Paper - II, Unit - III

1) What is analysis of Variance? Discuss its assumptions & applications. How Variance is analysed?

Ans.

Introduction:

Analysis of Variance is a statistical device used for determining the significance of the differences among several means. It is a statistical procedure of testing experimental hypotheses relating to the differences among several means.

The principles of analysis of variance are related to mainly two assumptions. a) When the means are independent, the principles of Variance analysis can be applied to determine the significance of the difference between the means. In other words analysis of Variance can be used when the sets of measure from which the means are derived, are uncorrelated. b) This technique may be used to determine the significance of the difference bet. the means when the means are not independent.

Variance can be analysed under two conditions: firstly, the Variance can be analysed when pairs of scores are added to yield a composite score.

Comparison among several means.

under this condition z will be equal to x + y. Under this condition z will be equal to x + y. Secondly, Variance can be analysed when two set of scores are combined into a single distribution. It will indicate what proportion of the variance of the composite z is attributable to the variance of x & the variance of y.

(2) Uses & Applications :—

Analysis of variance as a statistical device has the following uses & applications :—

1) Comparison among several means :— This statistical device is useful when there are more than two means to be compared. Suppose that we wish to study the effects of 8 diff. experimental conditions such as A B C D E F G H, upon performance on a sensory motor task. From a total of 48 subjects, 6 are assigned at random to each of 8 groups. Now the problem is do the means of scores under all the 8 conds. differ significantly. Now this prob. can be solved by using analysis of Variance (F test). If the obtained F is significant at 0.05 or

Comparison of Two means.
Single group method

0.01 levels, it can be safely concluded that there is a significant difference among all the means. It should be noted that under such cond. the t test is not advisable due to its being lengthy & complex procedure.

2) Comparison of two means:— The F test i.e the analysis of Variance can also be used when ever a Comparison has to be made bet. two groups or two means. Suppose that one mean is 135 & the other mean is 140 they have 7.5 & 6.5 as their Std. Deviations. The no. of scores is 100 each. Now the prob. is do the means differ significantly from each other? This prob. can be solved by using both F test t test. However, here the t test is preferable due to its simplicity in this respect.

3) Single group Method:— Sometimes analysis of Variance is used as a single group method. In other words the F test can be used when the same group is measured more than once. Suppose that a group of 12 subjects has been

7/ Analysis of Co-Variance

For example if a group of 12 subjects is given 5 successive trials upon a digit symbol test the scores for trials 1 to 5 have been obtained. Now the prob. is if the mean of the scores on fifth trial is significantly superior to the mean of scores of the first trial. This prob. can be easily solved by using F test. It should be noted that here also the t test may be used in place of the F test. However the F test claims its superiority over the t test in the sense that the F test can also determine the interaction effect, which the t test cannot.

8/ Analysis of Co Variance:- This is the special utility of analysis of Variance. It is specially useful to exp. tal psy. ists when it is difficult or impossible to equate control & exp. tal groups at the start. So this is an extension of the F test. Garrett (1979) says Analysis of Co-Variance represents an extension of analysis of Variance to allow for the correlation between initial & final scores.

(14)

Analysis of Covariance:- This is the special utility of the analysis of variance. It is specially useful to experimental Psychologists when it is difficult or impossible to equate control and experimental groups at the start. So it is an extension of the F test.

Garrett (1979) says that Analysis of Covariance is an extension of the Analysis of variance to allow for the correlation between initial & final scores.

Signi: bet SD's

(5) Cont.

Significance between S.D's

Significance between SD's :- Analysis of Variance may be used to determine the significance of the difference bet: two SD's provided that the samples are small & uncorrelated (independent). However here a slight modification in the traditional formula of F test is needed. Suppose that N1 is 6 & N2 is 10. The first Variance is 22 & the second Variance is 39.1. Naturally the F ratio will be $\frac{39.1}{22}$ or 1.78. It indicates that the larger Variance is equal to or greater than the smaller Variance. This is called one tailed test. In testing the differences bet: two Variances we need a two-tailed test. This gives a two tailed test at the 0.10 & 0.02 levels.

It is obvious that the F test or the analysis of Variance has its own requisites or assumptions & that it has different uses & applications as discussed above.

Suppose that N1 is 6 & N2 is 10. The first variance is 22 & the second variance is 39.1. Naturally the F ratio will be $\frac{39.1}{22}$ or 1.78. It shows that the larger variance is equal to or greater than the smaller variance. This is called one tailed test.

To test the difference between two variances we need a two tailed test which may be significant at .10 or .02 level.

As we see the F test Analysis of variance has its own requisites & assumptions & different uses & applications as discussed above.

(Mann-Whitney test)