Crm-33 Date 19/11/2024 (Evening)

Exam.Code:0003
Sub. Code: 17245

2124

B.A./B.Sc. (General) Third Semester
Statistics
Paper – 201: Statistical Inference

Time allowed: 3 Hours **Max. Marks: 65**

NOTE: *Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit. Use of electronic calculator with four basic mathematical operations and upto one memory is allowed. Candidates may ask for statistical tables from the Superintendent of Examination Centre. Various symbols used have their usual meaning.*

x-x-x

1. Answer the following:-
   i) Define sampling distribution of a statistic.
   ii) Discuss about sample proportion.
   iii) Distinguish between parameter and statistic.
   iv) Explain Type-I and Type-II errors.
   v) State the applications of t- distribution.
   vi) Define p-value and its role in hypothesis testing
   vii) Distinguish between null and alternative hypothesis. (2,2,2,2,2,1,2)

Unit-I

2: a) Discuss the concept of unbiasedness and consistency. Show that sample mean is an unbiased and consistent estimator for population mean in case of normal distribution N~(μ, σ^2).

b). X_1, X, X_3, X_4 *and* X_5 is a random sample of size 5 from a population with unknown mean μ and variance σ^2. T_1, T_2 *and* T_3 are the estimators used to estimate mean value μ, where $T_1 = \frac{X_1 + X_2 + X_3 + X_4 + X_5}{5}$, $T_2 = \frac{X_1 + X_2}{2} + X_3$,

and $T_3 = \frac{1}{3}(2X_1 + X_2 + \lambda X_3)$.

(i) Are T_1 *and* T_2 are unbiased estimators?

(ii) Find the value of λ such that T_3 a unbiased estimator for μ.

(iii) Which is the best estimator? (8, 5)

P.T.O.

3: a) If $X_i \overset{IID}{\sim} N(\mu, \sigma^2)$ then show that *sample variance* $s^2 = \frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})^2$ is a consistent estimator of population variance σ^2.

b) Define the concept of sufficiency. Show that $\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$ is a sufficient statistic for θ in exponential distribution having pdf $f(x,\theta) = \frac{1}{\theta}e^{-\frac{x}{\theta}}$; $x \geq 0$ (6, 7)

4: a) Define Maximum likelihood estimator. Obtain the maximum likelihood estimator of parameter 'θ' in case of Bernoulli distribution.

b) Let $X_1, X_2, \ldots, X_k$ are independent Binomial variates with parameters (n_i, p), $i = 1,2,\ldots,k$ then derive the distribution of $Y = \sum_{i=1}^{k} X_i$. (7, 6)

5: (a) Define Chi-square variate (χ^2) and find the relationship between chi-square and t-distribution.

(b) Define F-distribution. Derive its probability density function. (6, 7)

Unit-II

6: (a) Find the sampling distribution of the difference of two sample means for two normal populations, where population variances are equal and unknown and also find the confidence interval for difference of population means.

(b) A random sample of 18 pairs of observations from a normal population gave a correlation coefficient of 0.6. Is this significant of correlation in the population at 5% level of significance? (9, 4)

7: Write short notes on the following:

a) Fisher's Z-transformation.
b) Chi-square test of goodness of fit.
c) Yate's Correction.
d) One-Tailed tests. (4, 4, 4, 1)

8: a) In a random sample of 900 men from a particular district of Haryana, 180 are found to be drinkers. In one of 1600 men from a district of Punjab, 240 are drinkers. Do the data indicate that the two districts are significantly different with respect to the prevalence of drinking among men? Also calculate confidence interval at 5% level of significance.

b) Discuss a large sample test for testing the hypothetical value of population correlation coefficient. (7, 6)

9: (a) Test the significance for single mean when (i) the population standard deviation (σ) is unknown and (ii) the population standard deviation (σ) is known.

b) The result of a certain survey of 50 ordinary shops of small size is given below:

Area	Shops in		Total
	Town	Village	
Run by Men	17	18	35
Run by Women	3	12	15
Total	20	30	50

Can it be said that shops run by women are relatively more in villages than in towns. Use χ^2–test. (Given $\alpha = 5\%$). (7, 6)

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