Graeco Latin Square Design

By using LSD treatment effects can be estimated by eliminating two sources of variation. This technique can be extended further to eliminate more sources of variation. A Graeco LS is one such design where three sources of variation can be eliminated.

An orthogonal design by which three sources of variation can be eliminated by using only k^2 units where k is the no. of treatments is called a k x k Graeco latin square design.

A design is said to be orthogonal when the data obtained from it are orthogonal. When all the levels of a controlled factor occurs with each level of any other controlled factor in a design, the data obtained from such a design are always orthogonal.

In order to make the data from a Graeco latin Square orthogonal, we have to take another controlled factor R at k levels in addition to the two controlled factors P and Q introduced for the LSD, such that each level of R occurs with each level of P and only for Q only once. In that

case we have to allocate treatment to the units such that each treatment occurs once with each level of the controlled factors P, Q and R in the k^2 units.

For example, let us replace the five treatments symbol A, B, C, D and E in the example of the LSD written systematically by five Greek letters α, β, γ, δ and θ respectively. These letters represents the five level of the factor R. The following arrangement of five levels of each of two factors in 5^2 units.

Levels of Q \ Levels of P					
	α	β	γ	δ	θ
	β	γ	δ	θ	α
	γ	δ	θ	α	β
	δ	θ	α	β	γ
	θ	α	β	γ	δ

Now, five treatments A, B, C, D and E are to be allotted to the above 25 units such that each treatment occurs once in each row, each column and with each of the Greek letters.

It is not easy to allot the treatments to the units so as to satisfy the above requirements of a Graeco Latin square design. The problem can, however, be solved easily by exploiting the properties of ortho. L.S.

Analysis of Covariance:

The basic objective of the designs is to make the treatment comparisons with the greatest precision by reducing the experimental error through the powerful tool of local control.

Analysis of Covariance (ANOCOVA), like RBD or LSD, is a technique of increasing the precision of the design by reducing the experimental error. ANOCOVA is a technique in which it is possible to control sources of variation by taking additional observations on each of the experimental units. Let us suppose that in an experiment, y is the response

Variable and x is another variable which is linearly related to y. Moreover x cannot be controlled by the experimenter but can be observed alongwith the y's. The variable x is called the covariate or independent or ancillary variable. In ANOCOVA we adjust for the variation in the response variable (y) for the linear regression (effect) of the independent variable (x).

ANOCOVA procedure is a combination of the ANOVA and the regression analysis. Whenever it is possible to take additional observations on one or more of the variables from each of the experimental units in the design alongwith the response variable under study, the ANOCOVA technique has proved to be useful in many fields of research.