



[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 12703

K

Unique Paper Code : 2374002001

Name of the Paper : Sampling Distributions

Name of the Course : **GE 3(a) Sampling Distributions (NEP-UGCF)**

Semester : III

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **six** questions in all.
3. **All** questions carry equal marks.
4. Use of Non-Programmable Scientific Calculator is allowed.

1. (a) Discuss the test of significance for difference of means for large samples.

(b) In a random sample of 1000 persons taken from village A , 60 are found to be consuming tea. In another sample of 200 persons taken from village B, 100 persons are found to be consuming tea. Do the data reveal significant difference between the two villages so far as the habit of taking tea is concerned. Take level of significance as 5%. [$Z_{0.025} = 1.96$]

[7, 8]

2. (a) If X is a χ^2 variate with n d.f. , then prove that for large n ,

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

(b) Find the mean deviation about the mean of t-distribution with n degrees of freedom.

[7, 8]

3. (a) Explain the following terms:

- (i) Null hypothesis and Alternative hypothesis
- (ii) P-value
- (iii) Critical region

(b) Define F-statistic. Prove that if $n_1 = n_2$, then the median of F-distribution is at $F = 1$ and that the quartiles Q_1 and Q_3 satisfy the condition $Q_1 Q_3 = 1$.

[8, 7]

4. (a) State and prove the additive property of chi-square distribution.

(b) Find the mode of the chi-square variate with n degrees of freedom.

(c) Show that if $X \sim t_n$, then $X^2 \sim F_{1,n}$.

[5, 5, 5]

P.T.O.

5. (a) Obtain the mean and mode of F-distribution with (m, n) degrees of freedom.
 (b) A certain stimulus administered to each of the 12 patients resulted in the following increase of blood pressure: 5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4 and 6. Can it be concluded that the stimulus will, in general, be accompanied by an increase in blood pressure? [$t_{11(0.05)} = 1.796$ for one tail.] [8, 7]
6. (a) Define Student's -t and Fisher's -t statistics. Derive the sampling distribution of t statistic.
 (b) For the following set of data test whether a person's ability in Mathematics is independent of his interest in Statistics;

		Ability in Mathematics		
		Low	Average	High
Interest in Statistics	Low	63	42	15
	Average	58	61	31
	High	14	47	29

$$(\chi_4^2(0.05) = 9.488)$$

[7, 8]

7. (a) Let X_1, X_2, \dots, X_n be a random sample from $N(\mu, \sigma^2)$, σ^2 is unknown. Obtain 100 (1- α)% confidence interval for population mean μ .
 (b) If X_1 and X_2 are independent χ^2 variates with n_1 and n_2 d.f. respectively, then prove that $U = \frac{X_1}{X_1 + X_2}$ and $V = X_1 + X_2$ are independently distributed. [7, 8]
8. (a) Show that t-distribution tends to normal distribution when n tends to infinity.
 (b) Two machines A and B produce parts with a specified diameter. To compare the consistency of the two machines samples of 10 parts from machine A and 15 parts from machine b are taken. The sum of the squares of the deviation from the sample means are 40.5 and 44.8 respectively. Test the hypothesis that the population variances of the diameters of the parts of two machines are equal. Also write the null and alternative hypothesis. [$F_{10,15}(0.05) = 3.12$ and $F_{9,15}(0.05) = 3.28$]. [7, 8]