DESIGN OF EXPERIMENT 23 11 23

Thursday, November 23, 2023 6:45 PM

LS

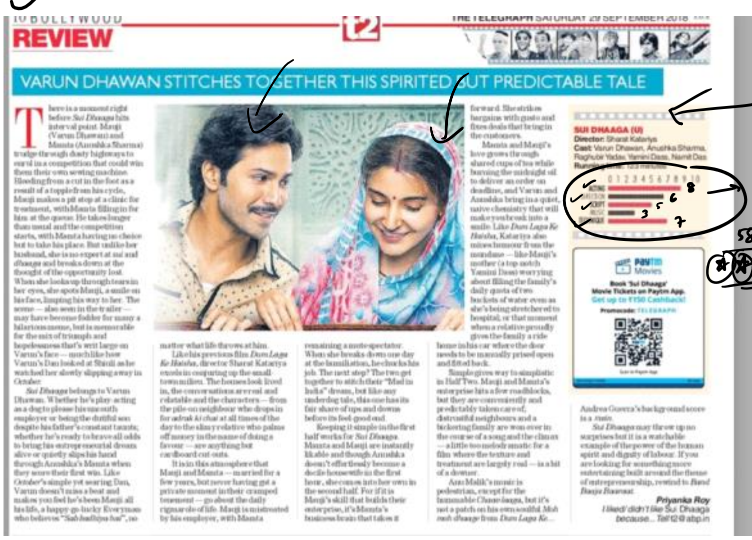
CRD	→ RBD	→ $\boxed{L}$SD
$y = \mu_i + \beta_i + \epsilon_i$	$y = \mu_i + \alpha_i + \beta_i + \epsilon_i$	$y = \mu_i + \alpha_i + \beta_i + \gamma_i + \epsilon_i$
1	2	3

Bad / Good

VB / VG / G/B

VVG / VVB / VG / VB / G / B

More the Blanks → better the decision



G / B

Block zone

44

58%

0

2.5 star

9562395723

Capta + lefar → exam

Applied Stat

Not a

Complete Reference ..

not a design framework

A	B	C	D
B	C	D	A
C	D	A	B
D	A	B	C

LSD

5 lr

105

9000

35 x 5

175 km

3.5/40 Scooter

Activa 125

(Car Saving)

Petrol → high mileage

BP HP Admin

CRD → RBD

(85-90)

40 km

175 → 500

LSD

1 km

2k daily

10/hr

20 hr

50 hr

C 1 2 3 4

D a b c d

LSD

D a b c d

P A B $\boxed{C}$ D

LSD

$4 \times 4 \times 4 = 64$ output

	1	2	3	4
a	A	B	C	D
b	B	C	D	A
c	C	D	A	B
d	D	A	B	C

4

A	B	C	D
B	A	D	C
C	D	B	A
D	C	A	B

A	B	C	D
B	C	D	A
C	D	A	B
D	A	B	C

A	B	C	D
B	D	A	C
C	A	D	B
D	C	B	A

p factor p!

need

No of LSD of order p

$\rightarrow p!(p-1)! \times$ No of Standard LSD

Graeco_LSD

$4 \times 4 \times 4 \times 2$

1 VS Graeco

Graeco-LSD

1 vs Couple

$A\alpha$	$B\beta$	$C\gamma$	$D\delta$
$B\delta$	$A\gamma$	$D\beta$	$C\alpha$
$C\beta$	$D\alpha$	$A\delta$	$B\gamma$
$D\gamma$	$C\delta$	$B\alpha$	$A\beta$

Liner Model of LSD

$$y_{ijk} = \mu + \alpha_i + \beta_j + \gamma_k + \epsilon_{ijk}$$

$i, j, k = 1, 2 \ldots n$

$\epsilon_{ijk} \to$ Random Error which are iid $\sim N(0, \sigma^2)$

$$\sum \alpha_i = 0, \quad \sum \beta_j = 0 \quad \sum \gamma_k = 0$$

α_i = Main Effect of Rows

β_j = Main Effect of Columns

γ_k = Main Effect of Treatments

$H_{0R} : \alpha_1 = \alpha_2 = \cdots = \alpha_n = 0$

$H_{0C} : \beta_1 = \beta_2 = \cdots = \beta_n = 0$

$H_{0T} : \gamma_1 = \gamma_2 = \cdots = \gamma_n = 0$

$\boxed{TSS = SSR + SSC + SST + SSE}$

Analysis of LSD (one observation per cell): ANOVA Table

The analysis of variance table is as follows

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F - value
Rows	$v-1$	SSR	MSR	F_R
Columns	$v-1$	SSC	MSC	F_C
Treatments	$v-1$	$SSTr$	$MSTr$	F_T
Error	$(v-1)(v-2)$	SSE	MSE	
Total	$v^2 - 1$	TSS		

$\frac{SSR}{v-1}$

$\frac{SSC}{v-1}$

$\frac{SSTr}{v-1}$

MISSING PLOT TECHNIQUES

??

What happens if some obs'n are missing ??

Solution

(i) estimate missing on the basis of available data

(ii) Replace it back in the data → make the data set complete..

Here Error Reduction is the main idea..

one missing

		Treatments (Factor B)						Block totals
		1	2	...	j	...	v	
Blocks (Factor A)	1	y_{11}	y_{12}	...	y_{1j}	...	y_{1v}	B_1
	2	y_{21}	y_{22}	...	y_{2j}	...	y_{2v}	B_2
	. . .	. . .	. . .		. . .		. . .	. . .
	i	y_{i1}	y_{i2}	...	$y_{ij} = x$	...	y_{iv}	$B_i = y'_{io} + x$
	. . .		. . .		. . .		. . .	. . .
	b	y_{b1}	y_{b2}	...	y_{bj}	...	y_{bv}	B_b
Treatment totals		T_1	T_2	...	$T_j = y'_{oj} + x$	...	T_v	Grand total $G = y'_{oo} + x$

where

y'_{oo} : total of known observations

y'_{io} : total of known observations in i^{th} block.

y'_{oj} : total of known observations in j^{th} treatment.

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$G^2 = (y_{oo} + x)^2$

Correction factor (CF) $= \frac{G^2}{n} = \frac{(400+x)^2}{bv}$

$$TSS = \sum\sum y_{ij}^2 - CF$$

$$SSE = TSS - \underline{SSB} - \underline{SST}$$

$$= x^2 - \frac{1}{v}(y_{i0}+x)^2 - \frac{1}{b}(y_{0j}+x)^2 + \frac{(400+x)^2}{b \cdot v}$$

$+$ (term which are const w.r.t. respect to x) $-$ CF ...

$$\boxed{\text{2 missing obsn}}$$

$$SSE = x^2 + y^2 - \frac{1}{v}\left[(R_1+x)^2 + (R_2+y)^2\right] - \frac{1}{b}\left[(C_1+x)^2 + (C_2+y)^2\right] + \frac{1}{bv}(S+x+y) + \text{term indep of } x, y$$

ANOVA assumption

1 2 3 Done procedure correctly

4 NO ~~Ass~~ End level Adjustment ..

Ayurda

Nerve

Tuesday

Thursday

Treatment

Bhavan

Bless

Wed/Thu/Fri