

This question paper contains 4+1 printed pages]

HPAS (Main)—2013

STATISTICS

Paper II

Time : 3 Hours

Maximum Marks : 150

Note :— Attempt Question Number 1 which is compulsory and any four questions from the rest, five in all. All questions carry equal marks. Symbols have their usual meanings.

1. (a) Explain the following with examples :
- (i) Hypotheses
 - (ii) Test
 - (iii) Critical Region
 - (iv) Errors in testing of Hypotheses.

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(b) Give tests for the following hypotheses :

(i) $\rho = 0$

(ii) $\rho = .4$

(iii) $\rho_1 = \rho_2 = \rho_3$

(iv) $\mu = \mu_0$ in $N(\mu, \sigma^2)$, σ^2 known.

(c) Explain why random numbers 00, 97, 98, 99 are omitted for selecting a sample random sample of size 6 from the population of size 16.

2. (a) Describe a method of finding out the most powerful test for testing a simple null hypothesis against a simple alternative hypothesis involving one parameter.

(b) For testing $H_0 : \mu = 10$ against $H_1 : \mu = 15$ in $N(\mu, \sigma^2)$, σ^2 known, critical region is taken as $\bar{x} > 10$ where \bar{x} is the sample mean. Calculate level of significance.

3. (a) Describe various tests based on t distribution.
- (b) For a most powerful test, prove that :

$$(1 - \beta) \geq \alpha$$

where α and β are the probabilities of making first and second kind of errors respectively.

4. (a) Discuss the need of non-parametric tests. When should the non-parametric tests preferably be used ? Discuss their advantages and disadvantages.
- (b) Describe test of randomness of a given sample.

5. Writing down the assumptions usually made in the general linear model :

$$\underset{n \times 1}{\underline{Y}} = \underset{n \times p}{\underline{X}} \underset{p \times 1}{\underline{\beta}} + \underset{n \times 1}{\underline{u}}$$

find out the least square estimator of β and discuss its properties. Also present a brief account of tests of hypothesis concerning β in this model under normality assumptions.

6. (a) Stating conditions show that ratio estimator is the best linear unbiased estimator under these conditions.
- (b) Distinguish between two stage and double sampling.
7. (a) Prove that sampling variance of the proportion of males in a simple random sample of n people drawn from a population of N units is :

$$\frac{N - n}{Nn} \frac{PQ}{n}$$

where $Q = 1 - P$ and P is the population proportion of males.

- (b) Distinguish between sampling and non-sampling errors.
8. (a) Explain analysis of 2^3 factorial experiment conducted in randomised blocks.
- (b) Write down the model for Latin Square Design (LSD). If degrees of freedom (d.f.) for error sum of squares in a LSD is 6, give the order of this design.