Practice Exam #2 - Answers

1. Soil uniformity - if experimental units are uniform, a CRD probably is best. If experimental units are not uniform overall, but blocks of uniform experimental units can be used, an RCBD is best. If there are gradients in two directions, consider a latin square. Yet, a 10x10 latin square is quite large. You might lose as much as you gained.

2. Highest - CRD, lowest - ls

3. CRD - each experimental unit is randomly assigned.
   RCBD - each replicate is grouped into a block and treatments are randomized within each replicate.

4.

CRD					RCBD				
A	B	C	A	D	C	A	D	B	E
D	C	D	B	E	A	E	B	C	D
E	A	E	B	C	C	B	E	A	D

5. To keep the variability among experimental units within a block as small as possible and to maximize differences among blocks. This design contributes to increased precision by detecting treatment differences.

6. Between

7. Sampling error is due to a failure of sample observations to be the same within experimental units.

8. SS Sampling Error = SS total - SS among Expt. Unit Total.

9. Experimental error is due to the failure of treatment observations to have the same relative rank in all replicates.

10. $Y_{ij} = \mu + \tau_i + \beta_j + \varepsilon_{ij}$
    μ estimated by $\bar{Y}_{..}$
    τ_i estimated by $\bar{Y}_{i.} - \bar{Y}_{..}$
    β_j estimated by $\bar{Y}_{.j} - \bar{Y}_{..}$
    ε_{ij} estimated by $Y_{ij} - \bar{Y}_{i.} + \bar{Y}_{.j} - \bar{Y}_{..}$

11. That you were successful and correct in not choosing the CRD as the design to use.

12. That some treatments are significantly different at alpha =0.05. To see which treatments are significantly different from each other we could use the LSD or DMRT.

13. a) i. Values are estimated for all values by one using the formula:

$$\frac{\bar{Y}i. + \bar{Y}.j}{2}$$

ii. The missing plot equation then is used to estimate the final plot.

iii. Using the number calculated in part ii, estimate the other missing value using the formula presented above.

iv. Keep doing part ii and iii until the estimated values stay the same.

b) 13

14. r = number of reps
B = block total containing missing plot
t = number of treatments
T = treatment total containing missing plot
G = Grand total

15.

SOV	df
Reps	3
TRT	9
Chk(Rep)	8
Error	27
Total	47
Pooled Error	35

16.

SOV	df
reps	3
trt	4
ck2(rep)	4
ck5(rep)	8
error	12
pooled error	24

Randomization example

Rep 1	T1	T4	T2	T5	T2	T5	T3	T5
Rep 2	T2	T2	T4	T1	T5	T3	T5	T5

17. Treatments to be assigned at random to experimental units in each replicate. Each replicate randomized separately. To randomize, use the random number table and assign coded treatments to eight experimental units per replicate.

18. a) 756.5
    b) 4,8,3
    c) 19

19. a) 6033.61
    b) 6027.44
    c) 9.50
    d) 3
    e) 2.15

20. Mean square error = 19
    Estimate of sigma square epsilon = 3

21. Sigma square + s sigma square epsilon

22. $$\frac{Y_{1.}^2}{12} + \frac{Y_{2.}^2}{4} + \ldots + \frac{Y_{6.}^2}{4} - \frac{Y_{..}^2}{32}$$

    b) $lsd = s_{\bar{D}} \times t$

    where $s_{\bar{D}} = \text{Error MS}[(12 + 4)/(12 \times 4)]$

    df =15

23. Trt df = 7
    Error df = 19

24. T1(reps) = 8 trt x sq = 8
    Exp. Error = 33 Exp. Error = 36

25. 5 x 5 to 8 x 8

26. a) Small df in error term
    b) Cost

27. 3 x 3

28. Small df in error term

29. Cost

30. trt = 5
    Error = 18

31. 1) A B C D 2) A B C D 3) A B C D
       B C D A   B A D C   B D A C
       C D A B   C D A B   C A D B
       D A B C   D C B A   D C B A

32.

SOV	df
Square	2
Row(square)	9
Column(square)	9
Treatment	3
Trt x Square	6
Error	18
Total	47

33.

	T1	T2	T3	T4	
Sq1	10	20	30	40	100
Sq2	20	30	40	50	140
	30	50	70	90	240

$$\text{Trt SS} = \frac{(30^2 + \ldots + 90^2)}{8} - \frac{240^2}{32}$$

$$\text{Sq x Trt SS} = \frac{(10^2 + \ldots + 50^2)}{4} - \text{CF}$$

34. 12

35. 30

36. i) Draw standard square
    ii) Randomize all columns
    iii) Randomize all but first row

37. a) SS A = 430.5625
    b) SS B = 264.0625
    c) SS A x B = 5.0625

38. A 3 to the fourth power factorial has four factors each having 3 levels. A 3 x 4 factorial has factor A with 3 levels and factor B with 4 levels.

39. 8 x 8

40. Variance of a treatment mean for A = AB MS/(5x4)
    Variance of a treatment mean for B = Error MS/(5x3)

Variance of a treatment mean for AxB =
Error MS/(5)

41. a) B= sigma square + ra sigma square BC + RAC sigma square B

b) Use estimated mean square for BC. BC = sigma square + ra sigma square BC.

42.

SOV	df
Variety	5
Rate	2
Var x Rate	10
Error	54
Total	71

43. a) 87
b) sqrt[(2 x Error MS)/(4x5x3)]

44. C MS = sigma square + ra sigma square BC + rab k square C

45. BC MS

46. B MS = Sigma square + rc sigma square AB + rac k square B

47. B MS = sigma square + rc sigma square AB + rac sigma square B

48. AD MS = sigma square + rb sigma square ACD + rbc sigma square AD

denominator would be the ACD EMS

49. Main effect A = 6.5
Interaction = 1.5

50. Simple effect of A at b1 = 15
Simple effect of A at b2 = 30
Main effect of A = 22.5
Simple effect of B at a1 = 10
Simple effect of B at a2 = 25
Main effect of B = 17.5
Interaction = 7.5