**Sr. No. of Question Paper :  364**          C          **Roll No.............**

Unique Paper Code        : 237351

Name of the Paper        : Statistical Methods – II

Name of the Course       : B.A. (Programme) 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) If the attributes A and B are independent, then

$$\frac{(AB)}{N} = \ldots$$

   (ii) For _____ degree of freedom, $\chi^2$ distribution reduces to negative exponential distribution.

   (iii) If a statistic $t$ follows student's $t$-distribution with n degrees of freedom, then $t^2$ follows _____ distribution with _____ d.f.

   (b) Show that standard error of the number of successes is the square root of the mean number of successes provided the mean proportion of successes is small.

(c) Define complete association and dissociation of two attributes.

(d) Describe Paired t-test.

(e) Let $\chi_i \sim N(i, i^2)$; $i = 1, 2, 3$ be independent random variables. Contruct a statistic that has a $t$-distribution with 2 degrees of freedom. (3×5=15)

2. (a) 800 candidates of both sexes appeared at an examination. The boys outnumbered the girls by 15% of the total. The number of candidates who passed exceeds the number failed by 480. Equal number of boys and girls failed in the examination. Prepare a 2×2 table and find the coefficient of association. Also comment on the answer.

(b) $n$ individuals fall in one or the other two categories with probability $p$ and $q = 1 - p$; the number in two categories being $n_1$ and $n_2$. Find $cov(n_1, n_2)$ and $\text{var}\left(\dfrac{n_1}{n} - \dfrac{n_2}{n}\right)$; where $n = n_1 + n_2$.. (6,6)

3. (a) Show that in a 2x2 contingency table wherein the frequency are

| a | b |
|---|---|
| c | d |

$\chi^2$ is calculated from the hypothesis of independence is

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

(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 that $P[\chi_5^2 \geq 11.07] = 0.05$ and $P\left[\chi_5^2 \geq 12.592\right] = 0.05$ (6,6)

4. (a) If the variable t has student t-distribution with 2 degree of freedom, then prove that

$$p[t \geq 2] = \frac{3 - \sqrt{6}}{6}.$$

(b) If $\chi_1^2$ and $\chi_2^2$ are two independent $\chi^2$ variables with $n_1$ and $n_2$ d.f. respectively, then prove that $\dfrac{\chi_1^2}{\chi_2^2} \sim \beta_2\left(\dfrac{n_1}{2}, \dfrac{n_2}{2}\right)$.  (6,6)

5. (a) Find the mode of F distribution with $n_1$ and $n_2$ d.f.

(b) Define student's t-distribution. Explain stating clearly the assumptions involved, the t-test for testing the significance of difference of means.  (6,6)

6. (a) Find the limiting form of $\chi_n^2$-distribution for large n.

(b) For the t-distribution with n d.f. show that :

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

$$\mu_{2r} = n^r \frac{\Gamma\left(\dfrac{n}{2} - r\right)\Gamma\left(r + \dfrac{1}{2}\right)}{\Gamma\left(\dfrac{1}{2}\right)\Gamma\left(\dfrac{n}{2}\right)}$$  (6,6)

7. (a) The heights of six randomly chosen sailors are (in inches) 63, 65, 68, 69, 71 and 72. Those of 10 randomly chosen soldiers are 61, 62, 65, 66, 69, 69, 70, 71, 72 and 73. Can we conclude from the given data that the sailors are on the average taller than soldiers.

(b) In the large city, 16 out of a random sample of 500 men were found to be drinkers. After the heavy increase in tax on intoxicants another random sample of 100 men in the same city included 3 drinkers. Was the observed decrease in the proportion of drinkers significant after tax increase ?  (6,6)

8.  Write short notes on :

    (a)  Chi- square test of goodness of fit

    (b)  Applications of F- distribution

    (c)  Relationship between t and F distribution                    (4,4,4)