

Homework 6

Here is the list of problems constituting the sixth homework assignment. First, please, try to find your own solutions and after this effort consult these solutions with the ones presented during tutorials and, finally, check the solutions that will be posted on the course webpage. Remember that problems can have several different but correct ways of solving them.

Multiple choice questions

1. Student-t distribution is used
 - A when data do not follow the normal model;
 - B when there is too many data to account for the normal model;
 - C when the standard deviation of the model is known;
 - D for testing percentages and proportions;
 - E for the data that follow the normal model with unknown standard deviation specially when sample sizes are small.
2. The paired sample test applies to
 - A testing the difference of two means for two samples taken independently from two different populations;
 - B testing the mean difference between elements of sampled pairs of values;
 - C testing equality of standard deviations for two samples;
 - D testing proportions between two populations;
 - E pooled sample made of two samples of the same size.
3. If two samples are taken independently and are of different and small sizes, then
 - A it is impossible to test for the equality of their means;
 - B one can use Student-t distribution to test the difference of their means if their variances are equal;
 - C one can use approximate normal distribution to test the difference of their means;
 - D one can use Student-t distribution to test the difference of their means if their variances are not equal;
 - E one can use the paired sample test to test the difference of their means.
4. The observed significance level (also called p -value)
 - A is always smaller than the significance level α ;
 - B represents our believe that the null hypothesis is correct;
 - C can be used for testing by rejecting the null hypothesis if it is smaller than the significance level α ;

- D** is equal to the power of the test;
E is equal to the chances of Type I Error.
5. The significance level α is
- A** equal to chances of rejecting the null hypothesis given that it is true;
B is equal to chances of Type II Error;
C is equal to one minus the chances of Type II Error;
D is always set to 5%;
E is smaller more data are available.

Problems

1. A sample of scores one an examination given in Business Statistics are:

Males: 72 69 98 66 85 76 79 80 77
 Females: 81 67 90 78 81 80 76

At the 5% significance level test if there is a difference in the mean scores between female and male students. In the process of doing this

- write down the test statistic that is used for this purpose of testing;
- identify the distribution of this statistic;
- find from the table the critical value for this test;
- evaluate test statistic;
- compare the evaluated value with the critical value;
- write the conclusion to the test.

The following values can be found usefull when solving the problem: the sample mean for males is 78 and sample standard deviation is 9.49, the sample mean for females is 79 and sample standard deviation is 6.88.

2. • Cigarette Tar Content Problem have been used in the lecture to illustrate importance of accounting for variation in the process of decision making. Here we will discuss the problem for more comprehensive data set of 100 measurements of the tar content of a certain type of cigarette. The average value has been reported 14.1 and standard deviation was reported equal to 0.3 (all in milligrams). Test for the difference between the mean of this sample (14.1 mg/cg) and the average tar content claimed by the cigarette manufacturer, $\mu_0 = 14.0$ at the 5% significance level ($\alpha = 0.05$).
- Assume that another brand of cigarettes has been also studied and a sample of 50 cigarettes has been taken and the tar content has been measured yielding the mean 14.2 and sample standard deviation 1.3 has been reported. Test the same hypothesis as before for this new data set.
 - In view of the obtained results, discuss if looking only at the mean tar content is a sufficient criterium of the quality of cigarettes.