Shivaji University , Kolhapur
Question Bank For Mar 2022 (Summer) Examination

Subject Code : 79700 Subject Name: Statistics Paper XI(Design of Experiments)

Q 1) Choose the most correct alternative:

1. A completely randomized design is also known as______

(a) unsystematic design (b) non-restrictional design

(c) single block design (d) all the above

2. A missing value in an experiment is estimated by the method of_____-

(a) minimizing the error mean square (b) analysis of covariance

(c) both (a) and (b) (d) neither (a) and (b)

3. In a randomized block design with 4 blocks and 5 treatments having one missing value, the error degrees of freedom will be_____

(a) 12 (b) 11 (c) 10 (d) 9

4. A Latin square design controls_____

(a) two way variation (b) three way variation

(c) multiway variation (d) no variation

5. Which of the following is a contrast?

(a) $3T_1+T_2-3T_3+T_4$ (b) $T_1+3T_2-3T_3+T_4$

(c) $-3T_1-T_2+T_3+3T_4$ (d) $T_1+T_2+T_3-T_4$

6. Missing observation in a completely randomized block design is to be______

(a) estimated (b) deleted

(c) gussed (d) none of the above

7. A randomized block design has_____

(a) one way classification (b)two way classification

(c) three way classification (d) no classification

8. Error sum of squares in RBD as compared to CRD using the same material is_____

(a) more (b) less (c) equal (d) not comparable

9. In Latin square design, number of rows, columns and treatments are_____

(a) all different (b) always equal

(c) not necessarily equal (d) none of the above

10. While analyzing the data of a k*k Latin square, the error d.f. in analysis of variance is equal to_____

(a) (k-1) (k-2) (b) k (k-1) (k-2)

(c) k^2-2 (d) k^2-k-2

11. The method of confounding is a device to reduce the size of ______

(a) experiments (b) replications (c) blocks (d) all the above

12. The precision of whole-plot treatment can be increased by assigning the treatments to whole plots_____

(a) randomly (b) in randomized block arrangement

(c) in a Latin square arrangement (d) all the above

13. The concept of fractional factorial design was first expounded by______

(a) F. Yates (b) D.J. Finney (c) C.R. Rao (d) G.E.P. Box

14. Local control helps to ______

(a) reduce the number of treatments (b) increase the number of plots

(c) reduce the error variance (d) increase the error d.f.

15. The additional effect gained due to combined effect of two or more factors is known as______

(a) main effect (b) interaction effect

(c) either of (a) or (b) (d) neither of (a) or (b)

16. If different effects are confounded in different blocks, it is said to be_____

(a) complete confounding (b) partial confounding

(c) balanced confounding (d) none of the above

17. The effect, which is confounded in all the blocks in an experimental design_____

(a) is estimated more precisely (b) is estimated less precisely

(c) cannot be estimated (d) none of the above

18. If the interactions AB and BC are confounded with incomplete blocks in a 2^n factorial experiment, then automatically confounded effect is_____

(a) ABC (b) AC (c) A (d) C

19. The analysis of variance of an experimental data is based on the assumptions that______

(a) the response variable is distributed normally

(b) the errors are independent

(c) the errors are homoscedastic

(d) all the above

20. In one way classification, with more than two treatments, the equality of treatment means is tested by_____

(a) t-test (b) chi-square test

(c) F- test (d) none of the above

21. The total sum of squares due to all orthogonal contrasts in 2^n factorial experiment is equal to_____

(a) replication S.S. (b) treatment S.S.

(c) total S.S. (d) error S.S.

22. The effect which is utilized to divide a replicate into a fraction is called_____

(a) defining contrast (b) alias

(c) confounded effect (d) all the above

23. In a CRD with t treatments and n experimental units, error d .f. is equal to_____

(a) n-t (b) n-t-1 (c) n-t+1 (d) t-n

24. Randomized block design is a_______

(a) three restrictional design (b) two restrictional design

(c) one restrictional design (d) no restrictional design

25. Randomization is a process in which the treatments are allocated to the experimental units_____

(a) in a sequence (b) with equal probability

(c) both (a) and (b) (d) none of the above

26. When there occurs a missing value in an experiment, treatment sum of square has______

(a) an upward bias (b) a downward bias

(c) no bias (d) none of the above

27. Two types of effects measured in a factorial experiment are_____

(a) main and interaction effects (b) simple and complex effects

(c) both (a) and (b) (d) neither (a) nor (b)

28. The contrast representing the quadratic effect among four treatments is_____

(a) $3T_1+T_2-3T_3+T_4$ (b) $-T_1+3T_2-3T_3+T_4$

(c) $-3T_1-T_2+T_3+3T_4$ (d) $T_1-T_2-T_3+T_4$

29. CRD are most suitable in the situations when_____

(a) all experimental units are homogeneous

(b) the units are likely to be destroyed during experimentation

(c) some units are likely to fail to response

(d) all the above

30. In the analysis of data of a RBD with b blocks and v treatments, the error degrees of freedom are_____

(a) b(v-1) (b) v(b-1) (c) (b-1) (v-1) d) none of the above

31. Each contrast among k treatment has ---

(a) one (b) k (c) k-1 (d) none of these

32. Efficiency of experimental design D_1, over design D_2 is denoted by E. If $E > 1$

Then design D_1 is ---- efficient than design D_2 .

