

(4)

>eiceyeæ ðeell eÜeUeve keâr elleDe mecePeeFS Deej Gve heej eñLeel eJel  
keâe GuueKe keâeepes epevecellñen GhelÜgeâ nelter nw N heej ceeCe keâe  
meceo mes n heej ceeCe keâe Skeâ >eiceyeæ ðeelleoMe&Ügee peele nw  
Üeb N=nK epevecellñ Skeâ heCekâ ny leeseoKeeFS ekâ ðeelleoMe  
ceeoÙe ceeoÙe meceo ceeoÙe keâe Deveel evel Deekâuekeâ nelte nw  
Fme Deekâuekeâ keâe ñemej Ce Yer eñkeâeefes~

Unit-III / FkeâF-III

6. Describe the layout and analysis of a completely randomised design (CRD). Also discuss the merits and demerits of the design.

mecheCe & KeC [keâ Deel ekeâuheve keâr meij Üevee SJeb ñeMuseCe keâe  
JeCelle keâeepes meeLe ner Fme Deel ekeâuh keâ ueyYe-nee eñeUelW keâe  
eñeUelW keâe keâeepes~

7. Present the complete analysis of a randomised block design. Give its advantages over completely randomised design.

Skeâ ÜeeÂÜ ñeale KeC [keâ Deel ekeâuheve keâe heCe ñeMuseCe keâeepes~  
heCeÜeeÂÜ ñeale Deel ekeâuheve mes Skeâ Deel ekeâuheve keâ ueyYe oepes~

Unit-IV / FkeâF-IV

8. Define factorial experiments. Give the analysis of  $2^3$  factorial experiment.

Ieškeâetle ñeUeieeW keâes heej Yeekele keâeepes~ Skeâ  $2^3$ -Ieškeâetle  
ñeUeiee keâe ñeMuseCe keâeepes~

9. Describe a Latin Square Design. How do you estimate one missing value in a Latin Square Design? Give its analysis.

ueñSve Jeie Deel ekeâuheve keâe JeCelle keâeepes~ Skeâ ueñSve Jeie  
Deel ekeâuheve ceW Skeâ uegle ñeCe keâe Deekâueve Ieotgej ñeFmekeâe  
ñeMuseCe keâmes keâj Ies nP

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B.A. (Part-II) Examination, 2015

(Regular & Exempted)

STATISTICS

Second Paper

(Sampling Theory & Design of Experiments)

Time Allowed : Three Hours ] [ Maximum Marks : 33

Note : Answer five questions in all. Question No.1 is compulsory. Attempt one question from each unit.

keâgue heej ñeMuseCe Goej oepes~ ñeMve meb1 Deefjeel eñeUelW  
ñeUelW keâe FkeâF & me Skeâ ñeMve keâeepes~

1. (a) Discuss the advantages of sampling over complete enumeration.  
heCe & ieCeve keâer Iegevee ceñleUeUeve keâ ueyYeñkeâer JUeeKUee  
keâeepes~
- (b) Discuss sampling and non-sampling errors.  
ñeUeUeve SJeb iej - ñeUeUeve SgnñUeUekeâe JeCelle keâeepes~
- (c) Write reasons of stratification  
mleef Iekeâj Ce keâ keâj CeeWkeâes eñeKeS~
- (d) What do you mean by sampling unit and sampling frame?

(2)

- Ques 1. Explain double sampling .  
Ans : Double sampling is a method of sampling where a sample is drawn from a population, and then a second sample is drawn from the same population based on certain criteria. This is done to obtain more precise estimates of population parameters.  
Ques 2. What is the purpose of local control?  
Ans : Local control is a technique used in experimental design to reduce the effect of extraneous variables on the outcome of the experiment. It involves controlling the environment or conditions around the experimental units to ensure that they are similar across all treatment groups.  
Ques 3. Write the model for two-way classification.  
Ans : The two-way classification model is a statistical model used to analyze data that has been categorized into two factors. The model is represented by the equation:  
$$Y_{ij} = \mu + \alpha_i + \beta_j + \epsilon_{ij}$$
where  $\mu$  is the overall mean,  $\alpha_i$  is the effect of factor A at level i,  $\beta_j$  is the effect of factor B at level j, and  $\epsilon_{ij}$  is the error term.  
Ques 4. Define experimental error. How can it be reduced?  
Ans : Experimental error is the difference between the observed value and the true value of a measured quantity. It can be reduced by using better instruments, improving experimental techniques, and controlling extraneous variables.  
Ques 5. Which of the basic principles are satisfied in R.B.D.?  
Ans : The basic principles satisfied in R.B.D. are:
  - a) Randomization: The treatments are assigned to experimental units randomly.
  - b) Replication: Each treatment is replicated several times to estimate its effect.
  - c) Local Control: The treatments are compared within their own environments.
  - d) Factorial Arrangement: All possible combinations of treatments are included in the experiment.  
Ques 6. Distinguish between precision and efficiency.  
Ans : Precision refers to the consistency of the results obtained from different samples drawn from the same population. Efficiency refers to the ability of a sampling method to provide accurate estimates of population parameters with a minimum amount of sampling effort.

