## Missing Plot Technique:

In designs of expts, the value(s) of the response variable ($y$) for some experimental units (plots in case of field experimentation) may be missing or lost, or even if available are too low or too high to be regarded as normal experimental observations. This may be due to

* accidents
* the depreciation (plundering) of one or more plots on the edge of the layout (field) by cattle or birds
* the value may be suspect due to certain extraneous causes, etc.

The effected plots or the plots for which the data have to be omitted from the analysis are known as <u>missing plots</u>. It should be clearly understood we should not reject any observation(s), however large or small it may be, as abnormal unless we have sufficient evidence to show that the plots have been affected by extraneous causes.

The following methods are used for the analysis of the designs with the missing plots.

(i) Fisher's Rule

(ii) Bartlett's (covariance) method and

(iii) Interactive method.

Analysis of MPD (Fisher's Rule):

This method of the analysis of MPD is due to Fisher. It consists of estimating the missing observations by the values which minimises the residual (error) sum of squares.

To estimate the missing observations, we first substitute the unknown values, say, $x, y, \ldots,$ etc. for the missing observations. We then obtain the expression for the ESS for the design and express it as a fn. of these unknown values. Next, we obtain the normal eqns. for estimating these unknowns by differentiating ESS with. r. t. each of these unknowns and equating the differentials to zero. Thus we obtain as many linear eqns. in the unknowns as the no. of missing observations. Solving these eqns. with the help of algebra, we obtain the estimates of the missing observations.

## Analysis of the Design

Let us suppose there are 'k' missing observations whose values are say, $x_1, x_2 \ldots x_k$. The ESS for the design as a fn. of these observations,

$$\text{Viz}., ESS = ESS(x_1, x_2 \ldots x_k) \rightarrow (1)$$

Using the principle of least squares, the normal eqns for estimating $x_1, x_2, \ldots, x_k$ are

$$\frac{d}{dx_i}\left[ESS(x_1, x_2, \ldots, x_k)\right] = 0 \quad ; \quad i = 1, 2, \ldots, k \rightarrow (2)$$

Let $x_1^*, x_2^*, \ldots, x_k^*$ be the estimates of the missing observations obtained on solving the k-linear eqns (2). Then the actual value of ESS is

$$ESS(x_1^*, x_2^*, \ldots, x_k^*) = E_1 \text{ (say)},$$ which is the residual sum of squares of the design after the estimated value of missing observations have been substituted.

The correct portion of the d.f for the TSS and ESS is obtained on subtracting 'k' [the no. of missing (estimated) observations] from the d.f of corresponding TSS and ESS for the complete design (when all obsrn. are known).

$|||^{rly}$, the actual conditional ESS due to certain hypothesis, (say, $H_0$ : equality of treatment means) may be obtained by using the estimated values say $x_1', x_2', \ldots, x_k'$ of $x_1, x_2, \ldots, x_k$ which minimises the conditional ESS under $H_0$. Let it be

$E_2 = ESS(x_1', x_2', \ldots, x_k')$. Then the sum of squares due to hypothesis (Treatments) is given by

$$
\begin{aligned}
Tr.S.S &= \min(\text{conditional } ESS \text{ under } H_0) - \min(ESS) \\
&= ESS(x_1', x_2', \ldots, x_k') - ESS(x_1^*, x_2^*, \ldots, x_k^*) \\
&= E_2 - E_1 \quad \rightarrow (3)
\end{aligned}
$$