**R17**

**Code No: 841AD**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**MCA I Semester Examinations, January - 2020**
**PROBABILITY AND STATISTICS**

**Time: 3hrs** **Max.Marks:75**

**Note:** This question paper contains two parts A and B.
Part A is compulsory which carries 25 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**

**5 × 5 Marks = 25**

1.a) If $p_1 = P(A), p_2 = P(B), p_3 = P(A \cap B), (p_1, p_2, p_3 > 0)$, express the following in Terms of $p_1$, $p_2$, $p_3$ (i) $P(\overline{A \cup B})$, (ii) $P(\bar{A} \cup \bar{B})$, (iii) $P(B/\bar{A})$, (iv) $P[\bar{A} \cap (A \cup B)]$. [5]

b) In a normal distribution, 31% of the items are under 45 and 8% of the items are over 64. Find the mean and standard deviation of the distribution. [5]

c) Show that $S^2$ is an unbiased estimator of the parameter $\sigma^2$ where $S^2 = \frac{1}{n-1}\sum_{i=1}^{n}(X_i - \bar{X})^2$. [5]

d) Explain the procedure generally followed in testing of hypothesis. [5]

e) Fit a straight line to the following data by the method of least squares. [5]

| | | | | | |
|---|---|---|---|---|---|
| $x$ | 10 | 12 | 15 | 23 | 20 |
| $y$ | 14 | 17 | 23 | 25 | 21 |

**PART - B**

**5 × 10 Marks = 50**

2.a) If $A_1, A_2, ....A_n$ are $n$ events then prove that $P\left(\bigcap_{i=1}^{n} A_i\right) \geq \sum_{i=1}^{n} P(A_i) - (n-1)$.

b) If A and B are independent events of a sample space S, then prove that are independent (i) $\bar{A}$ and $\bar{B}$ are independent, (ii) $\bar{A}$ and $B$ are independent, (iii) $A$ and $\bar{B}$. [5+5]

**OR**

3.a) State and Prove Baye's Theorem.

b) A Businessman goes to hotels X, Y, Z, 20%, 50%, and 30% of the times respectively. It is known that 5%, 4%, 8% of the rooms in X, Y, Z hotels have faulty TV sets. What is the probability that businessman's room having faulty TV set is in the hotel Z. [5+5]

4.a) A random variable X has the following probability function:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $x$ | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| $P(X=x)$ | 0 | $k$ | $2k$ | $2k$ | $3k$ | $k^2$ | $2k^2$ | $7k^2+k$ |

Find (i) mean of X.(ii) variance of X.

b) If two cards are drawn from a pack of 52 cards which are diamonds, using Poisson distribution find the probability of getting two diamonds atleast 3 times in 51 consecutive trails of two cards drawing each time. [5+5]

**OR**

5. Fit a Poisson distribution to the following data: [10]

| x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| f | 305 | 365 | 210 | 80 | 28 | 9 | 2 | 1 |

6. A population consists of the numbers 3,6,9,15,27.
a) List of all possible samples of size 2 with replacement.
b) Find the mean of the population.
c) Find the standard deviation of the population.
d) Calculate the mean of the sampling distribution of means.
e) Find the standard deviation of sampling distributions of means. [10]

**OR**

7. A professor's feeling about the mean mark in the final examination in probability of a large group of students expressed subjectively by normal distribution with $\mu_0 = 67.2$ and $\sigma_0 = 1.5$ (a) If the mean mark lies in the interval (65, 70) determine the prior probability the professor should assign to the mean mark. (b) Find the posterior mean $\mu_1$ and standard deviation $\sigma_1$ if the examinations are conducted on a random sample of 40 students yielding mean 74.9 and S.D 7.4. (c) Construct a 95% Bayesian interval for $\mu$. [10]

8.a) A random sample of six steel beams has a mean compressive strength of 58,392 with a Standard Deviation of 648. Use this information at 0.05 level of significance to test whether the true average compressive strength of the steel from which this sample came is 58,000?

b) If out of 80 patients treated with an antibiotic, 59 got cured, find 99% confidence limits to the true population of the cured. [5+5]

**OR**

9. Two horses **A** and **B** were tested according to the time to run a particular track with the following results.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Horse A | 28 | 30 | 32 | 33 | 33 | 29 | 34 |
| Horse B | 29 | 30 | 30 | 24 | 27 | 29 | -- |
| | | | | | | | |

Test whether the two horses have the same running capacity. [10]

10. Heights of fathers and sons are given in centimeters:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Heights of fathers(x) | 150 | 152 | 155 | 157 | 160 | 161 | 164 | 166 |
| Heights of sons(y) | 154 | 156 | 158 | 159 | 160 | 162 | 161 | 164 |

Find the two lines of regression and calculate the expected average heights of the son when the height of the father is 154 cm. [10]

**OR**

11. Find the coefficient of correlation between X and Y for the following data: [10]

| X | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Y | 10 | 11 | 12 | 14 | 13 | 15 | 16 | 17 | 18 |

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