, p = 0.220$
 - (b) What should be the significance value to recognise a difference between both types of diamond abrasives? R: $\alpha = 0.220$
4. In the past, 46 % of residents supported construction of a waste processing plant near their village. After an effort was made to persuade the residents to support the construction, a survey including 200 respondents was done where 101 of the respondents agreed with the construction.
 - (a) Can we claim, based on the survey, that the support for construction significantly increased? R: No. $z = 1.28, p = 0.100$.
 - (b) What should be the sample size to recognize the same resulting ratio as significant increase in support of the construction? R: $n \geq 332$.
5. Usage of non-bank saving in Austria and Slovenia is compared by using a telephone survey of a randomly selected population from each country. Among 300 respondents from Austria, 169 use non-bank saving while among 300 respondents from Slovenia there are 143 using non-bank saving.
 - (a) Can we claim that the population ratios of non-bank savers in Austria and Slovenia are equal? R: No. $z = 2.13, p = 0.033$
 - (b) What is the minimum significance value where the difference of population ratios would be recognised as significant? R: $\alpha = 0.033$
6. In continuous welding with a laser beam, weld depth is not constant. At the weld average depth of 4 mm, the current process achieves a standard deviation of weld depth 650 μm . In testing of a slightly modified procedure of laser welding a deviation of 450 μm has been achieved on a sample of ten welds. We assume that the depth of the weld is normally distributed.
 - (a) Can we claim that the modified procedure significantly reduces the standard deviation of the weld depth? R: No. $\chi^2 = 4.31, p = 0.110$

(b) What is the minimum significance value where the standard deviation of the modified procedure would be recognised as significantly reduced? R: $\alpha = 0.110$

7. Effectiveness of a new anti-cellulite cream is tested. On the first group of women the actual cream is applied while on the other, so called control group, placebo is applied. After one-month of therapy, reduction of thigh circumference at the desired location is measured. Data in mm is gathered in the table.

Cream	13	12	8	10	11	4	5	9
Placebo	8	2	6	7	5	9	0	3

It is estimated that the thigh circumference is normally distributed in both cases. Can we claim that the cream significantly influences the reduction of cellulite? Test means and standard deviations. R: Yes. $t = 2.53$, $p = 0.024$ and $f = 1.06$, $p = 0.941$

NOTE: To solve the problems, tabulated normal, Student, χ^2 , and Snedecor probability distributions are required (Tables A.1–3 and A.5–8 in the textbook *Opis naključnih pojavov*).