

[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 5171 F Your Roll No.....

Unique Paper Code : 237351

Name of the Paper : ST : Statistical Methods – II

Name of the Course : B.A. (Program) Statistics

Semester : III

Duration : 3 Hours

Maximum Marks : 75

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. Q. No. 1 is compulsory.
4. Simple calculator can be used.

1. (a) Fill in the blanks :

(i) χ^2 -distribution reduce to negative exponential distribution for ... d.f. .

(ii) If χ_1^2 and χ_2^2 are two independent Chi-square variates with n and m

d.f., respectively then $\frac{\chi_1^2}{\chi_2^2} \sim \dots$

(iii) If $X \sim F(n, m)$, then $\left(\frac{1}{X}\right) \sim \dots$

(b) Examine the consistency of the following data :

$N = 100$; $(A) = 55$, $(B) = 65$, $(AB) = 35$, the symbols having their usual meaning.

(c) Show that Student's 't' is a particular case of Fisher's 't'.

P.T.O.

(d) Let $X_i \sim N(i, i^2)$; $i = 1, 2, 3$ be independent random variables. Using only the three random variables X_1 , X_2 and X_3 , construct a statistic that has an F-distribution with (1,2) d.f.

(e) Find the mean of $X \sim \chi_{(n)}^2$. (3×5=15)

2. (a) 1600 candidates appeared for a competitive examination, 422 were successful, 256 had, attended a coaching class and of these 150 came out successful. Estimate the utility of the coaching classes.

(b) Define Yule's coefficient of association (Q) and the coefficient of colligation (Y). Establish the relation

$$Q = \frac{2Y}{1+Y^2}. \quad (6,6)$$

3. (a) If X is chi-square variate with n d.f., then prove that for large n,

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

(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 ? (6,6)

4. (a) Explain clearly the procedure generally followed in testing of a hypothesis. Point out the difference between one-tail and two-tail tests.

(b) If the random variables X_1 and X_2 are independent and follow chi-square distribution with n d.f., show that $\frac{\sqrt{n}(X_1 - X_2)}{2\sqrt{X_1 X_2}}$ is distributed as Student's t with n d.f., independently of $X_1 + X_2$. (6,6)

5. (a) For the entries in following 2×2 contingency table,

a	b
c	d

prove that chi-square test of independence gives

$$\chi^2 = \frac{N(ad - bc)^2}{(a+c)(b+d)(a+b)(c+d)},$$

where $N = a + b + c + d$.

- (b) In a certain experiment to compare two types of animal food A and B, the following results of increase in weights were observed in animals :

Animal number		1	2	3	4	5	6	7	8
Increase weight in lb	Food A	49	53	51	52	47	50	52	53
	Food B	52	55	52	53	50	54	54	53

Assuming that the two samples of animals are independent, can we conclude that food B is better than food A ?

(6,6)

6. (a) For t -distribution with n d.f. show that :

$$\mu_{2r+1} = 0$$

and

$$\mu_{2r} = n^r \frac{\Gamma\left(\frac{n}{2} - r\right) \Gamma\left(r + \frac{1}{2}\right)}{\Gamma\left(\frac{1}{2}\right) \Gamma\left(\frac{n}{2}\right)}; r = 0, 1, 2, \dots$$

- (b) Find mean and variance of F distribution with n_1 and n_2 d.f.. (6,6)

7. (a) A soft drink vending machine is set in such a way that the amount of drink dispensed is a random variable with a mean of 20 millilitres and a standard deviation of 15 millilitres. What is the probability that the average amount dispensed in a random sample of size 36 is at least 205 millilitres ?

(b) State and prove relationship between F and χ^2 distribution. (6,6)

8. Write short notes on :

(a) χ^2 test for goodness fit.

(b) t-test for difference of means.

(c) Test of significance of the difference of standard deviation, in case of large sampling. (4,4,4)