BA5106: Statistics for Management

Two Mark Questions with Answer

Unit-III TESTING OF HYPOTHESIS-PARAMETRIC TESTS

1. What is a statistical hypothesis?

   A statistical hypothesis is an assumption about a population parameter. This assumption may or may not be true.

2. What are the types of statistical hypothesis?

   There are two types of statistical hypothesis.

   - Null hypothesis: The null hypothesis, denoted by H_0, is usually the hypothesis that sample observations result purely from chance.
   - Alternative hypothesis: The alternative hypothesis, denoted by H_1 or H_a, is the hypothesis that sample observations are influenced by some non-random cause.

3. What is hypothesis testing?

   Statisticians follow a formal process to determine whether to eject a null hypothesis, based on sample data. This process is called hypothesis testing.

4. Define the steps of hypothesis testing?

   Hypothesis testing consists of four steps.

   - State the hypotheses. This involves sating the null and alternative hypotheses. The hypotheses are stated in such a way that they are mutually exclusive. That is, if one is true the other must be false.
   - Formulae an analysis plan. The analysis plan describes how to use sample data evaluate the null hypothesis. The evaluation often focuses around a single test statistic.
   - Analyse sample data. Find the value of the test statistic (mean score, Proportion, t-score, z-score, etc.) described in the analysis plan.
   - Interpret results. Apply the decision rule described in the analysis plan. If the value of the test statistic is unlikely, based on the null hypothesis, reject the null hypothesis.

5. What are decision errors?

   Two types are errors are result from the hypothesis test.

   - Type I error: Type I error occurs when the researcher rejects a null hypothesis when it is true. The probability of committing a type I error is called the significance level. This probability is also called alpha, and is often denoted by α.

- Type II error. A type II error occurs when the researcher fails to reject a null hypothesis that is false. The probability of committing a Type II error is called beta, and often dented by β. The probability of not committing a type II error is called the power of the test.

6. How to arrive on a decision on hypothesis?

   The decision rules can be taken in two ways – with reference to a P-value or with reference to a region of acceptance.

   - P-value: The strength of evidence in support of a null hypothesis is measured by the P-value statistic as extreme as S, assuming the null hypothesis is true. If the P-value is less than the significance level, we reject the null hypothesis.
   - Region of acceptance: The region of acceptance is a range of values. If the test statistic falls within the region of acceptance the null hypothesis is not rejected. The region of acceptance is defined so that the chance of making a Type I error is equal to the significance level. The set of values outside the region of acceptance is called the region of rejection. If the test statistic falls within the region of rejection, the null hypothesis is rejected. In such cases, we say that the hypothesis has been rejected at the α level of significance.

7. Explain one-tailed and two-tailed tests.

   A test of a hypothesis, where the region of rejection is on only one side of the sampling distribution is called a one-tailed test. For example, suppose the null hypothesis states that the mean is less than or equal to 10. The alternative hypothesis would be that the mean is greater than 10. The region of rejection would consist of a range of numbers located on the right side of sampling distribution; that is, a set of numbers greater than 10.

   A test of a statistical hypothesis, where the region of rejection is on both sides of the sampling distribution is called a two-tailed test. For example, suppose the null hypothesis states that the mean is equal to 10. The alternative hypothesis would be that the mean is less than 10 or greater than 10. The region of rejection would consist of a range of numbers located on both sides of sampling distribution; that is, the region of rejection would consist partly of numbers that were greater than 10.

8. What is Chi-Square in statistics?

   Suppose MS Dhoni plays 100 tests, and 20 times he made 50. Is he a good player?

   In statistics, the Chi-Square test calculates how well a series of numbers fits a distribution. In this module, we only test for whether results fit an even distribution. It doesn't simply say "yes" or "no". instead , it gives you a confidence interval, which sets upper and lower bounds on the likelihood that the variation in your data is due to chance.

   There are basically two types of random variables and they yield two types of data: Numerical and Categorical.

A Chi-Square (X2) statistic is used to investigate whether distributions of categorial variables differ from one another. Basically, categorial variable yield data in the categories and numerical variables yield data in numerical form.

Responses to such questions as “What is your major” or “Do you own a car?” are categorial because they yield data such as “biology” or “no”. In contrast, responses to such questions as “how tall are you?” or “What is your G.P.A.?” are numerical. Numerical data can be either discrete or continuous.

9. What is ANOVA?

Analysis of variance (ANOVA) is a collection of statistical models and their associated procedures in which the observed variance is partitioned into components due to different sources of variation. ANOVA provides a statistical test of whether or not the means of several groups are all equal.

10. What are the assumptions in ANOVA?

The following assumptions are made to perform ANOVA:

- Independence of cases – this is an assumption of the model that simplifies the statistical analysis.
- Normality – Distributions of the residuals are normal.
- Equality (or “homogeneity”) of variances, called homoscedastically – the variance of data in groups should be the same. Model – based approaches usually assume that the variance is constant. The constant-variance property also appears in the randomization (design-based) analysis of randomized experiments, where it is a necessary consequence of the randomized design and the assumption of unit treatment additivity (Ilinkemann and Kempthorne); then the assumption of unit treatment additivity is necessarily violated. It has been shown, however that the F-test is robust to violations of this assumption.

11. What is the logic of ANOVA?

Partitioning the sum of squares

The fundamental technique is a partitioning of the total sum of squares (abbreviated SS) into components related to the effects used in the model. For example, we show the model for a simplified ANOVA with one type of treatment at different levels.

$$SS_{Total} = SS_{Error} + SS_{Treatments}$$

So, the number of degrees of freedom (abbreviated df) can be partitioned in a similar way and specifies the Chi-Square distribution which describes the associated sums of squares.

$$df_{Total} = df_{Error} + df_{Treatments}$$

12. What is the F-test?

The F-test is used for comparisons of the components of the total deviation. For example, in one -way or single-factor ANOVA, statistical significance is tested for by comparing the F-test statistic.

$$F = \frac{Variance\ between\ items}{Variance\ within\ items}$$

$$F = \frac{MSTR}{MSE}$$

Where

MSTR = $\frac{SSTR}{I-1}$ {I = number of treatments}

MSE = $\frac{SS}{nT-I}$ {nT = total number of cases}

To the F-distribution with I-1 & n-T, I degree of freedom, Using the F-distribution is a natural candidate because the test statistic is the quotation of two mean sums of squares which have a Chi-Square distribution.

13. Why is ANOVA helpful?

ANOVA is helpful because they posses a certain advantage over a two-sample t-test. Doing multiple two-sample t-tests would result in a largely increased chance of committing a type I error. For this reason, ANOVA are useful in comparing three or more means.