Exercise 14.1

1. Complete the following statements:

(i) Probability of an event E + Probability of the event 'not E' = ……

Sol. Probability of an event E + Probability of the event 'not E' = 1

(ii) The probability of an event that cannot happen is… … Such an event is called…….

Sol. The probability of an event that cannot happen is 0. Such an event is called impossible event.

(iii) The probability of an event that is certain to happen is …… Such an event is called……

Sol. The probability of an event that is certain to happen is 1. Such an event is called sure event.

(iv) The sum of the probabilities of all the elementary events of an experiment is……

Sol. The sum of the probabilities of all the elementary events of an experiment is 1.

(v) The probability of an event is greater than or equal to ……and less than or equal to ……

Sol. The probability of an event is greater than or equal to 0 and less than or equal to 1.

2. Which of the following experiments have equally likely outcomes? Explain.

(i) A driver attempts to start a car. The car starts or does not start.

Sol. The given statement has not equally likely outcomes. There are many other factors which effect the starting of the car like wiring, fuel etc.

(ii) A player attempts to shoot a basketball. She/he shoots or misses the shot.

Sol. The given statement has not equally likely outcomes. As it depends on the ability of a player.

(iii) A trial is made to answer a true-false question. The answer is right or wrong.

Sol. The given statement has equally likely outcomes. As the answer is either right or wrong.

(iv) A baby is born. It is a boy or a girl.
Sol. The given statement has equally likely outcomes. As the new born baby is either a boy or a girl.

3. Why is tossing a coin considered to be a fair way of deciding which team should get the ball at the beginning of a football game?
Sol. Tossing of a coin has equally likely outcomes head or tail so, it is a fair way of deciding which team should get the ball at the beginning of a football game.

4. Which of the following cannot be the probability of an event?
(A) $\frac{2}{3}$ (B) –1.5 (C) 15% (D) 0.7
Sol. (B) –1.5 [Because the probability of an event is greater than or equal to 0 and less than or equal to 1]

5. If P(E) = 0.05, what is the probability of 'not E'?
Sol. We know P(E) + P(not E) = 1
⇒ 0.05 + P(not E) = 1
⇒ P(not E) = 1 - 0.05
⇒ P(not E) = 0.95 Ans.

6. A bag contains lemon flavoured candies only. Malini takes out one candy without looking into the bag. What is the probability that she takes out (i) an orange flavoured candy? (ii) a lemon flavoured candy?
Sol. The bag contains lemon flavoured candies only.
(i) And no of orange flavoured candy = 0
∴ P (orange flavoured candy) = 0 [∵ it is impossible event]
(ii) P (lemon flavoured candy) = 1 [∵ it is sure event] Ans.

7. It is given that in a group of 3 students, the probability of 2 students not having the same birthday is 0.992. What is the probability that the 2 students have the same birthday?
Sol. It is given that the probability of 2 students not having the same birthday is 0.992. Let E is the event of same birthday.
We know, P(E) + P (not E) = 1
⇒ P(E) + 0.992 = 1
⇒ P(E) = 1 - 0.992

$\Rightarrow P(E) = 0.008$

$\therefore$ The probability of 2 students has the same birthday is 0.008. Ans.

8. A bag contains 3 red balls and 5 black balls. A ball is drawn at random from the bag. What is the probability that the ball drawn is (i) red? (ii) not red?

Sol. Total no of balls in the bag = 8 balls (3 red + 5 black)

(i) $P(\text{red ball}) = \frac{\text{no.of red balls}}{\text{Total no of balls}}$

$= \frac{3}{8}$

(ii) P (not red ball) = 1 - P (red ball)

$= 1 - \frac{3}{8}$

$= \frac{8-3}{8}$

$= \frac{5}{8}$

$\therefore$ The probability that the ball drawn is (i) red is $\frac{3}{8}$ (ii) not red is $\frac{5}{8}$ Ans.

9. 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?

