UNIT - II: Continuous Distributions and sampling

<table>
<tr><th>S. No</th><th></th><th>Questions</th><th>BT</th><th>CO</th><th>PO</th></tr>
<tr><td colspan="6">Part – A (Short Answer Questions)</td></tr>
<tr><td>1</td><td></td><td>Define expectation of a random variable X</td><td>L1</td><td>CO2</td><td>PO1</td></tr>
<tr><td>2</td><td></td><td>Define variance of a random variable X for discrete and continuous cases.</td><td>L1</td><td>CO2</td><td>PO1</td></tr>
<tr><td>3</td><td></td><td>Let X be a random variable with density function
$$f(x)=\begin{cases}\frac{x^3}{3}, -1<x<2\\ 0, else\ where\end{cases}$$
Find the expected value of g(x)=4x+3</td><td>L3</td><td>CO2</td><td>PO2</td></tr>
<tr><td>4</td><td></td><td>Let the random variable X represent the number of defective parts for a machine when 3 parts are sampled from a production line and tested. The following is the probability distribution of X.
<table><tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>F(x)</td><td>0.51</td><td>0.38</td><td>0.10</td><td>0.01</td></tr></table>Calculate E(X) and E(X^2).</td><td>L3</td><td>CO2</td><td>PO2</td></tr>
<tr><td>5</td><td></td><td>20% of item produced from a factory are defective. Find the probability that in a sample of 5 chosen at random P(1<x<4).</td><td>L3</td><td>CO2</td><td>PO2</td></tr>
<tr><td>6</td><td></td><td>If the probability of a defective bolt is 0.2 find the mean and variances of the number of successes.</td><td>L3</td><td>CO2</td><td>PO2</td></tr>
<tr><td>7</td><td></td><td>Define geometric distribution.</td><td>L1</td><td>CO2</td><td>PO1</td></tr>
<tr><td>8</td><td></td><td>If a random variable has a Poisson distribution such that P(1) =P(2), find mean of the distribution.</td><td>L3</td><td>CO2</td><td>PO2</td></tr>
<tr><td>9</td><td></td><td>Using Poisson distribution, find the probability that the ace of spades will be drawn from a pack of well shuffled cards at least once in 104 consecutive trials.</td><td>L3</td><td>CO2</td><td>PO2</td></tr>
<tr><td>10</td><td></td><td>In 256 set of 12 tosses of a coin, in how many cases one can expect 8 heads and 4 tails.</td><td>L3</td><td>CO2</td><td>PO2</td></tr>
<tr><td colspan="6">Part – B (Long Answer Questions)</td></tr>
<tr><td>11</td><td></td><td>Seven coins are tossed and the number of heads are noted. The experiment is repeated 128 times and the following distribution is obtained. Fit a Binomial Distribution to the following data assuming the coin is unbiased
<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>f</td><td>7</td><td>6</td><td>19</td><td>35</td><td>30</td><td>23</td><td>7</td><td>1</td></tr></table></td><td>L3,L5</td><td>CO2</td><td>PO3</td></tr>
<tr><td>12</td><td>a)</td><td>Using recurrence formula find the probabilities when X=0,1,2,3,4 and 5, if the mean of Poisson distribution is 3.</td><td>L3,L5</td><td>CO2</td><td>PO3</td></tr>
<tr><td></td><td>b)</td><td>If the probability that an individual suffers a bad reaction from a certain injection is 0.001, determine the probability that out of 2000 individuals
i. Exactly 3
ii. More than 2 individuals</td><td>L3</td><td>CO2</td><td>PO2</td></tr>
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<tr><td></td><td></td><td>iii. None
iv. More than one individual suffers bad reaction</td><td></td><td></td><td></td></tr>
<tr><td>13</td><td>a)</td><td>Derive mean and variance of Geometric Distribution</td><td>L1</td><td>CO2</td><td>PO1</td></tr>
<tr><td></td><td>b)</td><td>The weekly demand for a drinking-water product, in thousands of liters, from a local chain of efficiency stores is a continuous random variable X having the probability density. Find mean and variance.
$$f(x) = \begin{cases} 2(x-1); 1 < x < 2 \\ 0; else\ where \end{cases}$$</td><td>L3</td><td>CO2</td><td>PO2</td></tr>
<tr><td>14</td><td></td><td>Out of 800 families with 5 children each, how many would you expect to have
a. 3boys
b. 5girls
c. At least one boy
d. Mean
e. Variance</td><td>L3,L4,L5</td><td>CO2</td><td>PO3</td></tr>
<tr><td>15</td><td>a)</td><td>Derive mean and variance of Poisson distribution</td><td>L1</td><td>CO2</td><td>PO1</td></tr>
<tr><td></td><td>b)</td><td>A die is tossed until 6 appears. Find the probability that it must be cast more than 5 times.</td><td>L2</td><td>CO2</td><td>PO2</td></tr>
<tr><td>16</td><td>a)</td><td>If a Poisson Distribution is such that $\frac{3}{2}P(X=1) = P(X=3)$. Find
i. P(X≥1)
ii. P(X≤3)</td><td>L2</td><td>CO2</td><td>PO2</td></tr>
<tr><td></td><td>b)</td><td>Calculate the variance of g(X)=2X + 3, where X is a random variable with the following probability distribution
<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>F(x)</td><td>1/4</td><td>1/8</td><td>1/2</td><td>1/8</td></tr></table></td><td>L3</td><td>CO2</td><td>PO2</td></tr>
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