Unit-I / Fk&F-I

- Ques 7. Distinguish between simple random sampling with and without replacement. Obtain an unbiased estimator for population mean and find the sampling variance in both the cases.  
Ans : Simple random sampling with replacement (SRSWOR) is a sampling method where each unit in the population has an equal chance of being selected, and the selection of one unit does not affect the probability of selecting another unit. The sampling variance for SRSWOR is given by:  
$$\text{Var}(\bar{Y}) = \frac{\sigma^2}{n}$$
where  $\sigma^2$  is the population variance and  $n$  is the sample size.  
Simple random sampling without replacement (SRSWR) is a sampling method where each unit in the population has an equal chance of being selected, but once a unit is selected, it is not available for selection again. The sampling variance for SRSWR is given by:  
$$\text{Var}(\bar{Y}) = \frac{\sigma^2}{n} \left( \frac{n}{N-n} \right)$$
where  $N$  is the population size.

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- Ques 8. Discuss the conditions under which stratified sampling is more suitable than simple random sampling. Obtain the variances under proportional, optimum and random allocations.

Ans : Stratified sampling is more suitable than simple random sampling when the population is heterogeneous and can be divided into distinct subgroups or strata. Stratified sampling involves dividing the population into strata and then drawing a sample from each stratum. The variances under proportional, optimum and random allocations are given by:  
$$\text{Var}_{\text{Proportional}} = \frac{\sigma^2}{n} \left( \frac{N_1}{N} \right)^2 + \frac{\sigma^2}{N} \left( \frac{N_1}{n} \right)^2$$
  
$$\text{Var}_{\text{Optimum}} = \frac{\sigma^2}{n} \left( \frac{N_1}{N} \right)^2 + \frac{\sigma^2}{N} \left( \frac{N_1}{n} \right)^2 + \frac{\sigma^2}{N} \left( \frac{N_1}{n} \right) \left( \frac{N_1}{N} - \frac{N_1}{n} \right)$$
  
$$\text{Var}_{\text{Random}} = \frac{\sigma^2}{n} \left( \frac{N_1}{N} \right)^2 + \frac{\sigma^2}{N} \left( \frac{N_1}{n} \right)^2 + \frac{\sigma^2}{N} \left( \frac{N_1}{n} \right) \left( \frac{N_1}{N} - \frac{N_1}{n} \right)$$

Unit-II / Fk&F-II

- Ques 9. Explain the method of cluster sampling and its usefulness. When the clusters are of equal size, find an unbiased estimate of the population mean. Compare this estimate with the one obtained from an equivalent simple random sample.

Ans : Cluster sampling is a sampling method where the population is divided into clusters or groups, and a sample is drawn from each cluster. The usefulness of cluster sampling lies in its cost-effectiveness and ease of implementation. When the clusters are of equal size, the unbiased estimate of the population mean is given by:  
$$\hat{\mu}_c = \frac{1}{C} \sum_{i=1}^C \bar{Y}_i$$
where  $C$  is the number of clusters and  $\bar{Y}_i$  is the mean of the  $i$ -th cluster. This estimate is compared with the one obtained from an equivalent simple random sample.

- Ques 10. Explain the procedure of systematic sampling and explain the situations where it is appropriate. A systematic sample of size  $n$  is drawn from a population of size  $N$ . If  $N=nK$ , where  $K$  is an integer, show that sample mean is an unbiased estimator of population mean. Also find out its variance.

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P.T.O.