Sol. Total no of marbles in the box = 5 + 8 + 4

= 17 marbles

(i) $P(\text{red marble}) = \frac{\text{no. of red marbles}}{\text{Total no. of marbles}}$

$= \frac{5}{17}$

(ii) $P(\text{white marble}) = \frac{\text{no.of white marbles}}{\text{Total no of marbles}}$

$= \frac{8}{17}$

(iii) P (not green marble) = 1 - P (green marble)

$= 1 - \frac{\text{no.of green marbles}}{\text{Total no of marbles}}$

$= 1 - \frac{4}{17}$

$= \frac{17-4}{17}$

$= \frac{13}{17}$

$\therefore$ The probability that the marble taken out will be (i) red is $\frac{5}{17}$ (ii) white is $\frac{8}{17}$ and (iii) not green is $\frac{13}{17}$ Ans.

10. A piggy bank contains hundred 50p coins, fifty Rs. 1 coin, 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 50p coin? (ii) will not be a Rs. 5 coins?

Sol. Total no coins in the piggy bank = 100 + 50 + 20 + 10

= 180 coins

(i) P (50 paise coin) = $\frac{\text{no.of 50 paise coins}}{\text{Total no of coins}}$

= $\frac{100}{180}$

= $\frac{5}{9}$

(ii) P (not a Rs. 5 coin) = 1 – P (Rs. 5 coin)

= 1 - $\frac{\text{no.of Rs. 5 coins}}{\text{Total no of coins}}$

= 1 - $\frac{10}{180}$

= 1 - $\frac{1}{18}$

= $\frac{18-1}{18}$

= $\frac{17}{18}$

∴ The probability coin (i) will be a 50p coin is $\frac{5}{9}$

and (ii) will not be a Rs. 5 coins $\frac{17}{18}$. Ans.

11. Gopi buys a fish from a shop for his aquarium. The shopkeeper takes out one fish at random from a tank containing 5 male fish and 8 female fish. What is the probability that the fish taken out is a male fish?

Sol. Total no of fish in tank = 13 [5 male fish and 8 female fish]

P (male fish) = $\frac{\text{no.of male fish}}{\text{Total no of fish}}$ = $\frac{5}{13}$

∴ The probability that the fish taken out is a male fish is $\frac{5}{13}$ Ans.

12. A game of chance consists of spinning an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8, and these are equally likely outcomes. What is the probability that it will point at
(i) 8? (ii) an odd number? (iii) a number greater than 2? (iv) a number less than 9?

Sol. Possible outcomes = 8 [1, 2, 3, 4, 5, 6, 7, 8]

(i) P (8) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

= $\frac{1}{8}$ Ans.

(ii) odd number = {1, 3, 5, 7}

P (odd number) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

= $\frac{4}{8}$

= $\frac{1}{2}$

(iii) number greater than 2 = {3, 4, 5, 6, 7, 8}

P (number greater than 2) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

= $\frac{6}{8}$

= $\frac{3}{4}$

(iv) a number less than 9= {1, 2, 3, 4, 5, 6, 7, 8}

P (number less than 9) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

= $\frac{8}{8}$

= 1

∴ The probability that it will point at (i) 8 is $\frac{1}{8}$, (ii) an odd number is $\frac{1}{2}$, (iii) a number greater than 2 is $\frac{3}{4}$, (iv) a number less than 9 is 1. Ans.

13. A die is thrown once. Find the probability of getting (i) a prime number; (ii) a number lying between 2 and 6; (iii) an odd number.

Sol. Possible outcomes = {1, 2, 3, 4, 5, 6}

(i) Prime number = {2, 3, 5}

∴ P (prime number) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

= $\frac{3}{6}$

= $\frac{1}{2}$ Ans.

(ii) numbers lying between 2 and 6= {3, 4, 5}

∴ P (a number lying between 2 and 6) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

= $\frac{3}{6}$

= $\frac{1}{2}$ Ans.

