CHAPTER – 14
PROBABILITY

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The theoretical probability (also called classical probability) of an event A, written as P(A), is defined as

$$P(A) = \frac{\text{Number of outcomes favourable to A}}{\text{Number of all possible outcomes of the experiment}}$$

COMPLIMENTARY EVENTS AND PROBABILITY

We denote the event 'not E' by $\overline{E}$. This is called the **complement** event of event E.
So, P(E) + P(not E) = 1
i.e., P(E) + P($\overline{E}$) = 1, which gives us P($\overline{E}$) = 1 – P(E).

- ☞ The probability of an event which is impossible to occur is 0. Such an event is called an **impossible event**.
- ☞ The probability of an event which is sure (or certain) to occur is 1. Such an event is called a **sure event** or a **certain event**.
- ☞ The probability of an event E is a number P(E) such that $0 \leq P(E) \leq 1$
- ☞ An event having only one outcome is called an elementary event. The sum of the probabilities of all the elementary events of an experiment is 1.

DECK OF CARDS AND PROBABILITY

A deck of playing cards consists of 52 cards which are divided into 4 suits of 13 cards each. They are black spades (♠) red hearts (♥), red diamonds (♦) and black clubs (♣).

The cards in each suit are Ace, King, Queen, Jack, 10, 9, 8, 7, 6, 5, 4, 3 and 2. Kings, Queens and Jacks are called face cards.

Example set of 52 poker playing cards

Suit	Ace	2	3	4	5	6	7	8	9	10	Jack	Queen	King
Clubs													
Diamonds													
Hearts													
Spades													

IMPORTANT QUESTIONS

Two dice are thrown together. Find the probability that the sum of the numbers on the top of the dice is (i) 9 (ii) 10

Solution:

Here, total number of outcomes, n(s) = 36

(i) Let A be the event of getting the sum of the numbers on the top of the dice is 9 then we have n(A) = 4 i.e. (3, 6), (4, 5), (5, 4), (6, 3)

Therefore, Probability of getting the sum of the numbers on the top of the dice is 9, $P(A) = \frac{n(A)}{n(S)}$

$\Rightarrow P(A) = \frac{4}{36} = \frac{1}{9}$

(ii) Let B be the event of getting the sum of the numbers on the top of the dice is 10 then we have n(B) = 3 i.e. (4, 6), (5, 5), (6, 4)

Therefore, Probability of getting the sum of the numbers on the top of the dice is 10, $P(B) = \frac{n(B)}{n(S)}$

$\Rightarrow P(B) = \frac{3}{36} = \frac{1}{12}$

One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting (i) red colour ace card (ii) a face card or a spade card (iii) a black face card

Solution:

Here, total number of outcomes, n(s) = 52

(i) Let A be the event of getting red colour ace card and we know that the number of red ace card is 2 then we have, n(A) = 2

Therefore, Probability of getting red colour ace card, $P(A) = \frac{n(A)}{n(S)}$

$\Rightarrow P(A) = \frac{2}{52} = \frac{1}{26}$

(ii) Let B be the event of getting a face card or a spade card and we know that there are 12 face cards, 13 spade cards and 3 face cards are spade then we have, n(B) = 12 + 13 – 3 = 22

Therefore, Probability of getting a face card or a spade card, $P(B) = \frac{n(B)}{n(S)}$

$\Rightarrow P(B) = \frac{22}{52} = \frac{11}{26}$

(ii) Let B be the event of getting a black face card and we know that there are 6 face cards are black then we have, n(C) = 6

Therefore, Probability of getting a black face card, $P(C) = \frac{n(C)}{n(S)}$

$\Rightarrow P(C) = \frac{6}{52} = \frac{3}{26}$

Questions for Practice

1. Two dice are thrown together. Find the probability that the product of the numbers on the top of the dice is (i) 6 (ii) 12 (iii) 7
2. A die is thrown twice. What is the probability that (i) 5 will not come up either time? (ii) 5 will come up at least once?
3. A lot consists of 144 ball pens of which 20 are defective and the others are good. Nuri will buy a pen if it is good, but will not buy if it is defective. The shopkeeper draws one pen at random and gives it to her. What is the probability that (i) She will buy it ? (ii) She will not buy it ?

