Relative efficiency of the Latin square design

1) To compared Relative efficiency between the L.s and CRD design use the following equation:

$$R.E.\% = \frac{MSr + MSc + (r-1)MSe}{(r+1)MSe} \times 100$$

Ex\ if the experiment result was according to Latin square design, must we do as follow:

S.O.V	df	SS	MS	F cal.
Rows	4	13601	3400	
Columns	4	6144	1536	
Treats	4	4156	1039	0.98
Error	12	12668	1056	
Total	24	36569		

$$R.E.\% = \frac{3400 + 1536 + (5-1)1056}{(5+1)1056} \times 100 = 145\%$$

- That's mean the Relative efficiency of Latin square design the best by 45% compare CRD design.

2) To compared Relative efficiency between the L.s and RCBD design use the following equation:

$$R.E.\% = \frac{MSc + (r-1)MSe}{r\,(MSe)} \times 100$$

When we use the previous example results, we follow the following:

$$R.E.\% = \frac{1536 + (5-1)1056}{5(1056)} \times 100 = 109\%$$

- That's mean the Relative efficiency of Latin square design the best by 9 % compare RCBD design.

Factorial Experimental Design

Factorial experiment is mean, the experiment that includes the study of two or more factors and the interactions between the factors.

Some experiments involve the study of the effects of multiple factors. For such studies, the factorial experimental design is very useful. A full factorial design, also known as fully crossed design, refers to an experimental design that consists of two or more factors, with each factor having multiple discrete possible values or “levels".

-Interaction: An Interaction between factors occurs when the difference in response between the levels of one factor is not the same at all the levels of the other factor.

Advantages of factorial experiments

1) Reduce cost and time, if we use a test for each factor alone, we will need twice the number of experimental units.

2) Easy to analyze as there is only one experimental error.

3) Increasing the accuracy of the experiment compared to the simple experiments because decrease in the experimental error value.

4) The possibility of discovering and estimating the interactions of factors, which is not possible in simple experiments.

Disadvantages of using factor experiments

1) Higher degree interactions are difficult to explain.

2) It is difficult to carry out large global experiments in the field or laboratory.

Not\ It is recommended that, the number of factors does not exceed 4 so that the interactions can be explained.

Not\ the dimensions of the factorial experience are determined by the number of factors involved in it and the number of levels for each factor, for example, the experiment.

A factorial that includes two factors, one with two factors and every factor has three levels, is called a factorial experiment and reads "two by three" (2×3).

A	B	R1	R2	R3	$Y_{ij.}$	$Y_{i..}$	$Y_{.j.}$
	b1						
a1	b2						
	b1						
a2	b2						

A	B	R1	R2	R3	$Y_{ij.}$	$Y_{i..}$	$Y_{.j.}$
	b1	Y_{111}	Y_{112}	Y_{113}	$Y_{11.}$		$Y_{.1.}$
a1	b2	Y_{121}	Y_{122}	Y_{123}	$Y_{12.}$	$Y_{1..}$	
	b1	Y_{211}	Y_{212}	Y_{213}	$Y_{21.}$		$Y_{.2.}$
a2	b2	Y_{221}	Y_{222}	Y_{223}	$Y_{22.}$	$Y_{2..}$	
						$Y_{...}$	

	b1	b2	$y_{i..}$
a1	$y_{11.}$	$y_{12.}$	$y_{1..}$
a2	$y_{21.}$	$y_{22.}$	$y_{2..}$
$y_{.j.}$	$y_{.1.}$	$y_{.2.}$	$y_{...}$

Linear model

$$y_{ijk} = \mu + A_i + \beta_j + (A\beta)_{ij} + e_{ijk}$$

Source	Sum of squares (SS)	Degree of freedom (df)	Mean squares (MS)	Expected Mean Square (EMS)
Factor A (cwnd)	SSA	$a-1$	MSA	$\sigma_\varepsilon^2 + n\sigma_{cs}^2 + bn\sigma_c^2$
Factor B (sleep)	SSB	$b-1$	MSB	$\sigma_\varepsilon^2 + n\sigma_{cs}^2 + an\sigma_s^2$
Interaction AB	SSAB	$(a-1)(b-1)$	MSAB	$\sigma_\varepsilon^2 + n\sigma_{cs}^2$
Error	SSE	$ab(n-1)$	MSE	σ_ε^2
Totals	TSS	$abn-1$		