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Question Paper Code: 55P22

Ph.D COURSE WORK EXAMINATION, MAY 2018

Elective

CAD / CAM

15PCD522 - DESIGN AND ANALYSIS OF EXPERIMENTS

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 20 = 100 Marks)

1. (a) Prove a necessary and sufficient condition of estimability. If $e_0 \beta$ and $m_0 \beta$ are estimable, find $V(e_0 \hat{\beta})$ and covariance $C(e_0 \hat{\beta}, m_0 \hat{\beta})$, where $\hat{\beta}$ is the least square estimate of β . CO1-Ana (20)

Or

- (b) Two kinds of trees, A and B, were planted on 20 pieces of land (plots). A-trees were planted on ten of the plots (randomly selected among the twenty) and B-trees were planted on the remaining ten plots. Six years after being planted the average height of the trees was measured for each plot, and the results were as follows: CO1-Ana (20)

A trees 3.2 2.7 3.0 2.7 1.7 3.3 2.7 2.6 2.9 3.3

B trees 2.8 2.7 2.0 3.0 2.1 4.0 1.5 2.2 2.7 2.5

Find a 95% confidence interval for the divergence in mean height, and state your assumptions made for doing this.

2. (a) Chemical yield may be influenced by the temperature, pressure, and/OR time in the reactor vessel. Each of these factors may be set at a high or a low level. Thus we have a 2^3 experiment. Unfortunately, the process feedstock is highly variable, so batch to batch differences in feedstock are expected; we must start with new feedstock every day. Furthermore, each batch of feedstock is only big enough for seven runs (experimental units). We have enough money for eight batches of feedstock. We decide to use a BIBD, with each of the eight factor-level combinations missing from one of the blocks. Give a skeleton ANOVA (source and degrees of freedom only), and describe an appropriate randomization scheme. CO2- App (20)

Or

- (b) Park managers need to know how resistant different vegetative types are to trampling so that the number of visitors can be controlled in sensitive areas. The experiment deals with alpine meadows in the White Mountains of New Hampshire. Twenty lanes were established, each .5 m wide and 1.5 m long. These twenty lanes were randomly assigned to five treatments: 0, 25, 75, 200, or 500 walking passes. Each pass consists of a 70-kg individual wearing lug soled boots walking in a natural gait down the lane. The response measured is the average height of the vegetation along the lane one year after trampling. Data based on Table 16 of Cole. CO2- U (20)

3. (a) In the case of two associate class PBIBD, define the parameters and develop the intra-block analysis using a suitable model. CO3-U (20)

Or

- (b) Explain Yates procedure for obtaining the various effect total in a 23 factorial experiment. CO3-U (20)

4. (a) Consider the data in problem 14 a. Suppose AC is confounded in replicate and ABC confounded in replicate R2 . Analyze the data and draw conclusions. CO4-Ana (10)

Or

- (b) An engineer is interested in the effects of cutting speed (A), tool geometry (B), and cutting angle (C) on the life (in hours) of a machine tool. Two levels of each factor is chosen, and two replicates of a 2 3 factorial design is run. The results are given below CO4-Ana (20)

Treatment:	(1)	a	b	ab	c	ac	bc	abc
Response								
R ₁	21	33	24	37	35	27	40	31
R ₂	17	29	40	36	28	26	44	37

5. (a) Develop the analysis of covariance for randomized block design with one concomitant variable, stating clearly the assumptions. CO5-App (20)

Or

- (b) Construct a 25 design in blocks of 8 plots confounding ABC, ADE and BCDE. Give the analysis of such a design with r replications. CO5-App (20)