

**MATH-57091 Probability and Statistics for High-School Teachers.**  
**Home Work 11, due on Wednesday November 19**  
**Instructor: Prof. Artem Zvavitch**

**Problem 1.** *To test the hypothesis*

$$H_0 : \mu = 105 \text{ against } H_1 : \mu \neq 105$$

*a sample of size 9 is chosen. If the sample mean is  $\bar{X} = 100$ , find the p value if the population standard deviation is known to be*

- $\sigma = 5$ .
- $\sigma = 10$ .
- $\sigma = 15$ .

**Problem 2.** *What will happened if in the previous problem we will change sample size to 36 but would keep the sample mean the same?*

**Problem 3.** *Traffic authorities claim that traffic lights are red for time that is normal with mean 30 seconds and standard deviation 1.4 seconds. To test this claim, a sample of 40 traffic lights was checked. If the average time of the 40 red lights observed was 32.2 seconds, can we conclude, at the 5 percent level of significance, that the authorities are incorrect? What about 1 percent level of significance?*

**Please, watch/study Lecture 11.2**

**Problem 4.** *It is known that the value received at a local receiving station is equal to the value sent plus a random error that is normal with mean 0 and standard deviation 2. If the same value is sent 7 times, compute the p value for the test of the null hypothesis that the value sent is equal to 14, if the values received are*

$$14.6, 14.8, 15.1, 13.2, 12.4, 16.8, 16.3.$$

**Problem 5.** *Please, compute the probability, in the previous problem, that the null hypothesis that the value 14 is sent will be rejected at the 5 percent level of significance, when the actual value sent is*

- 15
- 13
- 16

**Problem 6.** *It is very important in a certain chemical process that a solution to be used as a reactant have a pH level greater than 8.40. A method for determining pH that is available for solutions of this type is known to give measurements that are normally distributed with a mean equal to the actual pH and with a standard deviation of 0.05. Suppose that 10 independent measurements yielded the following pH values:*

$$8.30, 8.42, 8.44, 8.32, 8.43, 8.41, 8.42, 8.46, 8.37, 8.42.$$

*Suppose it is a very serious mistake to run the process with a reactant having a pH level less than or equal to 8.40*

- *What null hypothesis should be tested? (remember we only can reject!!!!)*
- *What is the alternative hypothesis?*
- *Using the 5 percent level of significance, what would you advise to use or not to use the solution?*
- *What is the p value of the hypothesis test?*