

## **Worksheet set-1 STATISTICS WORKSHEET-8**

Q1 to Q12 have only one correct answer. Choose the correct option to answer your question.

1. In hypothesis testing, type II error is represented by  $\beta$  and the power of the test is  $1-\beta$  then  $\beta$  is:

- a. The probability of rejecting  $H_0$  when  $H_1$  is true
- b. The probability of failing to reject  $H_0$  when  $H_1$  is true
- c. The probability of failing to reject  $H_1$  when  $H_0$  is true
- d. The probability of rejecting  $H_0$  when  $H_1$  is true.

**Ans:** b. The probability of failing to reject  $H_0$  when  $H_1$  is true

2. In hypothesis testing, the hypothesis which is tentatively assumed to be true is called the

- a. correct hypothesis
- b. null hypothesis
- c. alternative hypothesis
- d. level of significance

**Ans:** b. null hypothesis

3. When the null hypothesis has been true, but the sample information has resulted in the rejection of the null, a \_\_\_\_\_ has been made

- a. level of significance
- b. Type II error
- c. critical value
- d. Type I error

**Ans:** d. Type I error

4. For finding the p-value when the population standard deviation is unknown, if it is reasonable to assume that the population is normal, we use

- a. the z distribution
- b. the t distribution with  $n - 1$  degrees of freedom
- c. the t distribution with  $n + 1$  degrees of freedom

d. none of the above

**Ans:** b. the t distribution with  $n - 1$  degrees of freedom

5. A Type II error is the error of

a. accepting  $H_0$  when it is false

b. accepting  $H_0$  when it is true

c. rejecting  $H_0$  when it is false

d. rejecting  $H_0$  when it is true

**Ans:** d. rejecting  $H_0$  when it is true

6. A hypothesis test in which rejection of the null hypothesis occurs for values of the point estimator in either tail of the sampling distribution is called

a. the null hypothesis      b. the alternative hypothesis

c. a one-tailed test      d. a two-tailed test

**Ans:** d. a two-tailed test

7. In hypothesis testing, the level of significance is

a. the probability of committing a Type II error

b. the probability of committing a Type I error

c. the probability of either a Type I or Type II, depending on the hypothesis to be tested

d. none of the above

**Ans:** b. the probability of committing a Type I error

8. In hypothesis testing,  $\beta$  is

a. the probability of committing a Type II error

b. the probability of committing a Type I error

c. the probability of either a Type I or Type II, depending on the hypothesis to be test

d. none of the above

**Ans:** a. the probability of committing a Type II error

9. When testing the following hypotheses at an  $\alpha$  level of significance  $H_0: p = 0.7$   $H_1: p > 0.7$  The null hypothesis will be rejected if the test statistic  $Z$  is

- a.  $z > z_\alpha$
- b.  $z < z_\alpha$
- c.  $z < -z$
- d. none of the above

**Ans:** c.  $z < -z$

10. Which of the following does not need to be known in order to compute the P-value?

- a. knowledge of whether the test is one-tailed or two-tail
- b. the value of the test statistic
- c. the level of significance
- d. All of the above are needed

**Ans:** c. the level of significance

11. The maximum probability of a Type I error that the decision maker will tolerate is called the

- a. level of significance      b. critical value
- c. decision value              d. probability value

**Ans:** a. level of significance

12. For t distribution, increasing the sample size, the effect will be on

- a. Degrees of Freedom                      b. The t-ratio
- c. Standard Error of the Means              d. All of the Above

**Ans:** a. Degrees of Freedom

Q13 to Q15 are subjective answers type questions. Answers them in their own words briefly. 13. What is Anova in SPSS? 14. What are the assumptions of Anova? 15. What is the difference between one way Anova and two way Anova

13. What is Anova in SPSS?

**Ans:**The ANOVA test allows a comparison of more than two groups at the same time to determine **whether a relationship exists between them**.

ANOVA is a method to determine if the mean of groups are different. In inferential statistics, we use samples to infer properties of populations. Statistical tests like ANOVA help us justify if sample results are applicable to populations.

This test is also called the Fisher analysis of variance. The use of ANOVA depends on the research design. Commonly, ANOVAs are used in three ways: **one-way ANOVA, two-way ANOVA, and N-way ANOVA**.

Analysis of Variance, i.e. ANOVA in SPSS, is used for examining the differences in the mean values of the dependent variable associated with the effect of the controlled independent variables, after taking into account the influence of the uncontrolled independent variables. Essentially ANOVA in SPSS is used as the test of means for two or more populations.

ANOVA in SPSS must have a dependent variable which should be metric(measured using an interval or ratio scale). ANOVA in SPSS must also have one or more independent variables, which should be categorical in nature. In ANOVA in SPSS, categorical independent variable are called factors. A particular combination of factor levels, or categories is called a treatment. If two or more factors are involved in ANOVA in SPSS, then it is termed as n way ANOVA. For example, if the researcher also wants to examine the preference for Total cereal by the customers who are loyal to it and those who are not, then we can use n way ANOVA in SPSS.

In ANOVA in SPSS, from the menu we choose:

“Analyze” then go to “Compare Means” and click on the “One-Way ANOVA.”

N way ANOVA in ANOVA in SPSS involves simultaneous examination of two or more categorical independent variables, which is also computed in a similar manner.

A major advantage of ANOVA in SPSS is that the interactions between the independent variables can be examined.

#### 14. What are the assumptions of Anova?

**Ans:** ANOVA assumes that the data is normally distributed. The ANOVA also assumes homogeneity of variance, which means that the variance among the groups should be approximately equal. ANOVA also assumes that the observations are independent of each other.

There are three primary assumptions in ANOVA:

- 1) **The responses for each factor level have a normal population distribution.**
- 2) **These distributions have the same variance.**
- 3) **The data are independent.**

Violations to the first two that are not extreme can be considered not serious. The sampling distribution of the test statistic is fairly robust, especially as sample size increases and more so if the sample sizes for all factor levels are equal. If you conduct an ANOVA test, you should always try to keep the same sample sizes for each factor level.

#### 15. What is the difference between one way Anova and two way Anova?

**Ans:** The key differences between one-way and two-way ANOVA are summarized clearly below.

1. A one-way ANOVA is primarily designed to enable the equality testing between three or more means. A two-way ANOVA is designed to assess the interrelationship of two independent variables on a dependent variable.
2. A one-way ANOVA only involves one factor or independent variable, whereas there are two independent variables in a two-way ANOVA.
3. In a one-way ANOVA, the one factor or independent variable analysed has three or more categorical groups. A two-way ANOVA instead compares multiple groups of two factors.
4. One-way ANOVA need to satisfy only two principles of design of experiments, i.e. replication and randomization. As opposed to two-way ANOVA, which meets all three principles of design of experiments which are replication, randomization and local control.

## One-way vs two-way ANOVA differences chart

	One-Way ANOVA	Two-Way ANOVA
Definition	A test that allows one to make comparisons between the means of three or more groups of data.	A test that allows one to make comparisons between the means of three or more groups of data, where two independent variables are considered.
Number of Independent Variables	One.	Two.
What is Being Compared?	The means of three or more groups of an independent variable on a dependent variable.	The effect of multiple groups of two independent variables on a dependent variable and on each other.
Number of Groups of Samples	Three or more.	Each variable should have multiple samples.