B.Sc. (Part-III) Mathematis, Examination-2020

Mathematics (Fourth (F) Paper)
(Mathematical Statistics)

Note : Attempt questions from all sections as per instructions.

[Section-(A) Very Short Answer Type Questions]

Note : Attempt all parts of this question. Give answer of each question in about 50 words. **1½ × 10 = 15**

1. (i) If A and B are any two events and are not disjoint, then show that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

(ii) Define dependent, independent and compounded events.

(iii) For the following density function $f(x) = cx^2(1-x), 0 < x < 1$ find its mean.

(iv) Define mathematical expectation of a random variable and show that $E(x+y) = E(x) + E(y)$.

(v) Write the Karl Pearson coefficient of correlation.

(vi) Show that correlation coefficient is the geometric mean between the regression coefficients.

(vii) Discuss the types of sampling.

(viii) Define errors in the sampling.

(ix) Define chi-square test of goodness of fit.

(x) Define ANOVA.

[Section-(B) Short Answer Type Questions]

Note : Attempt all questions. Give answer of each question in about 200 words. **8 × 5 = 40**

2. The odds that person X speak the truth are 3 : 2and the odds that the person Y speaks the truth are 5 : 3. In what percentage of cases are they likely to contradict to each other on an identical point.

Or State and prove the Baye's theorem.

3. Find the mean and variance of a binomial distribution.

Or Define exponential distribution and hence obtain its moment generating function.

4. Fit a parabola of second degree to the following data :

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

Or Calculate the coefficient of correlation between x and y for the following :

x	1	3	4	5	7	8	10
y	2	6	8	10	14	16	20

5. In a large consignment of oranges a random sample of 64 oranges revealed that 14 oranges were bad. Is it reasonable to assume that 20% of the oranges are bad ?

Or Explain clearly the terms "Standard Error" and "Sampling Distribution". Show that in a series of n independent trials with constant probability p of success, the standard error of the proportion of successes is $\sqrt{pq/n}$ where $q = 1 - p$

6. What is the limiting form of t distribution ? Prove it.

Or A random sample of 10 boys had the following I.Q's : 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. Do these data support the assumption of a population mean I.Q. of 100 ? Find a reasonable range in which most of the mean I.Q. values of sample of 10 boys lie. (Given tabulated value $t_{0.05}$ for 9 d.f. for two-tailed test is 2.262).

[Section–(C) Long Answer Type Questions]

Note : Attempt any two questions. Give answer of each question in about 500 words. Each question carries 10 marks. **10 × 2 = 20**

7. If two dice are thrown, what is the probability that the sum is greater than 8 and neither 7 or 11.

8. Show that for rectangular distribution $f(x) = \frac{1}{2a}$, $a < x < a$ the m.g.f. about the origin is $\frac{1}{at}(\sinh at)$. Also show the moments of even order are given by $\mu_{2n} = \frac{a^{2n}}{(2n+1)}$

9. The rankings of ten students in two subjects A and B are as follows :

A	3	5	8	4	7	10	2	1	6	9
B	6	4	9	8	1	2	3	10	5	7

Find the correlation coefficient.

10. Define the following :
   (i) Null hypothesis
   (ii) Level of significance
   (iii) Random sampling
   (iv) F-distribution

11. The theory predicts the proportion of beans in the four groups A, B, C & D should be 9 : 3 : 3 : 1. In an experiment among 1600 beans, the number in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory ? (Given tabulated $\chi^2_{0.05}$ for 3 d.f. = 7.815).