of Error variance in a LSD?

estimator of Error variance? Justify your answer.

19. Following data refer to the yields in bushels per acre of different varieties of wheat in the plots of approximately same fertility.

Varieties

A	B	C	D	E	F	G
15	20	16	12	19	17	14
12	14	16	16	17	11	18
18	15	14	17	16	15	15
13	17	15	12	21	12	13
14	13	13	19	14	16	18

Do the data indicate a significant differences in the yields of the varieties?

Lab

20. The follwing data refer to the yields in bushels per acre of 4 varieties of a corn.

Varieties

A	B	C	D
85.5	75.3	78.1	93.6
72.8	79.8	83.5	72.8
76.7	60.9	72.6	75.9
89.9	65.4	9.5	
	72.8	96.8	
	72.2	84.7	

(i) Test the hypothesis that true average yields of 4 varieties of corn are equal

(ii) Test hypothesis $\mu_B = \mu_D$

(iii) Compute 95% confidence interval for the difference $\mu_A - \mu_C$.

21. The following data relate to the gain in weight of a number of cows due to 4 different feeds. (Data are given in pound).

25	33	26	47
31	34	34	39
17	39	32	41
26	35	35	33

(i) Analyse the data and test whether ther is significant treatment effect.

(ii) Test the following

(a) $\mu_1 = \mu_2$

(b) $\mu_3 = \mu_4$

Lab

25. The following data are the number of defective pieces produced by 4 workmen operating in turn 4 different machines on 3 different days.

Workman

		B_1	B_2	B_3	B_4
Machine	A_1	25	26	28	30
		26	28	25	29
		25	31	33	28
	A_2	19	21	27	15
		24	27	25	13
		21	23	24	21
	A_3	23	34	26	25
		26	27	28	29
		24	29	24	29
	A_4	20	26	32	18
		23	28	28	20
		22	24	29	24

Analyse the data and test for significant differences among the workmen, significant differences among the machines and interaction and comment.

26. In an experiment to determine whether five makes of automobile average same number of miles per gallon, 3 cars of each make were selected at random in each of 3 cities gasolin. The following table records the number of miles travelled.

Cities

		Los Angels	San Fransisco	Portland
	A	20.3, 19.8, 21.4	21.6, 22.4, 21.3	19.8, 18.6, 21.0
	B	19.5, 18.6, 18.9	20.1, 19.9, 21.3	19.6, 18.3, 19.8
Makes	C	22.1, 23.0, 18.9	20.1, 21.0, 19.8	22.3, 22.0, 21.6
	D	17.6, 18.3, 18.2	19.5, 19.2, 20.3	19.4, 18.5, 19.1
	E	23.6, 24.5, 25.1	17.6, 18.3, 18.1	22.1, 24.3, 23.8

Analyse the data and determine whether ther is a significant difference among (i) makes and (ii) cities.

27. The following data refer to a RBD with 6 treatments in 4 blocks.

Treatments and yields

Blocks	1	A 28.9	C 31.8	B 24.8	D 20.4	F 28.9	E 20.3
	2	C 26.8	B 32.8	A 31.3	D 19.2	E 21.1	F 26.5
	3	F 30.4	D 23.6	C 40.8	A 42.6	B 43.7	E 19.7
	4	B 34.0	E 21.7	A 32.5	D 18.6	C 38.9	F 26.9

(i) Analyse the data and test the significance of treatment effects.

Column

Rows						
	F 219	E 250	D 227	C 162	B 182	A 89
	E 224	C 141	A 91	D 191	F 213	B 195
	B 204	A 94	F 225	E 229	D 250	C 207
	A 77	B 204	E 240	F 199	C 182	D 250
	D 250	F 231	C 209	B 204	A 92	E 227
	C 152	D 186	B 191	A 77	E 230	F 198

(i) Analyse the data and test the significance of difference among the treatment means.

(ii) Estimate the efficiency of this design relative to RBD and CRD.

(iii) Compute critical difference and hence compare among all pairs of treatment means.

(iv) Test the following

(a) $\mu_A = \mu_C$

(b) $\mu_B = \mu_F$

(v) Suppose that the yield under treatment E in 4th row is missing. Estimate the missing value.

29. A latin square was laid out to test the effects of fertilisers on the yields of potatoes. Relevant data are given below :

Column

A 449	B 444	C 401	D 299	E 292
B 463	C 375	D 323	E 264	a 415
C 393	D 353	E 278	A 404	B 425
D 371	E 241	A 441	B 410	C 392
E 258	A 430	B 450	C 385	D 347

(i) Analyse the data and test the significance of treatment effects.

(ii) Compare among all pairs of treatment means by Duncan's new multiple range test.

(iii) Compute 95% confidence limits for the difference $\mu_C - \mu_E$

Example 12 : The following data refer to the yields of a 2^3 factorial experiment with 3 factors A, B and C in a Randomised block design.

Blocks	Treatments with yields							
1	(1)	a	ab	b	c	ac	abc	bc
	257	232	230	211	210	176	186	175
2	ac	(1)	b	abc	a	c	ab	bc
	267	276	262	220	256	269	285	272
3	b	bc	c	a	ab	(1)	abc	ac
	188	186	160	188	164	214	182	166
4	ab	ac	(1)	bc	a	b	c	abc
	204	206	239	224	254	269	252	301

(i) Estimate the main effects and interactions

(ii) Test the significance of main effects and interactions.

(iii) Show a plan for confounding ABC and present anova table

Solution : Estimation of main effects and interactions by Yates' method

Treatmant Combination	Total yield	Column 1	Column 2	Column 3	Main effects & interactions	SS
(1)	966	1916	3729	7191	— —	—
a	930	1813	3462	− 157	− 9.8125 = A	770.28125
b	930	1716	− 103	− 73	− 4.5625 = B	166.53125
ab	883	1786	− 54	127	7.9375 = AB	504.03125
c	901	− 56	− 103	− 267	−16.6875 = C	2227.78125
ac	815	− 47	30	− 49	−3.0625 = AC	75.03125
bc	857	− 86	9	133	8.3125 = BC	552.78125
abc	889	32	118	109	6.8125 = ABC	371.28125
						46667.7188