UE19CS203 – STATISTICS FOR DATA SCIENCE
Unit-4 - Hypothesis and Inference

QUESTION BANK

Fixed Level Testing:

Exercises for section 6.12: [Text Book Exercise 6.12– Pg. No. 478]

1. A hypothesis test is performed, and the $P - value$ is 0.03. True or false:
    a. H_0 is rejected at the 5% level.
    b. H_0 is rejected at the 2% level.
    c. H_0 is not rejected at the 10% level.

2. A process for a certain type of ore is designed to reduce the concentration of impurities to less than 2%. It is known that the standard deviation of impurities for processed ore is 0.6%. Let μ represent the mean impurity level, in percent, for ore specimens treated by this process. The impurity of 80 ore specimens is measured, and a test of the hypothesis
    $H_0 : \mu \geq 2$ versus $H_1 : \mu < 2$ will be performed.

    a. If the test is made at the 5% level, what is the rejection region?
    b. If the sample mean impurity level is 1.85, will H_0 be rejected at the 10% level?
    c. If the sample mean pH is 1.85, will H_0 be rejected at the 1% level?
    d. If the value 1.9 is a critical point, what is the level of the test?

3. A new braking system is being evaluated for a certain type of car. The braking system will be installed if it can be conclusively demonstrated that the

stopping distance under certain controlled conditions at a speed of 30 mi/h is less than 90 ft. It is known that under these conditions the standard deviation of stopping distance is approximately 5 ft. A sample of 150 stops will be made from a speed of 30 mi/h. Let μ represent the mean stopping distance for the new braking system.

   a. State the appropriate null and alternate hypotheses.

   b. Find the rejection region if the test is to be conducted at the 5% level.

   c. Someone suggests rejecting H_0 if $X \geq 89.4$ ft. Is this an appropriate rejection region, or is something wrong? If this is an appropriate rejection region, find the level of the test. Otherwise explain what is wrong.

   d. Someone suggests rejecting H_0 if $X \leq 89.4$ ft. Is this an appropriate rejection region, or is something wrong? If this is an appropriate rejection region, find the level of the test. Otherwise explain what is wrong.

   e. Someone suggests rejecting H_0 if $X \leq 89.4$ ft or if $X \geq 90.6$ ft. Is this an appropriate rejection region, or is something wrong? If this is an appropriate rejection region, find the level of the test. Otherwise explain what is wrong.

4. A test is made of the hypotheses $H_0 : \mu \leq 10$ versus $H_1 : \mu > 10$. For each of the following situations, determine whether the decision was correct, a type I error occurred, or a type II error occurred.

   a. $\mu = 8, H_0 \text{ is rejected.}$
   b. $\mu = 10, H_0 \text{ is not rejected.}$
   c. $\mu = 14, H_0 \text{ is not rejected.}$
   d. $\mu = 12, H_0 \text{ is rejected.}$

5. A vendor claims that no more than 10% of the parts she supplies are defective. Let p denote the actual proportion of parts that are defective. A test is made of the hypotheses $H_0 : p \leq 0.10$ versus $H_1: p > 0.10$. For each of the following situations, determine whether the decision was correct, a type I error occurred, or a type II error occurred.

a. The claim is true, and H_0 is rejected.
b. The claim is false, and H_0 is rejected.
c. The claim is true, and H_0 is not rejected.
d. The claim is false, and H_0 is not rejected.

6. A hypothesis test is to be performed, and it is decided to reject the null hypothesis if $P \leq 0.10$. If H_0 is in fact true, what is the maximum probability that it will be rejected?

7. A new process is being considered for the liquefaction of coal. The old process yielded a mean of 15 kg of distillate fuel per kilogram of hydrogen consumed in the process. Let μ represent the mean of the new process. A test of $H_0 : \mu \leq 15$ versus $H_1 : \mu > 15$ will be performed. The new process will be put into production if H_0 is rejected. Putting the new process into production is very expensive. Therefore, it would be a costly error to put the new process into production if in fact it is no better than the old process. Which procedure provides a smaller probability for this error, to test at the 5% *level* or to test at the 1% level?