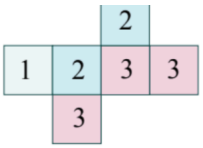
One Two academy

Probability Distribution

Time:- 90 minutes **STD 12 MATHEMATICS** **Total:- 45 marks**

	Answer any 4 of the following:- 4 x 2 = 8 Note:- **Question 7** is compulsory.
1)	Two balls are chosen randomly from an urn containing 6 red and 8 black balls. Suppose that we win Rs 15 for each red ball selected and we lose Rs 10 for each black ball selected. X denotes the winning amount, then find the values of X and number of points in its inverse images.
2)	Three fair coins are tossed simultaneously. Find the probability mass function for the number of heads occurred.
3)	Using binomial distribution find the mean and variance of X for the following experiment A fair coin is tossed 100 times, and X denote the number of heads.
4)	State any three properties of distribution function.
5)	If X is the random variable with distribution function $F(x)$ given by, $F(x)=\begin{cases}0, & -\infty<x<0\\ \frac{1}{2}\left(x^2+x\right) & 0\le x<1\\ 1, & 1\le x<\infty\end{cases}$ then find (i) the probability density function $f(x)$ (ii) $P(0.3\le X\le 0.6)$
6)	In a Binomial distribution if n = 5 and P(X=3) = 2 P(X=2) find p.
7)	If F(x) = $\frac{1}{\pi}[\frac{\pi}{2} + tan^{-1}x]$ $1 -\infty < x < \infty$ is a distribution function of a continuous variable X, Prove that P(0 ≤ x ≤ 1) = 1/4.
	Answer any 4 of the following:- 4 x 3 = 12 Note:- **Question 8** is compulsory
8)	The probability density function of X is given by $f(x)=\begin{cases}k\,x\,e^{-2x} & \text{for } x>0\\ 0 & \text{for } x\le 0\end{cases}$. Find the value of k.

9)	A commuter train arrives punctually at a station every half hour. Each morning, a student leaves his house to the train station. Let X denote the amount of time, in minutes, that the student waits for the train from the time he reaches the train station. It is known that the pdf of X is $$f(x)=\begin{cases}\frac{1}{30} & 0<x<30\\ 0 & \text{elsewhere}\end{cases}$$ Obtain and interpret the expected value of the random variable X.
10)	In a binomial distribution consisting of 5 independent trials, the probability of 1 and 2 successes are 0.4096 and 0.2048 respectively. Find the mean and variance of the random variable.
11)	Find the probability mass function $f(x)$ of the discrete random variable X whose cumulative distribution function $F(x)$ is given by $$F(x)=\begin{cases}0 & -\infty<x<-2\\ 0.25 & -2\le x<-1\\ 0.60 & -1\le x<0\\ 0.90 & 0\le x<1\\ 1 & 1\le x<\infty\end{cases}$$ Also find (i) $P(X<0)$ and (ii) $P(X\ge -1)$.
12)	A six sided die is marked '1' on one face, '2' on two of its faces, and '3' on remaining three faces. The die is rolled twice. If X denotes the total score in two throws. (i) Find the probability mass function.  
13)	A pair of fair dice is rolled once. Find the probability mass function to get the number of fours.
14)	In a gambling game a man wins Rs.10 if he gets all heads or all tails and loses Rs.5 if he gets 1 or 2 heads when 3 coins are tossed once. Find his expectation of gain.
	Answer the following:- 5 x 5 = 25
14)	A random variable X has the following pdf:- Find a) k b) P(2≤X<5) c) P(3<X). <table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>*f(x)*</td><td>k^2</td><td>$2k^2$</td><td>$3k^2$</td><td>2k</td><td>3k</td></tr></table> **OR** Give Mean and variance for a)The one point distribution b)The Two point distribution c) The Bernoulli distribution d)Binomial distribution.

15)	Find the probabilities mass function and cumulative distribution function of number of girl child in families with 4 children, assuming equal probabilities for boys and girls. **OR** Four coins are tossed once. Find probability mass function, mean and variance for number of heads occurred.
16)	Suppose the amount of milk sold daily at a milk booth is distributed with a minimum of 200 litres and a maximum of 600 litres with probability density function $f(x)=\begin{cases} k & 200 \le x \le 600 \\ 0 & \text{otherwise} \end{cases}$ Find (i) the value of k (ii) the distribution function (iii) the probability that daily sales will fall between 300 litres and 500 litres?
17)	Find the binomial distribution for each of the following. (i) Five fair coins are tossed once and X denotes the number of heads. (ii) A fair die is rolled 10 times and X denotes the number of times 4 appeared. **OR** A multiple choice examination has ten questions, each question has four distractors with exactly one correct answer. Suppose a student answers by guessing and if X denotes the number of correct answers, find (i) binomial distribution (ii) probability that the student will get seven correct answers (iii) the probability of getting at least one correct answer.
18)	State and Prove the properties of Mathematical expectations. **OR** Suppose a pair of unbiased dice is rolled once. If X denotes the total score of two dice, write down (i) the sample space (ii) The values taken by the random variable X (iii) The inverse image of 10 (iv) The number of elements in inverse image of X.

All the Best