List 6

Excercise 1. In order for the generating devices of a wind turbine to work, the average wind speed should exceed 4 m/s. For the purpose of determine whether it makes sense to build a wind farm, the average wind speed in the vicinity of Darłowo was measured for a period of year each month, obtaining the following results (in m/s):

5,9   4,4   5,4   3,8   4,0   4,2   3,4   3,6   4,6   6,5   5,6   4,8.

Assuming that the wind speed is a random variable with a normal distribution and assuming the significance level of α = 0.05, check whether the Darłowo area is suitable for the construction of wind farms.

Excercise 2. In a laboratory sample of drinking milk, 10 measurements (in %) of fat content were performed and the following was obtained:

1,5   1,8   1,5   1,7   1,6   1,6   1,8   1,6   1,7   1,6.

Assume that the fat distribution of the drinking milk is normal. Can it be said that the variance in milk fat content is less than 0.02 (%^{2})? (take the significance level α = 0.05)

Excercise 3. Cuckoos toss their eggs to various birds, including small wrens. Observations of naturalists indicate that the cuckoo can lay an egg similar to the size of the eggs of "adoptive parents". The length [in mm] of the 21 eggs planted in the wrens was measured and the results were:

17,93 18,52 19,66 14,30 17,52 20,76 20,26

19,82 21,40 16,54 18,64 17,62 20,79 19,14

16,74 14,93 18,56 15,43 15,19 21,05 20,79.

Wren eggs are known to have an average length of 17 mm and a standard deviation of 2.5 mm. We assume that the tested feature has a normal distribution. At the significance level of 0.05, verify the hypothesis put forward by naturalists about:

(a) the average length tossed eggs;   (b) variance in the length of the tossed eggs.

Excercise 4. A study of the quality of hen eggs from a certain farm was carried out. It is assumed that 2% of eggs are of poor quality. 1 200 eggs were randomly tested and 16 of them proved to be of poor quality. Do the observations confirm that this fraction of poor quality eggs in the studied farm is smaller? Conclude at the significance level of 0.05.

Excercise 5. A public opinion poll on the expected frequency at elections showed that 1,600 out of a randomly selected group of 2,500 people intend to vote. At the significance level of 0.05, does the sample contradict the statement that 60% of all people intend to vote?

Excercise 6. The number of tram tickets sold on the following Sundays in May and June is as follows (in thousands):

3.0, 3.3, 3.1, 3.2, 3.2, 3.0, 2.9, 3.1.

On the basis of these data, at the significance level of 0.1, verify the hypothesis that the average number of tickets sold on Sundays is 3.2 thousand, if it is known that the number of tickets sold has a normal distribution.

Excercise 7. Previous research shows that the depth of the lake at one point is normally distributed with a standard deviation of 5 meters. Five depth measurements (in meters) were made in this area: 862, 870, 876, 866, 871. At a significance level of 0.05, verify the hypothesis that the average depth in this area is different from 870 meters.

Excercise 8. We measured the distances obtained by the two pole vault jumpers. The results are as follows [in meters]:
Player I: 6.01, 5.48, 5.92, 6.12, 5.76, 5.88
Player II: 5.32, 5.66, 5.87, 5.99, 5.59
Assuming that the distribution of scores is normal, at the significance level of 0.02 verify the hypothesis about greater regularity of the first player's scores.

Excercise 9. We study the effect of a supplement on improving the amount of a certain vitamin in the human body. People were divided into two groups and given a supplement. Studies have shown that 250 out of 300 people in the first group improved the elemental composition in the body. On the other hand, in the second group, which consisted of 220 people, 135 showed an improvement in the amount of the tested vitamin. At the significance level of 0.01, verify the hypothesis about a greater percentage of people susceptible to the supplement in the first group.

Excercise 10. The assembly time of a certain detail was compared with two different tools. Time was measured 11 times for the first tool and 14 times for tool number two. The following results were obtained in seconds:

Tool I: 8.9, 9.5, 9.0, 9.4, 9.9, 8.7, 9.1, 9.1, 9.3, 8.9, 9.3

Tool II: 9.6, 8.5, 8.9, 9.4, 9.5, 9.3, 8.4, 9.0, 9.7, 9.2, 9.0, 9.1, 8.9, 9.4

The tool operator assumed that the average assembly time for the detail for the first tool is longer than for tool II. We assume that the distribution of this time is normal. At the significance level of 0.1, on the basis of the above samples, can we conclude that the above assumption is true?

Excercise 11. Two different age groups were surveyed to see if they would go to the elections in the upcoming vote. The first group consisted of people up to 45 years of age, and the second group consisted of people over 45 years of age. Among 450 respondents from the first group, 310 people expressed their willingness to participate in the elections. In the second group, 305 people were interviewed and 231 of them declared that they would vote in the elections. At the significance level of 0.1, verify the hypothesis about a greater percentage of people voting in the elections in the second group.