

CHAPTER 15



PROBABILITY

<u>SYNOPSIS</u>
<ul style="list-style-type: none"> <i>Probability is a measure of uncertainty.</i>
<u>SOME TERMS RELATED TO PROBABILITY</u>
<ul style="list-style-type: none"> An action which results in some well- defined outcomes is called an <u>experiment</u>.
<ul style="list-style-type: none"> An experiment is called <u>random</u> if it has more than one possible outcome and it is not possible to predict the outcome in advance. Eg : tossing a coin , throwing a dice
<ul style="list-style-type: none"> The collection of all possible outcomes of an experiment is called <u>sample space</u>.
<ul style="list-style-type: none"> When the <u>outcome of a random experiment satisfies the condition mentioned</u> in the event, then we say that event has <u>occurred</u>.
<ul style="list-style-type: none"> The <u>outcomes</u> which <u>ensure the occurrence of an event are called favorable outcomes</u> to that event.
<ul style="list-style-type: none"> If there is no reason for any one outcome to occur in preference to any other outcome , we say that the <u>outcomes are equally likely</u>.
<ul style="list-style-type: none"> Probability of an event E , written as P (E) , is defined as
$P (E) = \frac{\text{number of outcomes favourable to E}}{\text{Total number of possible outcomes}}$
<ul style="list-style-type: none"> An <u>event which always happens</u> is called a <u>sure event</u> . E g when we throw a dice , then the event of getting number less than 7 is a sure event.
<ul style="list-style-type: none"> An <u>event which never happens is called an impossible event</u> Eg when we throw a die the event of getting a number greater than 6 is an impossible event.
<ul style="list-style-type: none"> An <u>event</u> which has <u>only one outcome</u> from the sample space is called an <u>elementary even</u>.
<ul style="list-style-type: none"> The sum of the probabilities of all the elementary events of an experiment is 1.
<ul style="list-style-type: none"> An <u>event</u> which has <u>more than one (favourable) outcomes</u> from the sample space is called a compound event .E g when we throw a die , then the event of getting the number 5 is an elementary event whereas the event of getting an event number (2, 4 and 6) is a <u>compound event</u>.






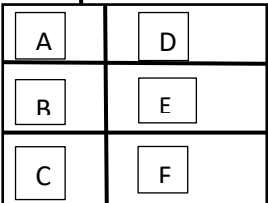

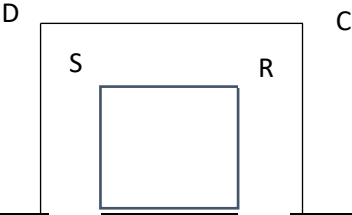

<ul style="list-style-type: none"> If E is an event, then the event “not E” is complementary event of E. Eg, when we throw a die the event of getting a number less than or equal to 2, then the event ‘not E’ is getting a number greater than 2 is complementary event of E 	
<ul style="list-style-type: none"> Complement of an event E is denoted by E' OR E^c 	
<ul style="list-style-type: none"> Let E be an event then we have : 	
1) $0 \leq P(E) \leq 1$	
2) $P(E') = 1 - P(E)$	
3) $P(E) = 1 - P(E')$	
4) $P(E) + P(E') = 1$	
<ul style="list-style-type: none"> Sure Event. Those events whose probability is one. 	
<ul style="list-style-type: none"> Impossible Event. Those events whose probability is zero 	
<ul style="list-style-type: none"> Probability of an event always lies between 0 and 1. 	
<ul style="list-style-type: none"> Probability of an event cannot be negative. 	
<p>Note. A pack of playing cards consists of 52 cards which are divided into 4 suits of 13 cards each. Each suit consists of one ace, one king, one queen, one jack and 9 other cards numbered from 2 to 10. Four suits named spades, hearts, diamonds and clubs.</p>	
<p>Remarks. King, queen and jack are called face cards.</p>	
<p>King, Queen, Jack and Ace are called picture cards</p>	
<p>1. Write the sample space when a coin is tossed.</p>	
<p>Sol. When a coin is tossed, there are two possible outcomes; a head (H) or a tail (T). The sample space of this experiment is $S = \{H, T\}$.</p>	
<p>2. Two dice are thrown simultaneously. List the sample space for this experiment.</p>	
<p>Sol. When two dice are thrown, there are $6 \times 6 = 6^2$ possible outcomes and $S = \{(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)\}$ Where $\{m, n\}$ stands for the ordered pair: First m, then n. The elements $\{n, n\} \in S, n = 1, 2, 3, 4, 5, 6$ are called doublets. For example $\{1, 1\}, \{2, 2\}, \{3, 3\}, \{4, 4\}, \{5, 5\}, \{6, 6\}$ are doublets (i.e. getting the same number on each dice). Similarly, when n dice are thrown, there are 6 to power n possible outcomes.</p>	
<p>3. A coin is tossed twice. If the second throw results in tail, a die is thrown. Describe the sample space.</p>	
<p>Sol. When a coin is tossed twice, the possible outcomes are HH, HT, TH, TT. The second throw results in head in HH, TH. The second throw results in tail in HT, TT. Now a die is tossed. The possible outcomes on a die are 1, 2, 3, 4, 5, 6.</p>	





