2020

STATISTICS — GENERAL

Paper : GE/CC-3

Full Marks : 50

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer ***any ten*** questions : 1×10

(a) Distinguish between a parameter and a statistic.

(b) What do you mean by a treatment in designs of experiments?

(c) In ANOVA, write down the assumption on the errors.

(d) What do you mean by sampling distribution of a statistic?

(e) If P (Type I error) = 0·2 and P (Type II error) = 0·75, find the power of the test.

(f) Distinguish between an estimator and an estimate of a parameter.

(g) What is critical difference in case of a completely randomized design (CRD)?

(h) What is the degrees of freedom for error in case of two way analysis of variance with one observation per cell?

(i) Write down an advantage of using an RBD over CRD.

(j) When is an estimator called BLUE?

(k) What do you mean by level of significance?

(l) Write down the $100(1-\alpha)\%$ confidence interval for the mean of a normal population with known variance on the basis of a random sample of size n.

(m) What is the variance of a χ^2-distribution with 5 degree of freedom?

(n) Write down the distribution of $\dfrac{\sum_{i=1}^{n}\left(X_i-\overline{X}\right)^2}{\sigma^2}$, where $(X_1, X_2, ..., X_n)$ is a random sample from $N(\mu, \sigma^2)$ distribution.

(o) Write down the three basic principles involved in design of experiments.

2. Answer ***any four*** questions : 5×4

(a) Derive the $100(1-\alpha)\%$ confidence limits for σ with known μ when a random sample of size n is drawn from $N(\mu, \sigma^2)$ distribution.

(b) If X_1 and X_2 are independently distributed Binomial random variables with parameters (n_1, p) and (n_2, p) respectively, obtain the distribution of $X_1 + X_2$.

(c) Suppose X_1, X_2, X_3 and X_4 are independently and identically distributed standard normal variables. Write down the distribution of (i) $\sum_{i=1}^{4} X_i^2$ and (ii) $\sqrt{3}X_1 \Big/ \sqrt{\sum_{i=2}^{4} X_i^2}$

(d) If T_1, T_2, T_3 are independent unbiased estimators of θ and respective variances of them are in the ratio 1 : 2 : 1, which of the following estimators of θ would you prefer?

$$\frac{T_1+T_2}{2},\ \frac{T_1+T_2+T_3}{3},\ \frac{2T_1+T_2+T_3}{4}.$$

(e) Write down the layout of a CRD.

(f) Derive the distributions of the different sums of squares involved in a two-way classified data with equal observations in each cell.

3. Answer ***any two*** questions :

(a) Describe, in detail, the layout and analysis involved in an RBD. Write the ANOVA table describing the analysis. 3+5+2

(b) Derive a suitable test for testing $H_0 : P = P_0$ against $H_1 : P \neq P_0$ on the basis of a random sample of size n, where P is the population proportion of individuals with a certain characteristic. 10

(c) If $X \sim Bin(n, p)$, derive the maximum likelihood estimator of p. Also find an unbiased estimator of p^2. 5+5

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