(iii) odd number = {1, 3, 5}

∴ P (an odd number) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

= $\frac{3}{6}$

= $\frac{1}{2}$ Ans.

14. 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

Sol. Total no of cards = 52

(i) kings of red colour = 2

$$\therefore P(\text{a king of red colour}) = \frac{\text{favourable outcomes}}{\text{Possible outcomes}}$$
$$= \frac{2}{52}$$
$$= \frac{1}{26} \text{ Ans.}$$

(ii) No. of face cards = 12

$$\therefore P(\text{a face card}) = \frac{\text{favourable outcomes}}{\text{Possible outcomes}}$$
$$= \frac{12}{52}$$
$$= \frac{3}{13} \text{ Ans.}$$

(iii) red face card = 6

$$\therefore P(\text{red face card}) = \frac{\text{favourable outcomes}}{\text{Possible outcomes}}$$
$$= \frac{6}{52}$$
$$= \frac{3}{26} \text{ Ans.}$$

(iv) the jack of hearts = 1

$$\therefore P(\text{jack of hearts}) = \frac{\text{favourable outcomes}}{\text{Possible outcomes}}$$
$$= \frac{1}{52} \text{ Ans.}$$

(v) no. of spade cards = 13

$$\therefore P(\text{spade card}) = \frac{\text{favourable outcomes}}{\text{Possible outcomes}}$$
$$= \frac{13}{52}$$
$$= \frac{1}{4} \text{ Ans.}$$

(vi) the queen of diamonds = 1

$$\therefore P(\text{queen of diamond}) = \frac{\text{favourable outcomes}}{\text{Possible outcomes}}$$
$$= \frac{1}{52} \text{ Ans.}$$

15. 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?

Sol. Total no of cards = 5

(i) No of cards of queen = 1

$$\therefore P(\text{queen}) = \frac{\text{favourable outcomes}}{\text{Possible outcomes}}$$
$$= \frac{1}{5} \text{ Ans.}$$

(ii) If the queen is drawn and put aside, then the number of cards left = 4

(a) No of ace cards = 1

$$\therefore P(\text{ace}) = \frac{\text{favourable outcomes}}{\text{Possible outcomes}}$$
$$= \frac{1}{4} \text{ Ans.}$$

(b) No of cards of queen = 0

$$\therefore P(\text{queen}) = \frac{\text{favourable outcomes}}{\text{Possible outcomes}}$$
$$= \frac{0}{4}$$
$$= 0 \text{ Ans.}$$

16. 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.

Sol. No. of defective pens = 12
No. of good pens = 132
Total no of pens = 12 + 132 = 144

$$\therefore P(\text{good pen}) = \frac{\text{favourable outcomes}}{\text{Possible outcomes}}$$
$$= \frac{132}{144}$$
$$= \frac{11}{12} \text{ Ans.}$$

17. (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?

Sol. Total no of bulbs = 20

No. of defective bulbs = 4

$\therefore$ P (defective bulb = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

$= \frac{4}{20}$

$= \frac{1}{5}$ Ans.

(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?

Sol. Since the drawn-out bulb is non-defective and not replaced so 19 bulbs are left.

Now the no of non-defective bulbs = 16 – 1 = 15

and total no of bulbs = 19

$\therefore$ P (non-defective bulb) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

$= \frac{15}{19}$ Ans.

18. 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.

Sol. Total no. of discs in the box = 90

(i) Two digits number = 81 [from 10 to 90]

$\therefore$ P (a two-digit number) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

$= \frac{81}{90}$

$= \frac{9}{10}$ Ans.

(ii) a perfect square number = 9 [1, 4, 9, 16, 25, 36, 49, 64, 81]

$\therefore$ P (a perfect square number) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

$= \frac{9}{90}$

$= \frac{1}{10}$ Ans.

(iii) a number divisible by 5 = 18 [5, 10, 15, 20, ...85, 90]

$\therefore$ P (a perfect square number) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

$= \frac{18}{90}$

$= \frac{1}{5}$ Ans.

