CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
II–B.TECH–I–Semester End Examinations (Supply) – August - 2023
PROBABILITY AND STATISTICS
(AI&DS)

[Time: 3 Hours]   [Max. Marks: 70]

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART-A   (20 Marks)

1. a) Define random variable with an example. [2M]
   b) State Bayes' theorem. [2M]
   c) The probability that there is no misprint in a book is e^{-4}. Calculate the mean. [2M]
   d) If n=4, p=0.5 then calculate the standard deviation of binomial distribution. [2M]
   e) Illustrate the properties of normal curve. [2M]
   f) Explain the formula for calculating the probability density function of exponential distribution. [2M]
   g) State the normal equations of second degree parabola in regression lines? [2M]
   h) If N=8, $\sum X = 544, \sum Y = 552, \sum XY = 37560$ then calculate COV (X, Y). [2M]
   i) In a manufacturing company out of 100 goods 25 are of top quality. Find the sample proportion. [2M]
   j) Distinguish between t distribution and F distribution. [2M]

PART-B   (50 Marks)

2. A continuous random variable has the probability density function [10M]

$$f(x) = \begin{cases} kxe^{-\lambda x}, for\ x \geq 0, \lambda > 0 \\ 0, otherwise \end{cases}$$

Determine i. k ii. Mean iii. Variance.

OR

3.a) A random variable X has the following probability function: [5M]

X	-3	-2	-1	0	1	2	3
P(X)	K	0.1	K	0.2	2K	0.4	2K

Then find i. k ii. mean

b) Suppose 5 men out of 100 and 25 women out of 10000 are colour blind. A colour blind person is chosen at random. What is the probability of the person being a male? (Assume male and female to be in equal numbers). [5M]

4. Out of 800 families with 5 children each, calculate how many would you expect to have i. 3 boys ii. 5 girls iii. either 2 or 3 boys? Assume equal probabilities for boys and girls. [10M]

OR

5.a) The probability that a man hitting a target is 1/3. If he fires 5 times, find the probability that he fires. [5M]
   i. At most 3 times. ii. At least 2 times.

   b) If a Poisson distribution is such that $P(X=1)=\dfrac{3}{2}P(X=3)$ then Calculate $P(X \geq 1)$ [5M]

6. A monitor issues a warning signal when an action is needed as part of a production process. The interval, X hours, between successive signals follows an exponential distribution with parameter 0.08.   [10M]

i. Find the probability that the interval between the next two signals is:

a. Between 10 and 20 hours;

b. Less than two hours;

c. Longer than 50 hours.

ii. State the mean and standard deviation of the intervals between successive signals. Following a warning signal, what is the longest time the production process could be left unsupervised whilst ensuring the probability of missing the next signal is less than 0.01?

<div align="center">OR</div>

7.a) For a normally distributed variate with mean 1 and standard deviation 3.   [5M]

Calculate   i. $P(3.43 \leq X \leq 6.19)$

            ii. $P(-1.43 \leq X \leq 6.19)$.

b) Let $X \sim Gamma(\alpha, \lambda)$, where $\alpha, \lambda > 0$. Find $E(X)$, and $Var(X)$.   [5M]

8. Calculate both regression lines which best fit to the following data: [10M]

x	2	4	6	8	10	12	14
y	4	2	5	10	4	11	12

Also, i) find y when x = 13. ii) find x when y = 11.5

<div align="center">OR</div>

9. A sample of 11 fathers and their elder sons gave the following data.   [10M]

F	65	63	67	64	68	62	70	66	68	69	71
S	68	66	68	65	69	66	68	65	71	68	70

Where F: Father's height in inches and S:Son's height in inches. Calculate the coefficient of correlation.

10.a) The average breaking strength of the steel rods is specified to be 18.5 thousand pounds. Sample of 14 rods were tested. The mean and S.D obtained were 17.85 and 1.955 respectively. Is the result of experiment significant?   [5M]

b) A cigarette manufacturing firm claims that brand A line of cigarettes outsells its brand B by 8%. If it is found that 42 out of a sample of 200 smokers prefer brand A and 18 out of another sample of 100 smokers prefer brand B. Examine whether 8% difference is a valid claim.   [5M]

<div align="center">OR</div>

11.a) A social worker believes that fewer than 25% couples in certain area have ever used any form of birth control. A random sample of 120 couples were contacted 20 of them said that they have used. Test the belief of social worker at 0.05 level of significance.   [5M]

b) The means of two large samples of sizes 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the samples be regarded as drawn from the same population of S.D 2.5 inches?   [5M]

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