2^3 - Factorial Experiment

In 2^3 - experiment we consider three factors, say A, B and C each at two levels, say (a_0, a_1), (b_0, b_1) and (c_0, c_1) respectively, so that there are $2^3 = 8$ treatment combination in all. Extending the notations due to Yates for a 2^3 experiment, let the corresponding small letters a, b and c denote the second level of each of the corresponding factors. The eight treatment combinations in a standard order are

'1', a, b, ab, c, ac, bc, abc.

2^3 - factorial experiment can be performed as a CRD with 8 treatments, or RBD with r replicates (say), each replicate containing 8 treatments of LSD with $m = 8$ and data can be analysed accordingly. In 2^3 - experiment we split up the treatment S.S with 7 d.f into 7 orthogonal components corresponding to the three main effects A, B and C, the ~~first~~ three first order interactions AB, AC and BC and one second order interaction ABC, each carrying 1 d.f.

§ Model of 2^3 - Design:

The linear model for a 2^3 factorial expt. is

$$y_{ijkl} = \mu + \alpha_i + \beta_j + \gamma_k + (\alpha\beta)_{ij} + (\alpha\gamma)_{ik} +$$

$$(\alpha\beta\gamma)_{ijk} + \rho_l + \epsilon_{ijkl}$$

Here $i, j, k = 0, 1$; $l = 1, 2, \dots, r$.

where

μ is the general mean

α_i, β_j and γ_k are the effect of the i^{th} level of A, j^{th} level of B and k^{th} level of C respectively.

$(\alpha\beta)_{ij}$ and $(\alpha\gamma)_{ik}$ are the interaction effect of i^{th} level of A with j^{th} level of B and k^{th} level of C respectively.

$(\beta\gamma)_{jk}$ is the interaction effect of j^{th} level of B and k^{th} level of C

$(\alpha\beta\gamma)_{ijk}$ is the interaction effect of i^{th} level of A with j^{th} level of B and k^{th} level of C.

ρ_l is the effect due to the l^{th} replicate

ϵ_{ijkl} is the error effect due to chance are i.i.d $N(0, \sigma^2)$.