2016

STATISTICS — GENERAL

Second Paper

Full Marks – 100

The figures in the margin indicate full marks

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

SET – I

Group – A

Answer ***Question No. 1*** and ***any three*** questions from the rest

1. Answer ***any four*** of the following questions : 2×4

(a) Define unbiasedness of an estimator.

(b) Consistency is a Large sample property— Explain.

(c) Define the pdf of a χ^2–variate with 11 degrees of freedom.

(d) Distinguish between 'statistic' and 'parameter'.

(e) What is confidence coefficient ?

(f) Define power function of a hypothesis testing procedure and hence specify the power of the test.

(g) Write down the test statistic with its sampling distribution for testing the equality of two variances based on samples drawn from two independent normal distributions.

(h) What is 'z-score' ? Mention its uses.

2. (a) Briefly explain the following in connection with hypothesis testing problem :

(i) size
(ii) p-value.

(b) suppose a random sample of n pairs of observations $(x_1, y_1), (x_2, y_2), \ldots, (x_n, y_n)$ is drawn from a bivariate normal population with means μ_x and μ_y, variances σ_x^2 and σ_y^2 and correlation coefficient ρ. Then perform the following tests :

(i) $H_0 : \mu_x = \mu_y$ against $H_1 : \mu_x \neq \mu_y$ and

(ii) $H_0 : \mu_x = \mu_y$ against $H_1 : \sigma_x \neq \sigma_y$. (2+2)+(5+5)

[Turn Over]

3. (a) If X and Y are two independent random variables where X follows Poisson (λ_1) and Y follows Poisson (λ_2). Then derive the distribution of $(X+Y)$.

(b) Mention the important properties of t and F distribution.

(c) If X_1, X_2, X_3 be a random sample from $N(0,\sigma^2)$ population, then write down the distribution of $(X_2^2+X_3^2)/\sigma^2$. State the sampling distributions of the statistics.

$$\frac{\sqrt{2}X_3}{\sqrt{X_1^2+X_2^2}} \text{ and } \frac{X_2^2}{X_3^2}.$$

4+(2+2)+(2+2+2)

4. (a) Define minimum variance unbiased estimator.

(b) Write down two important properties of maximum likelihood estimator (MLE). Find the MLE of σ^2 based on $X_1, X_2, \ldots, X_n$ drawn from $N(\mu,\sigma^2)$ for both the situations with known and unknown μ. Also check the unbiasedness for both the estimators.

2+(2+6+4)

5. (a) Find a confidence interval for population median with confidence coefficient $(1-\alpha)$ based on a sample of size n from a normal population with mean μ and variance σ^2 (unknown).

(b) Sketch the testing procedure for equality of two proportions based on large samples of size n_1 and n_2 drawn, respectively, from two populations.

(c) Describe the test for 'goodness of fit' and mention two other uses of Pearsonian Chi square test.

5+4+(3+2)

6. (a) Show that sample mean is consistent for population mean under appropriate assumption.

(b) Let T_1 and T_2 be statistics with $E(T_1)=\theta_1+\theta_2$ and $E(T_2)=\theta_1-\theta_2$. Find unbiased estimators of θ_1 and θ_2.

(c) Derive the test of significance for testing whether population correlation coefficient is zero or not based on a sample of size n from a bivariate normal population.

4+4+6

7. Write notes on ***any two*** of the following :

7×2

(a) Student's t-test

(b) Method of Moments estimation

(c) χ^2 -distribution.

Group – B

Answer ***Question No. 8*** and ***any three*** questions from the rest

8. Answer ***any four*** of the following questions : 2×4

(a) What do you mean by 'Standardized Death Rate' ?

(b) Write down the advantage of NRR over GRR.

(c) Mention one relative merit and demerit of mathematical curve-fitting method to find trend in a time series data.

(d) Define the additive model that is usually adopted to analyse time series data.

(e) What is 'purchasing power of money' ? Explain with example.

(f) Define 'Fisher Ideal Index' and show that it satisfies 'Time Reversal Test'.

(g) Write down the possible indications about lack of control in a production process.

(h) What is AOQL ? Explain in connection with single sampling plan.

9. (a) Define CBR and point out its defects. Discuss the uses of General Fertility Rate and Total Fertility Rate in this connection.

(b) Point out the uses of Life Table. Write down the difference between Complete and Abridged Life Table. (3+3+3)+(3+2)

10. (a) What is an Index Number ? Briefly discuss the various steps in the construction of Index Number.

(b) Define Weighted Aggregative Index and hence formulate the Laspeyres' Index and Edgeworth-Marshall's Index.

(c) Verify whether Laspeyres' and Paasche's price index numbers satisfy the 'Time Reversal Test'. (2+5)+4+3

11. (a) What do you mean by 'Statistical Quality Control' ? Distinguish between Process Control and Product Control.

(b) How do you examine whether the process is in control based on the range ? Discuss both the situations when underlying parameters are specified and not-specified.

(c) What is the role of OC function in a single sampling inspection plan ? (2+4)+6+2

12. (a) Briefly discuss about various components of a time series. Give an example of an appropriate time series data with which you would associate the trend component.

(b) What is "Moving Average Mehtod' ? Write down two merits and demerits of this method. (6+1)+(3+2+2)

13. (a) Distinguish the following :

(i) Item quality measure and subgroup quality measure

(ii) Seasonal and Cyclical Fluctuations.

(b) Show that GRR is more than NRR.

(c) Discuss about the errors in index numbers. (3×2)+3+5

14. Write notes on ***any two*** of the following : 7×2

(a) Factor Reversal Test

(b) Ratio to Moving Average method

(c) Control chart for number of defective items.