SEC-A

MULTIPLE CHOICE QUESTIONS (1mark)

	<p>(1) The probability of a leap year selected at random contain 53 Sunday is: (a) 53/ 366 (b) 1/7 (c) 2/7 (d) 53/365</p> <p>(2) A bag contains 3 red and 2 blue marbles. A marble is drawn at random. The probability of drawing a black ball is : (a) 3/5 (b) 2/5 (c) 0/5 (d) 1/5</p> <p>(3) The probability that it will rain tomorrow is 0.85. What is the probability that it will not rain tomorrow? (a) 0.25 (b) 0.145 (c) 3/20 (d) none of these</p> <p>(4) What is the probability that a number selected from the numbers (1, 2, 3,.....,15) is a multiple of 4? (a) 1/5 (b) 4/5 (c) 2/15 (d) 1/3</p> <p>(5) What are the total outcomes when we throw three coins? (a) 4 (b) 5 (c) 8 (d) 7</p> <p>(6) The probability that a prime number selected at random from the numbers (1,2,3,35) is : (a) 12/35 (b) 11/35 (c) 13/35 (d) none of these</p> <p>(7) The sum of the probability of an event and non event is : (a) 2 (b) 1 (c) 0 (d) none of these.</p> <p>(8) The following probabilities are given; choose the correct answer for that which is not possible. (a) 0.15 (b) 2/7 (c) 7/5 (d) none of these.</p> <p>(9) If three coins are tossed simultaneously, than the probability of getting at least two heads, is (a) ¼ (b) 3/8 (c) ½ (d) 1/8</p> <p>(10) A letter is chosen at random from the letters of the word ◆ASSASSINATION◆. The probability that the letter chosen has: (a) 6/13 (b) 7/13 (c) 1 (d) none of these.</p>		
VERY SHORT ANSWERS (1mark)			
1.		If a digit is chosen at random from the digits 1,2,3,4,5,6,7,8,9 then find the probability that is odd.	C
2.		If three coins are tossed simultaneously, then find the probability of getting at least two heads.	U

