# Pabna Cadet College

**Test Examination - 2021**

**Class: XII**

**Subject: Statistics First Paper (Creative)**

**Time: 2 hours & 25 minutes** **Subject Code: 129** **Full Marks: 50**

Answer five questions taking at least 2 (two) from each group. Figures in the right indicate full marks.

## Group A

1. **It is observed that in a college, there are 100 students, of whom 30 play football, 40 play cricket, and 20 play both.**

   (a) What is a sample space? 1

   (b) What is the relationship between independence and mutual excluvity? 2

   (c) Are the probabilities of playing cricket and that of football independent? Prove. 3

   (d) If a student is selected randomly,a nd if he plays cricket, what is the probability that he does not play football? 4

2. **The probability density function of a continuous random variable is**

$$f(x) = \begin{cases} kx^2 + kx + \frac{1}{8}, & 0 \leq x \leq 2 \\ 0, & otherwise \end{cases}$$

   (a) What is a random variable? 1

   (b) Find the value of k 2

   (c) Find the probability that the values of x would lie between 0 and 1. 3

   (d) Is $f(x)$ a probability density function? Justify. 4

3. **For a lottery, 9 red and 7 white balls are placed in a box. Different combinations of balls are then picked up from the box.**

   (a) What is the probability of an impossible event? 1

   (b) If a ball is drawn, what is the probability the ball not white? 2

   (c) If 6 balls are picked randomly, what is the probability that 3 balls are red and 3 balls are white? 3

   (d) When two balls are drawn without replacement, what is the probability that none is red? If this task is repeated a hundred times, approximately how many times would we get all-non-red balls? 4

4. **A statistician of a customer care center investigates the calls received and finds that the call center receives 5 calls per hour on average.**

   (a) What is a Poisson process? 1

   (b) Prove that the summation of probability of all possible values of a Poisson distribution is 1. 2

   (c) What is the probability that no less than three calls would be received in an hour? 3

   (d) Is the probability of receiving one call greater than that of receiving no calls? Justify mathematically and logically. 4

## Group B

5. **In an industry, 3% products are found to be defective. A quality control officer collects a sample of 20 items.**

   (a) What is Bernoulli trial? 1

   (b) What is the relationship between Bernoulli and Binomial distribution? 2

   (c) Determine the probability that at least 3 items are defective. 3

   (d) Find the probability that no. of defective items would be less than the mean. 4

| x | -3 | -2 | -1 | 0 | 1 | 2 |
|---|---|---|---|---|---|---|
| P(x) | k | 2k | 3k | 2k | 4k | 0.4 |

6. **Probability distribution of a random variable is shown on the table:**

   (a) What is the formula of variance in terms of expectation? 1

   (b) Prove expected value is equal to arithmetic mean. 2

   (c) Find the value of $k$ and $P(-3 \leq X \leq 0)$. 3

   (d) Determine the $E(X)$ and $V(X)$. 4

7. **In winter, the probability that it rains on a particular day is 0.015. An analyst observes 100 winter days.**

   (a) What is an experiment? 1

   (b) When can the Poisson distribution be approximated by the Binomial distribution? 2

   (c) Find, using Binomial distribution, the probability that it would not rain at all on the observed days. 3

   (d) Find the probability in 3(c) using Poisson distribution. 4

8. **For projection of population in a future time period, demographers use simple, geometric or exponential growth technique. Each method has its advantages and disadvantages.**

   (a) For projection of population in a future time period, demographers use simple, geometric or exponential growth technique. Each method has its advantages and disadvantages. 1

   (b) In geometric growth method, obtain the formula for time required for the population to get doubled [denote rate as r]. 2

   (c) In exponential method, how much unit of time is required for the population to get tripled? 3

   (d) For projecting (predicting future values), is geometric growth method better than the exponential method? Justify. 4