6. One-sample Tests of Hypotheses about Means and Proportions

Task 1. The mayor of Philadelphia worries about the current unemployment level. He would like to know whether the mean duration of unemployment in Philadelphia is greater than the US national mean duration of 14.6 weeks. He requested a study on the status of unemployment. *Develop the null and alternative hypotheses most appropriate for this study.*

Task 2. During a study of a new drug against viral infection, you have found that 70 out of 100 mice survived, whereas the survival after the standard therapy is 60% of the infected population. Is this enhancement statistically significant? Use error level $\alpha=0.05$

      2.1. Formulate the hypotheses

      2.2. Calculate confidence interval (C.I.) and draw the conclusions using interval estimation

      2.3. Calculate the p-value and draw the conclusions

Task 3 Assume, that an average survival time for glioblastoma patients (early state, age<50) is 18 months. You have developed a new treatment which should increase the survival time. You perform a pilot clinical trial (10 patients) in order to determine the positive effect. As a result, you observed the average survival of 20 months. Experimentally observed standard deviation was equal to 5 months.

      3.1. Formulate the hypotheses.

      3.2. Is the increase on survival time statistically significant (error level $\alpha=0.05$)?

      3.3. How could you enhance the result?

Task 4. A geneticist, studying flower color in *Mirabilis jalapa*, the four-o'clock flower, crossed pink and white individuals together and predicted 50% white-flowered offspring and 50% pink-flowered offspring. Of the 100 seeds collected and germinated, 60 resulted in pink-flowered plants and 40 resulted in white-flowered plants. Was this result significantly different from the expectation.

Task 5. As part of benthic community survey of Lady Elliot Island, 16 sea stars, *Linckia laevigata*, were collected and their longest arm was measured to the nearest tenth of cm:

      10.3   11.0   10.5   10.0   11.3   14.5   13.0   12.1

      12.1   9.4   11.3   12.0   11.5   9.3   10.1   7.6

    a) Calculate the 95% C.I. for the population mean.

    b) Test whether the mean is significantly different from 12 cm.

Task 6. In healthy adult males the sciatic nerve conduction velocity values are normally distributed with a mean of 65 cm/ms. The conduction velocities of 16 subjects admitted to the poison control center of a metropolitan hospital with a diagnosis of methylmercury poisoning had a mean velocity of 55 cm/ms and a variance of 49 $(cm/ms)^2$. Do these data provide sufficient evidence to indicate that the conduction velocities are significantly slower in the poisoned individuals?

Task 7. A television documentary on overeating claimed that adult American males are on average 15 lb overweight. To test this claim, 25 randomly selected adult males were examined, and the average excess weight was found to be 18 lb with a standard deviation of 0.5 lb. Do these data give us a reason to believe the claim of 15 lb is incorrect?

Does the result look realistic for you? What kind of an error you could make here? Explain.