

Latin square design essay sample



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Latin square design(Lsd): In analysis of variance context, the term “ Latin square design” was first used by R. A Fisher. Latin square design is a design in which experimental units are arranged in complete blocks in two different ways, called rows and columns and then the selected treatments are randomly allocated to experimental units within each row and each column. Such that each treatment appears exactly once in each row and once in each column.

Since this design is a square arrangement where the treatments are denoted by Latin letter. So this is named by Latin square design. In general a Latin square is an arrangement of letters in rows and columns such that each letter appears once in each row and once each column. Thus a Latin square is given by

Example:

i)In agricultural field experiments, LSD is used to eliminate the variation due to soil fertility difference in two perpendicular directions and then to compare the yields of several varieties of paddy or wheat. ii)In animal feeding experiments LSD may be used to remove the variation due to breeds and ages of cows and then to compare the yields of milk from cows fed on different nations.

Advantages of LSD:

i)LSD is more efficient than RBD and CRD. Since it control more of the variation than CRD or RBD. ii)Statistical analysis of data remains simple even with missing observations. iii)LSD is an complete layout needs less number of observations than the corresponding complete layout. So LSD has adequate

economy in the use of experimental material. iv) LSD covers relatively complete situations where factors can be studied simultaneously.

Disadvantages of LSD:

- i) LSD is not suitable for large number of treatments.
- ii) Analysis of data in a LSD depends on the assumption that there is no interaction among rows, columns and treatments. So LSD is not appropriate when interactions are present in data.
- iii) Error d. f is relatively small in a LSD. In fact, there is no error for latin square.
- iv) Property of orthogonality is lost by missing values in LSD.

Uses of LSD: Latin square design is used in experimentation in different ways:

- i) Glass house experiments, where there may exist variation across the house due to light differences and along the house due to treatment differences.
- ii) Cow feeding experiment.
- iii) Used to eliminate two extraneous sources of variability.
- iv) Field experiment.

Question: How does LSD or incomplete three way classification differ from complete three way classification? Ans: A complete three way classification involves possible level combinations. While a LSD or incomplete three way classification is a design involving observations out possible level combinations.

Difference between LSD and RBD:

LSD differs from RBD in the following points:

- i) Where in RBD, treatments are arranged in complete blocks in one direction

to eliminate one extraneous source of variability. In LSD treatments are arranged in complete blocks in two directions to remove two extraneous sources of variation.

ii) The number of blocks and treatments need not be equal in RBD. While number of rows, columns and treatments must be equal in LSD. iii) RBD is a complete layout while LSD is incomplete layout viewed from the types of blocks used.

Types of Latin squares: According to Fisher and Yates various types of Latin squares are as defined below:

Standard square: A square is said to be standard square if the first row and the first column are ordered alphabetically or numerically. For example,

Conjugate square: Two standard squares are said to be conjugate if the row of one square are the columns of the other. For example, are conjugate square.

Self conjugate square: A square is called self conjugate square if its arrangement of rows and columns are the same. For example, is self conjugate square.

Adjugate set/square: By permuting with each other the three category rows and columns and letters six set of latin square are formed but they are not necessary different. These sets are said to be adjugate set.

Self adjugate square: A square is said to be self adjugate if the permutation of three category rows, columns and letters results in the same set.

Orthogonal Latin squares: Two latin squares of same size are said to be orthogonal latin squares if each letter of one square appears exactly once with each letter of the other square when the two latin squares are superimposed. For example,

are orthogonal latin square.

Maximum number of orthogonal latin squares of size is $n-1$. Then a set of orthogonal latin squares of order n is called a complete set of orthogonal latin squares. A complete set of orthogonal latin square can be constructed when n is a prime number or the power of prime number.

Statistical analysis of LSD:

A fixed effect model for LSD is given by

Assumption:

- i) μ and τ_j are unknown parameters
- ii) There is no interaction effect between rows, columns and treatment.