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4417

Your Roll No.

Subsidiary for B.Sc. (Hons.)/II AS

MATHEMATICS – Paper IV (ii)

(Statistics)

Time : 3 Hours

Maximum Marks : 75

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

Attempt any six questions.

All questions carry equal marks.

1. (a) Let μ_r' denote the r th moment about any arbitrary point a . Express μ_r' in terms of various moments about the mean. (6½)
- (b) The first four moments of a distribution about the value 4 of the variable are -1.5 , 17 , -30 and 108 . Find the moments about mean, β_1 and β_2 . (6)
2. (a) (i) Find the expectation of the number on a dice when thrown.
- (ii) Two unbiased dice are thrown. Find the expected values of the sum of number of points on them. (6)

P.T.O.

(b) If X is a random variable then show that $V(aX + b) = a^2V(X)$ where a and b are constants and $V(X)$ denotes the variance of X . Hence deduce the following results

(i) Variance is not independent of change of scale

(ii) Variance of constant is zero

(iii) Variance is independent of change of origin
(6½)

3. (a) For any two events A and B prove that

$$(i) P(\bar{A} \cap B) = P(B) - P(A \cap B)$$

$$(ii) P(A \cap \bar{B}) = P(A) - P(A \cap B) \quad (6)$$

(b) Three groups of children contain respectively 3 girls and 1 boy, 2 girls and 2 boys and 1 girl and 3 boys. One child is selected at random from each group. Show that the chance that the three selected consist of 1 girl and 2 boys is $\frac{13}{32}$.
(6½)

4. (a) Six rats are administered a certain dose of poison and the number of rats dying within 24 hours is observed. Suppose that each rat has a probability $\frac{1}{4}$ of dying and that the survival of each rat is independent of the survival of other rats. What is the probability that

(i) exactly 4 rats will die

(ii) all rats will die
(6½)

- (b) Find the mean deviation about mean of binomial distribution. (6)
5. (a) A hospital administrator who has been studying daily emergency admissions over a period of several years has concluded that they are distributed according to the poisson law. Hospital records reveal that emergency admissions have averaged 3 per day during this period. Find the probability that
- (i) Exactly two emergency admissions will occur on a given day.
 - (ii) Either three or four emergency cases will be admitted (Given $e^{-3} = 0.050$). (6½)
- (b) Show that the sum of independent poisson variates is also a poisson variate. Is the difference of two independent poisson variates a poisson variate? Justify your answer. (6)
6. (a) Assume the mean height of soldiers in a normal distribution to be 68.22 inches and variance 10.8 inches. How many soldiers in a regiment of 10000 soldiers would you expect to be over six feet tall. (6½)

- (b) For a normal distribution, show that all odd order moments about mean vanish and even order moments about mean are given by

$$\mu_{2n} = 1.3.5 \dots (2n - 1) \sigma^{2n} \quad (6)$$

7. (a) The weights of a calf taken at weekly intervals are given below

Age (x) (in weeks)	1	2	3	4	5
wt (y) (in kg)	30	34	37	43	45

Fit a straight line to the above data and then give an estimate of weight for the calf when it becomes 7 weeks old. (6)

- (b) Seven mice are taken and then body weight (X) and length from nose to tail (Y) are measured. Find the coefficient of correlation between the two measures

Mouse	1	2	3	4	5	6	7
Unit of weight (x)	1	4	3	4	8	9	8
Unit of length (y)	2	5	8	12	14	19	22

(6½)

8. (a) In two large populations there are 30 and 25 percent respectively of fair haired people. Is this difference likely to be hidden in samples of 1200 and 900 respectively from the two populations at 5% level of significance (6)

- (b) In a survey of buying habits 400 women shoppers are chosen at random in super market A located in a certain section of the city. The average weekly food expenditure is Rs. 250 with a standard deviation of Rs. 40. For 400 women shoppers chosen at random in super market 'B' in another section of the city the average weekly food expenditure is Rs. 220 with a standard deviation of Rs. 55. Test at 1% level of significance whether the average weekly food expenditure of the two populations of shoppers are equal. (6½)

9. (a) The following figures show the distributions of digits in numbers chosen at random from a telephone directory

Digits :	0	1	2	3	4	5
Frequency :	1026	1107	997	966	1075	933
Digits :	6	7	8	9	Total	
Frequency :	1107	972	964	853	10,000	

Test whether the digits may be taken to occur frequently in the directory.

$$(\chi_{0.05}^2 \text{ for 9 degrees of freedom} = 16.919)$$

(6½)

- (b) An experiment was conducted on a set of nine bean plants treated with hormones and another

set of 10 plants without treatment. The number of pods per plant was noted and the data summarized are given below. Examine whether the hormone treatment had real effect on the number of pods

	Size	Mean no. of pods	Sum of squares of deviation from mean
Sample I	9	22.2	112.7
Sample II	10	19.3	98.6

($t_{0.05}$ for HdF = 2.110) (6)