4. One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting (i) a king of red colour (ii) a face card (iii) a red face card (iv) the jack of hearts (v) a spade (vi) the queen of diamonds

5. Five cards—the ten, jack, queen, king and ace of diamonds, are well-shuffled with their face downwards. One card is then picked up at random. (i) What is the probability that the card is the queen? (ii) If the queen is drawn and put aside, what is the probability that the second card picked up is (a) an ace? (b) a queen?

6. 12 defective pens are accidentally mixed with 132 good ones. It is not possible to just look at a pen and tell whether or not it is defective. One pen is taken out at random from this lot. Determine the probability that the pen taken out is a good one.

7. A piggy bank contains hundred 50p coins, fifty Re 1 coins, twenty Rs 2 coins and ten Rs 5 coins. If it is equally likely that one of the coins will fall out when the bank is turned upside down, what is the probability that the coin (i) will be a 50 p coin ? (ii) will not be a Rs 5 coin?

8. A box contains 5 red marbles, 8 white marbles and 4 green marbles. One marble is taken out of the box at random. What is the probability that the marble taken out will be (i) red ? (ii) white ? (iii) not green?

9. (i) A lot of 20 bulbs contain 4 defective ones. One bulb is drawn at random from the lot. What is the probability that this bulb is defective?
(ii) Suppose the bulb drawn in (i) is not defective and is not replaced. Now one bulb is drawn at random from the rest. What is the probability that this bulb is not defective ?

10. A box contains 90 discs which are numbered from 1 to 90. If one disc is drawn at random from the box, find the probability that it bears (i) a two-digit number (ii) a perfect square number (iii) a number divisible by 5.

11. A carton consists of 100 shirts of which 88 are good, 8 have minor defects and 4 have major defects. Jimmy, a trader, will only accept the shirts which are good, but Sujatha, another trader, will only reject the shirts which have major defects. One shirt is drawn at random from the carton. What is the probability that (i) it is acceptable to Jimmy? (ii) it is acceptable to Sujatha?

12. Two customers are visiting a particular shop in the same week (Monday to Saturday). Each is equally likely to visit the shop on any day as on another day. What is the probability that both will visit the shop on (i) the same day? (ii) consecutive days? (iii) different days?

13. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball is *double* that of a red ball, determine the number of blue balls in the bag.

14. A box contains 12 balls out of which x are black. If one ball is drawn at random from the box, what is the probability that it will be a black ball? If 6 more black balls are put in the box, the probability of drawing a black ball is now double of what it was before. Find x.

15. A jar contains 24 marbles, some are green and others are blue. If a marble is drawn at random from the jar, the probability that it is green is $\frac{2}{3}$. Find the number of blue marbles in the jar.

MCQ (1 MARK)

1. There are 6 marbles in a box with number 1 to6 marked on each of them . What is the probability of drawing a marble with number 2 ?

(a) $\frac{1}{6}$ (b) $\frac{1}{5}$ (c) $\frac{1}{3}$ (d) 1

2. A coin is flipped to decide which team starts the game . What is the probability of your team will start ?

(a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) 1 (d) 0

3. A die is thrown once . What will be the probability of getting a prime number ?

(a) $\frac{1}{6}$ (b) $\frac{1}{2}$ (c) 1 (d) 0

Cards are marked with numbers 1 to 25 are placed in the box and mixed thoroughly. One card is drawn at random from the box. Answer the following questions (Q4-Q13)