19. A child has a die whose six faces show the letters as given below: A, B, C, D, E and A. The die is thrown once. What is the probability of getting (i) A? (ii) D?

Sol. (i) Possible outcomes = 6 [A, B, C, D, E, and A]

(i) Favourable outcomes = 2 [A, A]

$\therefore$ P (A) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

$= \frac{2}{6}$

$= \frac{1}{3}$ Ans.

(ii) Favourable outcomes = 1 [D]

$\therefore$ P (D) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

$= \frac{1}{6}$

$= \frac{1}{6}$ Ans.

20. Suppose you drop a die at random on the rectangular region shown in fig. What is the probability that it will land inside the circle with diameter 1m?

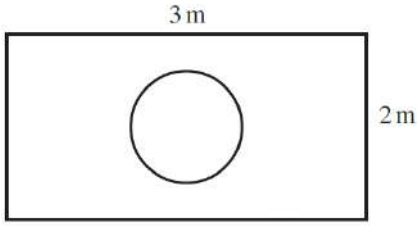
Sol. Area of rectangle = $3 \times 2\ m^2$

$= 6\ m^2$

And area of circle = πr^2

$= \pi \frac{1}{2} \times \frac{1}{2}\ m^2$

$= \frac{\pi}{4}\ m^2$



$\therefore$ P (D) = $\frac{\text{Area of circle}}{\text{Area of rectangle}}$

$= \frac{\frac{\pi}{4} m^2}{6\ m^2}$

$= \frac{\pi}{24}$ Ans.

21. 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?

Sol. Total number of pens in the lot = 144
Number of defective pens = 20
∴ Number of non-defective pens = 144 – 20
= 124

(i) She will buy it if the pen is non-defective

$$\therefore P(\text{Nuri will buy the pen}) = \frac{\text{favourable outcomes}}{\text{Possible outcomes}}$$
$$= \frac{124}{144}$$
$$= \frac{31}{36} \text{ Ans.}$$

(ii) She will not buy it if the pen is defective

$$\therefore P(\text{Nuri will not buy the pen}) = \frac{\text{favourable outcomes}}{\text{Possible outcomes}}$$
$$= \frac{20}{144}$$
$$= \frac{5}{36} \text{ Ans.}$$

22. Two dice are through at the same time. All the possible outcomes are noted. Now, complete the following table by the probability that the sum of the two numbers appearing on the top of the dice is:

Sum on 2 dice'	2	3	4	5	6	7	8	9	10	11	12
Probability	$\frac{1}{36}$						$\frac{5}{36}$				$\frac{1}{36}$

(ii) A student argues that 'there are 11 possible outcomes 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12. Therefore, each of them has a probability $\frac{1}{11}$. Do you agree with this argument? Justify your answer.

Sol. Possible outcomes = {(1, 1), (1, 2), (1, 3), (1, 4), ... (6, 6)}
Let A (sum 2) = {(1, 1)}

$$\therefore P(\text{sum 2}) = \frac{\text{favourable outcomes}}{\text{Possible outcomes}}$$
$$= \frac{1}{36}$$

