

## PRACTICE QUESTIONS DISCRETE RANDOM VARIABLE

### EXERCISE – 3.1

#### DISCRETE PROBABILITY DISTRIBUTION

1. Find the probability distribution for number of heads appeared when two coins are tossed once.

(Ans : seetable)

x	0	1	2
P(x)	1/4	2/4	1/4

2. Write out the probability distribution for the number of tails, X, obtained when three fair coins are tossed once.

(Ans : seetable)

x	0	1	2	3
P(x)	1/8	3/8	3/8	1/8

3. Find the probability distribution for the product of dots appeared when two dice are thrown once.

(Ans : seetable)

4. Two tetrahedral dice, each with faces labeled 1,2,3 and 4 are thrown and the score noted, where the score is the sum of the two numbers on which the dice land. Find the probability distribution of the score.

(Ans : seetable)

x	2	3	4	5	6	7	8
P(x)	1/16	2/16	3/16	4/16	3/16	2/16	1/16

5. A number is picked at random from the set of integers  $\{1,2,3,\dots,100\}$ . Suppose X represents the remainder after dividing the number by 7. Find the probability distribution of X.

(Ans : seetable)

x	0	1	2	3	4	5	6
P(x)	0.14	0.15	0.15	0.14	0.14	0.14	0.14

6. Determine the constant k in each case of the following cases if the probability function of a random variable X is given by

(a)  $P(X = x) = k(x - 2)$ ,  $x = 3, 4, 5, 6$

(b)  $P(X = x) = k|x - 2|$ ,  $x = -1, 0, 1, 3$

(c)  $P(X = x) = k {}^2C_x {}^3C_{3-x}$ ,  $x = 0, 1, 2$

(Ans :  $\frac{1}{10}, \frac{1}{7}, \frac{1}{10}$ )

7. The discrete random variable  $X$  has p.d.f  $P(X = r) = c(3 - r)$  for  $r = 0, 1, 2, 3$ .

(a) Find the value of the constant  $c$ .

(b) Find  $P(1 \leq X < 3)$

(Ans :  $\frac{1}{6}, \frac{1}{2}$ )

8. The discrete random variable  $X$  has the given probability distribution

x	1	2	3	4	5
P(x)	0.2	0.25	0.4	a	0.05

Then find

(a) the value of  $a$ .

(b)  $P(1 \leq X \leq 3)$

(c)  $P(X > 2)$

(d)  $P(2 < X < 5)$

(Ans : 0.1, 0.85, 0.55, 0.5)

9. The discrete random variable  $X$  has the given probability distribution

x	1	2	3	4	5
P(x)	0.1	0.3	a	0.2	0.05

Then find

(a) the value of  $a$ .

(b)  $P(X \geq 4)$

(c)  $P(X < 1)$

(d)  $P(2 \leq X < 4)$

(Ans :  $\frac{7}{20}, \frac{1}{4}, 0, \frac{13}{20}$ )

10. Let  $X$  be a random variable with the following probability distribution.

x	-5	-3	-1	0	1	2	3	8
P(x)	0.2	0.1	0.15	0.05	0.1	0.2	0.15	0.05

Find

(a)  $P(X \text{ is Even})$

(b)  $P(X \text{ is a multiple of } 3)$

(c)  $P(|X| < 3)$

(Ans : 0.3, 0.3, 0, 0.5)

**EXERCISE – 3.2****DISTRIBUTION FUNCTION FOR DISCRETE RANDOM VARIABLE**

1. The probability distribution of X, the number of imperfections per 10 meters of a synthetic fabric in rolls of uniform width, is given by

X	0	1	2	3	4
P(x)	0.41	0.37	0.16	0.05	0.01

Construct the cumulative distribution function of X.

(Ans : see table)

X	$x < 0$	$0 \leq x < 1$	$1 \leq x < 2$	$2 \leq x < 3$	$3 \leq x < 4$	$x \geq 4$
F(x)	0	0.41	0.78	0.94	0.99	1

2. A random variable X is defined by the function

$$P(X = x) = {}^4C_x (0.6)^x (0.4)^{4-x}, \quad x = 0, 1, 2, 3, 4$$

- (a) Construct the probability distribution for X  
 (b) Construct the distribution function for X.

(Ans : see table)

X	0	1	2	3	4
P(x)	0.0256	0.1536	0.3456	0.3456	0.1296

X	$x < 0$	$0 \leq x < 1$	$1 \leq x < 2$	$2 \leq x < 3$	$3 \leq x < 4$	$x \geq 4$
F(x)	0	0.0256	0.1792	0.5248	0.8704	1

3. The following table shows the distribution function  $F(x)$  of the random variable X as shown in the table

X	$x \leq 1$	$x \leq 2$	$x \leq 3$	$x \leq 4$
F(x)	1/8	3/8	3/4	1

Find the following

- (a) Probability distribution of the random variable X  
 (b)  $P(1 \leq X \leq 3)$   
 (c)  $P(X \leq 2)$   
 (d)  $P(X < 3)$

(Ans : see table)

X	1	2	3	4
P(x)	1/8	1/4	3/8	1/4

(Ans : 3/4, 3/8, 3/8)

4. For a discrete random variable  $X$  the cumulative distribution function  $F(x)$  is shown in the table

$X$	1	2	3	4
$F(x)$	0.13	0.54	0.75	1

Find the following using probability distribution and distribution function tables

(a)  $P(X = 2)$

(b)  $P(X > 1)$

(c)  $P(X \geq 3)$

(d)  $P(X \geq 3)$

(e)  $P(X < 2)$

(Ans : 0.41, 0.87, 0.46, 0.75, 0.13)

5. The cumulative probabilities for  $X$  are given in the following table, where  $X$  takes the values 0, 1, 2, ..., 12.

$X$	$F(x)$
0	0.0115
1	0.0692
2	0.2061
3	0.4114
4	0.6296
5	0.8042
6	0.9133
7	0.9679
8	0.9900
9	0.9974
10	0.9994
11	0.9999
12	1

Use table to find the following

(a)  $P(X \leq 8)$

(b)  $P(X = 5)$

(c)  $P(X \geq 4)$

(d)  $P(3 < X \leq 7)$

(e)  $P(1 \leq X < 9)$

(Ans : 0.9900, 0.1746, 0.5886, 0.5565, 0.9785)