4. What is the probability of getting a number 5?

(a) 1 (b) 0 (c) $\frac{1}{25}$ (d) $\frac{1}{5}$

5. What is the probability of getting a number less than 11?

(a) 1 (b) 0 (c) $\frac{1}{5}$ (d) $\frac{2}{5}$

6. What is the probability of getting a number greater than 25?

(a) 1 (b) 0 (c) $\frac{1}{5}$ (d) $\frac{2}{5}$

7. What is the probability of getting a multiple of 5?

(a) 1 (b) 0 (c) $\frac{1}{25}$ (d) $\frac{1}{5}$

8. What is the probability of getting an even number?

(a) 1 (b) 0 (c) $\frac{12}{25}$ (d) $\frac{13}{25}$

9. What is the probability of getting an odd number?

(a) 1 (b) 0 (c) $\frac{12}{25}$ (d) $\frac{13}{25}$

10. What is the probability of getting a prime number?

(a) $\frac{8}{25}$ (b) $\frac{9}{25}$ (c) $\frac{12}{25}$ (d) $\frac{13}{25}$

11. What is the probability of getting a number divisible by 3?

(a) $\frac{8}{25}$ (b) $\frac{9}{25}$ (c) $\frac{12}{25}$ (d) $\frac{13}{25}$

12. What is the probability of getting a number divisible by 4?

(a) $\frac{8}{25}$ (b) $\frac{9}{25}$ (c) $\frac{6}{25}$ (d) $\frac{3}{25}$

13. What is the probability of getting a number divisible by 7?

(a) $\frac{8}{25}$ (b) $\frac{9}{25}$ (c) $\frac{6}{25}$ (d) $\frac{3}{25}$

14. A bag has 4 red balls and 2 yellow balls. A ball is drawn from the bag without looking into the bag. What is probability of getting a red ball?

(a) $\frac{1}{6}$ (b) $\frac{2}{3}$ (c) $\frac{1}{3}$ (d) 1

15. A bag has 4 red balls and 2 yellow balls. A ball is drawn from the bag without looking into the bag. What is probability of getting a yellow ball?

(a) $\frac{1}{6}$ (b) $\frac{2}{3}$ (c) $\frac{1}{3}$ (d) 1

One card is drawn from a well-shuffled deck of 52 cards. Answer the question from 1 to 12.

16. Find the probability of getting a king of red colour

(a) $\frac{1}{26}$ (b) $\frac{2}{13}$ (c) $\frac{1}{13}$ (d) $\frac{3}{26}$

17. Find the probability of getting a face card.

(a) $\frac{1}{26}$ (b) $\frac{2}{13}$ (c) $\frac{1}{13}$ (d) $\frac{3}{13}$

18. Find the probability of getting a black face card

(a) $\frac{1}{26}$ (b) $\frac{2}{13}$ (c) $\frac{1}{13}$ (d) $\frac{3}{26}$

19. Find the probability of getting an ace.

(a) $\frac{1}{26}$ (b) $\frac{2}{13}$ (c) $\frac{1}{13}$ (d) $\frac{3}{26}$

20. Find the probability of getting a black card.

(a) $\frac{1}{2}$ (b) $\frac{2}{13}$ (c) $\frac{1}{13}$ (d) $\frac{3}{26}$

21. Find the probability of getting a face card or an ace.

(a) $\frac{4}{13}$ (b) $\frac{2}{13}$ (c) $\frac{1}{13}$ (d) $\frac{3}{13}$

22. Find the probability of getting face card or black card.

(a) $\frac{4}{13}$ (b) $\frac{8}{13}$ (c) $\frac{7}{13}$ (d) $\frac{3}{13}$

23. Find the probability of getting a king or red card.

(a) $\frac{4}{13}$ (b) $\frac{8}{13}$ (c) $\frac{7}{13}$ (d) $\frac{3}{13}$

24. Find the probability of getting a king and red card.

(a) $\frac{1}{26}$ (b) $\frac{2}{13}$ (c) $\frac{1}{13}$ (d) $\frac{3}{26}$

25. Find the probability of getting a king or queen card.

(a) $\frac{1}{26}$ (b) $\frac{2}{13}$ (c) $\frac{1}{13}$ (d) $\frac{3}{26}$