B (sum 3) = {(1, 2), (2, 1)}

$\therefore$ P (sum 3) = $\frac{2}{36}$

= $\frac{1}{18}$

C (sum 4) = {(1, 3), (2, 2), (3, 1)}

$\therefore$ P (sum 4) = $\frac{3}{36}$

= $\frac{1}{12}$

D (sum 5) = {(1, 4), (2, 3), (3, 2), (4, 1)}

$\therefore$ P (sum 5) = $\frac{4}{36}$

= $\frac{1}{9}$

E (sum 6) = {(1, 5), (2, 4), (3, 3), (4, 2), (5, 1)}

$\therefore$ P (sum 6) = $\frac{5}{36}$

F (sum 7) = {(1, 6), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1)}

$\therefore$ P (sum 7) = $\frac{6}{36}$

= $\frac{1}{6}$

G (sum 8) = {(2, 6), (3, 5), (4, 4), (5, 3), (6, 2)}

$\therefore$ P (sum 8) = $\frac{5}{36}$

H (sum 9) = {(3, 6), (4, 5), (5, 4), (6, 3)}

$\therefore$ P (sum 9) = $\frac{4}{36}$

= $\frac{1}{9}$

I (sum 10) = {(4, 6), (5, 5), (6, 4)}

$\therefore$ P (sum 10) = $\frac{3}{36}$

= $\frac{1}{12}$

J (sum 11) = {(5, 6), (5, 6)}

$\therefore$ P (sum 11) = $\frac{2}{36}$

= $\frac{1}{18}$

And K (sum 12) = {(6, 6)}

$\therefore$ P (sum 12) = $\frac{1}{36}$

Sum on 2 dice'	2	3	4	5	6	7	8	9	10	11	12
Probability	$\frac{1}{36}$	$\frac{1}{18}$	$\frac{1}{12}$	$\frac{1}{9}$	$\frac{5}{36}$	$\frac{1}{6}$	$\frac{5}{36}$	$\frac{1}{9}$	$\frac{1}{12}$	$\frac{1}{18}$	$\frac{1}{36}$

23. A game consists of tossing a one-rupee coin 3 times and noting its outcome each time. Hanif wins if all the tosses give the same result i.e., three heads or three tails, and loses otherwise. Calculate the probability that Hanif will lose the game.

Sol. Possible outcomes

= {(HHH), (HHT), (HTH), (THH), (HTT), (THT), (TTH), (TTT)}

A (Hanif will lose the game)

= {(HHT), (HTH), (THH), (HTT), (THT), (TTH)}

$\therefore$ P (Hanif will lose the game) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

= $\frac{6}{8}$

= $\frac{3}{4}$ Ans.

24. 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?

Sol. Possible outcomes = {(1, 1), (1, 2), (1, 3), (1, 4), ... (6, 6)}

(i) A (5 will come up either time)

(ii) = {(1, 5), (2, 5), (3, 5), (4, 5), (5, 5), (6, 5),
(5, 1), (5, 2), (5, 3), (5, 4), (5, 6)}

$\therefore$ P (5 will come up either time) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

= $\frac{11}{36}$

$\therefore$ P (5 will not come up either time) = 1 - P (5 will come up either time)

= 1 - $\frac{11}{36}$

= $\frac{25}{36}$ Ans.

(ii) 5 will come up at least once = {(1, 5), (2, 5), (3, 5), (4, 5), (5, 5), (6, 5),
(5, 1), (5, 2), (5, 3), (5, 4), (5, 6)}

$\therefore$ P (5 will come up at least once) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

= $\frac{11}{36}$ Ans.

25. Which of the following arguments are correct and which are not correct? Give reasons for your answer.

(i) If two coins are tossed simultaneously there are three possible outcomes—two heads, two tails or one of each. Therefore, for each of these outcomes, the probability is $\frac{1}{3}$.

Sol. Possible outcomes = {(HH), (HT), (TH), (TT)}

$\therefore$ P (2 Heads) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

$= \frac{1}{4}$

$\therefore$ P (2 Tails) = $\frac{1}{4}$

$\therefore$ P (1 Head and 1 Tail) = $\frac{2}{4}$

$= \frac{1}{2}$

$\therefore$ The given statement is not correct. Ans.

(ii) If a die is thrown, there are two possible outcomes—an odd number or an even number. Therefore, the probability of getting an odd number is $\frac{1}{2}$.

Sol. Possible outcomes = {1, 2, 3, 4, 5, 6}

$\therefore$ P (odd number) = $\frac{\text{favourable outcomes}}{\text{Possible outcomes}}$

$= \frac{3}{6} = \frac{1}{2}$

$\therefore$ P (even number) = $\frac{3}{6}$

$= \frac{1}{2}$

$\therefore$ The given statement is correct. Ans.