3.	!?	A number x is chosen at random from the numbers -3,-2,-1,0,1,2,3 the probability that	HOT
4.	!?	The probability of guessing the correct answer to a certain test questions is $\frac{x}{12}$. If the probability of not guessing the correct answer to this question is $\frac{2}{3}$, then find x	HOT
5.	?	If a digit is chosen at random from the digits 1,2,3,4,5,6,7,8,9 then find the probability that is odd.	C
		Short Answer Questions I (SA) 2 Marks	level
1	?	A card is drawn at random from a deck of 52 playing cards. Find the probability that the card drawn is neither an ace nor a king.	C
2	?	A card is drawn at random from a pack of 52 playing cards. Find the probability that the card drawn is neither a face card nor a black card.	C
3	☼	Find the probability that a number selected from the numbers 1 to 25 is not a prime number and when each of the given number is equally likely to be selected.	U
4	☼	Write down the sample space of a i coin is tossed once ii Die is thrown once	U
6.	☼	There are 30 cards of same size in a bag on which number 1 to 30 are written. One card is taken out of the bag in random. Find the probability that the number as the selected card is not divisible by 3.	U
7.	!?	From a well shuffled pack of 52 cards, black aces and black queens are removed. From the remaining cards, a card is drawn at random. Find the probability of draw of a king or a queen.	HOT
8.	!?	A box contains 12 balls out of which x are black balls. i If one ball is drawn at random what is the probability that it will be a black ball ? ii If 6 more black balls are put on the box, the probability of drawing a black ball will be double than that (i).Find the value of x.	HOT
		Long Answer Questions II (SA) 3 Marks	Level

1		A die is thrown once. What is the probability of getting i) a number other than 4 ii) an odd number	C
2		Three coins are tossed simultaneously. What is the probability of getting a. at least one head b. at most two heads	U
3		A bag contains 6 red balls, 8 white balls, 5 green balls and 3 black balls. One ball is drawn at random from the bag. find the probability that the ball drawn is a. red or black b. not green c. Neither white nor black	U
4		Find the probability of getting 53 Fridays in a leap year	MD
5		The figure shows the top view of an open box that is divided into 6 compartments with walls of equal height. Each of the rectangles D , E , F has twice the area of each of the squares A , B and C . When a marble is dropped into the box at random , it falls into one of the compartments. What is the probability that it will fall into compartment F ? 	HOT
6		A square dart board is shown . The length of a side of the larger square is 1.5 times the length of a side smaller square. If a dart is thrown and lands on the larger square. What is the probability that it will land in the interior of the smaller square ? 	HOT
7		From a pack of 52 cards, the king, queen, jack, and ace of red colour are removed. From the remaining cards one is drawn at random. Find the probability that the card drawn is a) a face card b) a queen c) neither jack nor ace	MD

		Long Answer Questions (LA) 4 Marks	Level
1		<p>Cards are numbered from 5 to 25. What is the probability of getting</p> <p>a. a perfect square</p> <p>b. a prime number</p>	U
2		<p>A bag contains 6 red balls, 8 green balls and some blue balls. A ball is selected from the bag at random. If the probability of blue ball is double that of green ball, find the number of blue balls in the bag.</p>	HOT
3		<p>A bag contains 5 red marbles, 8 white marbles and 4 green marbles. What is the probability, that if marble is taken out of the bag at random will be (i) red, (ii) white, (iii) not green</p>	U
4		<p>A group consists of 12 persons, of which 3 are extremely patient, other 6 are extremely honest and the rest are extremely kind. A person from the group is selected at random. Assuming that each person is equally likely to be selected, find the probability of selecting a person who is</p> <p>i) Extremely patient ii) extremely kind or honest</p> <p>Which one do you prefer ?</p>	HOT

PROBABILITY

ANSWERS

SECTION A
MCQ

1. a	2. c	3. c	4. a	5. c
6. b	7. b	8. c	9. c	10. b

SECTION A

1) $5/9$

2) $2\frac{1}{2}$

3) $3/7$

4) 4^4

SECTION B

1) $11/13$

2) $5/13$

3) $16/25$

4) (H , T) (1,2,3,4,5,6)

5) $2/3$

6) $1/8$ 7) $x/12$, 3

SECTION C

1) $5/6$, $\frac{1}{2}$

2) $7/8$, $7/8$

3) $7/8$, $7/8$

4) $9/22$, $17/22$, $\frac{1}{2}$

5) $41/97$

6) $2/9$

7) $4/9$

SECTION D

1) $\frac{3}{23}$, $\frac{1}{23}$, $\frac{20}{23}$ 9) $\frac{1}{7}$, $\frac{1}{8}$
2) 16
3) $\frac{5}{17}$, $\frac{8}{17}$, $\frac{13}{17}$
4) i) $\frac{1}{4}$, ii) $\frac{3}{4}$