(a) less (b) more (c) equally (d) none of these

33) The allocation of treatments to the experimental units giving equal probability to each unit is known as……

(a) Replication (b) Randomization (c) Local control d) None of these

34) Local control is technique used to……

(a) To reduce experimental error (b) increase efficiency of design

(c) Create homogeneity within a blocks d) All the above

35) If the overall F-test shows significant treatment effect then to identify out which pair(s) of treatments differ significantly ….. is used.

(a) t test (b) z test (c) Critical difference d) paired-t test

36) In Latin square design with v treatments, which of the following statement is true?

(a) Only treatment and row s. s. have (v-1) d. f.

(b) the error sum of square has (v-1) (v-2) d. f.

(c) The number of experimental units is v^3

d) The d. f. corresponding to sum of squares of various effects are not different.

36) If the true means of the k populations are equal, then MSTR/MSE should be:

(a) more than 1.00

(b) close to 1.00

(c) close to 0.00

(d) close to -1.00

37)When there occurs a missing value in an experiment calculation of exact treatment sum of square is to be carried out when …………

(a) Treatment effects are not significantly different

(b) Block effects are significantly different

(c) Treatment effects are significantly different

d) none of these

38) In Factorial experiments when the level of one factor produces a distinct response with changing level of another factor, the phenomenon is known as----------

(a) main effect (b) interaction effect

(c) Replication effect d) joint effect

39) In 2^3 factorial experiment in usual notation, the interaction ACis given by ……….

(a) (a+1) (b-1) (c-1) /4 (b) (a-1) (b-1) (c-1)/4

(c) (a-1) (b+1) (c-1)/4 d) (a-1) (b-1) (c+1)/4

40) In which of the following design all three principles of design of experiments are not used?

(a) CRD (b) RBD (c) LSD (d) both b and c

41)To reduce the experimental error which of the following principles are used?

(a) Replication and local control

(b) Replication and Randomization

(c) Randomization and local control

(d)Replication, Randomization and local control

42) If the interaction effect ABC is confounded completely in 2^3 experiments then d.f. for error is……

(a) 6(r-1)

(b) 7(r-1)

(c)8(r-1)

(d) (7r-1)

44) Analysis of variance is a statistical method of comparing the ________ of several populations.

(a) standard deviations

(b) variances

(c) means

(d) proportions

45) If the response for the treatment in a factorial experiment with factors A and B each at two levels from two replications are a_0b_0=16, a_0b_1 =25, a_1b_0 = 15,

a_1b_1 = 28, The sum of squares for interaction AB is………..

(a) 4 (b) 0.5 (c) 1 (d) 2

46) The Standard error of the difference between two treatment means in RBD with t treatments and r replications and mean error sum of square S^2_E will be ………..

(a) $\sqrt{\frac{2S^2{}_E}{t}}$ (b) $\sqrt{\frac{\boldsymbol{2S^2{}_E}}{\boldsymbol{r}}}$ (c)$S^2{}_E \sqrt{\frac{2}{r}}$ (d) $S^2{}_E \sqrt{\frac{2}{t}}$

47) In 2^3 factorials experiment the arrangement of a replicate with two blocks each of 4 plots is as shown below. Which interaction effect is confounded in the given replicate?

Block 1:	a	b	ac	bc
Block 2:	abc	1	c	ab

(a) AB is confounded (b) AC is confounded

(c) BC is confounded (d) ABC is confounded

48)Two linear combinations $\Sigma C_i t_i$ and $\Sigma d_i t_i$ of treatment means are called as orthogonal contrasts if...........

(a) $\Sigma C_i=0$ and $\Sigma d_i=0$ (b) $\Sigma d_i=0$
(c) $\Sigma C_i=0$ (d) $\Sigma C_i=0$, $\Sigma d_i=0$ and $\Sigma C_i d_i=0$

Q 2) Attempt any two of the following:

1) What are the three basic principles of design of experiments? Explain each in brief.

2) Give the concept and definition of efficiency of a design. Derive the expression for efficiency of RBD over CRD.

3) What is confounding in factorial experiment? Explain partial confounding in 2^3 factorial experiment with ANOVA table and test statistic.

4) What is LSD? Give mathematical model, split the total sum of squares, hypothesis to be tested and ANOVA table.

5) What is confounding in factorial experiment? Explain total confounding in 2^3 factorial experiment with ANOVA table and test statistic.

6) Give the concept and definition of efficiency of a design. Derive the expression for efficiency of LSD over CRD.

7) Give the concept and definition of efficiency of a design. Derive the expression for efficiency of LSD over RBD when rows are taken as blocks.

