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S. No. of Question Paper : 23

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Name of the Paper : Statistical Methods—II (STP-303)

Name of the Course : B.Sc. (Math. Sciences) Statistics

Semester : III

Duration : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any six questions.

1. (a) If X has a chi-square distribution with n degrees of freedom, then find its m.g.f. Hence find mean and variance of the distribution.
- (b) Prove that, for large degrees of freedom, t -distribution tends to normal distribution. 6½,6
2. (a) Discuss the χ^2 test for goodness of fit of a theoretical distribution to an observed frequency distribution.
- (b) Show that the mode of the F-distribution with $n_1(\geq 2)$, n_2 d.f. is given by :

$$\frac{n_2(n_1 - 2)}{n_1(n_2 + 2)}$$

and is always less than unity.

6½,6

3. (a) Explain the terms sampling distribution and standard error. Show that in series of n independent trials with constant probability of success p , the standard error of the proportion of successes is \sqrt{pq} / n , where $q = 1 - p$.

P.T.O.

- (b) Obtain the distribution function and hence the p.d.f. of the smallest sample observation $X_{(1)}$ in a random sample of size n from a population with a continuous distribution function $F(x)$. Show that for random sample of size 2 from normal population, 6½,6

$$N(0, \sigma^2), E(X_{(1)}) = \frac{-\sigma}{\sqrt{\pi}}.$$

4. (a) When are two attributes said to be :

- (i) positively associated and
(ii) negatively associated ?

Also define complete association and dissociation of two attributes.

- (b) Determine if A and B are independent, positively associated or negatively associated for the following data :

$$N = 1000, (A) = 470, (B) = 620, (AB) = 320,$$

the symbols have usual meaning.

6½,6

5. (a) Discuss in detail, the test of significance for difference of proportions for large samples.
- (b) A die is thrown 60 times with the following results :

Face	1	2	3	4	5	6
Frequency	8	7	12	8	14	11

Test, at 5% level of significance, if the die is unbiased. Given the values of chi-square at 5, 6, 7 d.f. respectively as 11.07, 12.59 and 14.06. 6½,6

6. (a) Establish the relationship between t , F and chi-square distributions.
- (b) If X is a chi-square variate with n degrees of freedom, then prove that for large n : 6½,6

$$\sqrt{2X} \sim N(\sqrt{2n}, 1).$$

7. (a) If X_i ($i = 1, 2, \dots, n$) are independent $N(0, \sigma^2)$ and they are transformed to a new set of variables Y_i ($i = 1, 2, \dots, n$) by means of a linear orthogonal transformation then show that Y_i ($i = 1, 2, \dots, n$) are also independent $N(0, \sigma^2)$.
- (b) In one sample of 8 observations, the sum of the squares of deviations of the sample values from the sample mean was 84.4 and in the other sample of 10 observations it was 102.6. Test whether this difference is significant at 5% level of significance.
(Given that $F_{0.05}(7, 9) = 3.29$ and $F_{0.05}(9, 7) = 3.69$). 6½,6
8. (a) Discuss the test of significance for single proportion. Write down 95% and 99% confidence limits for the population proportion P .
- (b) Define the following terms :
- (i) Type I and Type II errors
 - (ii) Parameter and Statistic
 - (iii) Critical region. 6½,6