8) Give the concept and definition of efficiency of a design. Derive the expression for efficiency of LSD over RBD when columns are taken as blocks.

9) What is CRD? Give mathematical model, split the total sum of squares, hypothesis to be tested and ANOVA table.

10) What is RBD? Give mathematical model, split the total sum of squares, hypothesis to be tested and ANOVA table.

11) Derive the formula for estimating one missing observation in case of LSD.

12) Derive the formula for estimating one missing observation in case of RBD.

13) what are any of the three basic principles of the design of the experiment? Explain each in brief

14) Give the concept and definition of the efficiency of a design. Derive the expression for efficiency of RBD over CRD .

15) What is CRD? Give mathematical model, split the total sum of squares, hypothesis to be tested ad ANOVA table

16) What is RBD? Give mathematical model, split the total sum of squares hypothesis to be tested, and ANOVA table

17)What is LS ? Give mathematical model, split the total sum of squares, hypothesis to be tested, and ANOVA table

18)Give the concept and definition of the efficiency of a design. Derive the expression for efficiency of LSD over CRD.

19) Give the concept and definition of the efficiency of a design. Derive the expression for efficiency of LSD over RBD when columns are taken as blocks.

20) Give the concept and definition of the efficiency of a design. Derive the expression for efficiency of LSD over RBD when rows are taken as blocks.

21) Derive the formula for estimating one missing observation in case of RBD .

22) Derive the formula for estimating one missing observation in case of LSD .

23) What is factorial experiment ? Give mathematical model , hypothesis to be tested , main & interaction effect and ANOVA table .for 2^2 factorial experiment.

24) what is factorial experiment Give mathematical model . hypothesis to be tested , Yates table , & ANOVA table for 23 factorial experiment .

25) what is confounding in factorial experiment & Explain total confounding in 23 factorial experiment with ANOVA table and test statistic

26) What is confounding in factorial experiment? Explain partial in 23 factorial experiment with ANOVA table and test statistic.

27) Derive the main and interaction effects for 23 factorial design .

Q 3) Attempt any four of the following:

1) Give the test for equality of two specified treatment effects in CRD.

2) Give the test for equality of two specified treatment effects in RBD.

3) Give the test for equality of two specified treatment effects in LSD.

4) Explain in brief replication, the one of the basic principles of design.

5) Explain in brief randomization, the one of the basic principles of design.

6) Explain in brief local control, the one of the basic principles of design.

7) Explain main effects and interaction effects in factorial experiments.

8) What is confounding? Explain total confounding in brief.

9) What is confounding? Explain partial confounding in brief.

10) State the advantages and disadvantages of confounding

11) Explain: i) Treatment ii) Experimental error

12) Explain: i) Block ii) Experimental unit 13) Explain: i) Absolute experiments ii) Comparative experiments

14) Write a short note on choice of size and shape of plots.

15) Write a short note on precision of the experiment

16) State the advantages and disadvantages of CRD.

17) State the advantages and disadvantages of RBD.

18) State the advantages and disadvantages of LSD.

19) Write a note on Yates table for computing the effect totals.

20) Give the mathematical model and assumptions for the 2^3 factorial experiment.

21) Give the test for equality of two specified treatment effects in CRD.

22) Give the test for equality of two specified treatment effects in RBD.

23) Give the test for equality of two specified treatment effects in LSD of design

24) Explain in brief replication, one of the basic principles of design.

25) Explain in brief randomization, one of the basic principles of design.

26) Explain in brief Local control, the of the basic principles of design

27) What is CRD? Give a Mathematical model for CRD & estimate the parameters for the same.

28) What is RBD? Give mathematical model for RBD and estimate parameters using least square estimation for the same

29) Explain the main and interaction effects in the factorial experiment

30) what is confounding? Explain total confounding in brief

31) what is confounding? Explain partial confounding in brief.

32) Give the difference between total confounding & partial Confounding.

33) State the advantages & disadvantages of total & partial Confounding

34) Explain: Treatment and Explain Experimental error.

35) Explain: Block, Experimental unit , and yield

36) Explain : Experimental material and uniformity trial

37) Explain: Absolute experiments and comparative experiments

38) write a short note on the precision of the experiment

39) write a short note on the experiment choice of size & shape of plots.

40) state the advantages & disadvantages of CRD .

41) state the advantages & disadvantages of RBD

42) State the advantages & disadvantages of LSD

43) Explain the factorial experiment with an example and give an expression of the main & interaction effect for 22 factorial experiment

44) What is contrast & orthogonal contrast? And for 22 factorial experiment give treatment effect and factorial effects.

45) Explain the non - parametric method in the analysis of variance and the Kruskal Wallis test.

46) Explain in brief square root transformation for counts and sin-1(.) transformation for proportions

47) What is residual & explain in brief and give the expression for residual of RBD .

48) Explain any two methods of checking normality.

49) state the applications of CRD, RBD and LSD.

50) Write a short note on Cochran's theorem.

51) Give the situation of missing observation & also give an idea for two missing observations in RBD .