CHAPTER 15

PROBABILITY

ONE MARK QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. The probability that a number selected at random from the numbers 1, 2, 3, ..., 15 is a multiple of 4 is

(a) $\frac{4}{15}$ (b) $\frac{2}{15}$

(c) $\frac{1}{15}$ (d) $\frac{1}{5}$

Ans : [Board 2020 Delhi Basic]

Total possible outcome, $n(S) = 15$

Number of multiples of 4 between 1 to 15 are 4, 8, 12 i.e. 3 favourable outcome.

$$n(E) = 3$$

Required Probability, $P(E) = \frac{n(E)}{n(S)}$

$= \frac{3}{15} = \frac{1}{5}$

Thus (d) is correct option.

2. Two coins are tossed simultaneously. The probability of getting at most one head is

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

(c) $\frac{2}{3}$ (d) $\frac{3}{4}$

Ans : [Board 2020 OD Basic]

All possible outcomes are {HH, HT, TH, TT}.

Thus $n(S) = 4$

Favourable outcomes are {HT, TH, TT}.

$$n(E) = 3$$

Probability of getting at most one head,

$$P(E) = \frac{n(E)}{n(S)} = \frac{3}{4}$$

Thus (d) is correct option.

3. If an event cannot occur, then its probability is

(a) 1 (b) $\frac{3}{4}$

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

Ans :

The event which cannot occur is said to be impossible event and probability of impossible event is zero.

Thus (d) is correct option.

4. Which of the following cannot be the probability of an event?

(a) $\frac{1}{3}$ (b) 0.1

(c) 3% (d) $\frac{17}{16}$

Ans :

Probability of an event always lies between 0 and 1.

Thus (d) is correct option.

5. An event is very unlikely to happen. Its probability is closest to

(a) 0.0001 (b) 0.001

(c) 0.01 (d) 0.1

Ans :

The probability of an event which is very unlikely to happen is closest to zero and from the given options 0.0001 is closest to zero.

Thus (a) is correct option.

6. If the probability of an event is p, then the probability of its complementary event will be

(a) $p-1$ (b) p

(c) $1-p$ (d) $1-\frac{1}{p}$

Ans :

Since,

$$P(E) + P(\overline{E}) = 1$$

$$P(E) = 1 - P(\overline{E})$$

$$= 1 - p$$

Thus (c) is correct option.

7. The probability expressed as a percentage of a particular occurrence can never be

(a) less than 100

(b) less than 0

(c) greater than 1

(d) anything but a whole number

Ans :

We know that the probability expressed as a percentage always lie between 0 and 100. So, it cannot be less than 0.

Thus (b) is correct option.

8. The $P(A)$ denotes the probability of an event A, then

(a) $P(A) < 0$ (b) $P(A) > 1$

(c) $0 \leq P(A) \leq 1$ (d) $-1 \leq P(A) \leq 1$

Ans :

Probability of an event always lies between 0 and 1.

Thus (c) is correct option.

9. If a card is selected from a deck of 52 cards, then the probability of its being a red face card is

(a) $\frac{3}{26}$ (b) $\frac{3}{13}$

(c) $\frac{2}{13}$ (d) $\frac{1}{2}$

Ans :

In a deck of 52 cards, there are 12 face cards i.e., 6 red and 6 black cards.

$$n(S) = 52$$

$$n(E) = 6$$

So, probability of getting a red face card,

$$P(E) = \frac{n(E)}{n(S)} = \frac{6}{52} = \frac{3}{26}$$

Thus (a) is correct option.

10. A card is drawn from a deck of 52 cards. The event E is that card is not an ace of hearts. The number of outcomes favourable to E is

(a) 4 (b) 13

(c) 48 (d) 51

Ans :

In a deck of 52 cards, there are 13 cards of heart and 1 is ace of heart.

Hence, the number of outcomes favourable

$$n(E) = 52 - 1 = 51$$

Thus (d) is correct option.

11. When a die is thrown, the probability of getting an odd number less than 3 is

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

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

Ans :

Odd number less than 3 is 1 only.

$$n(S) = 6$$

$$n(E) = 1$$

So, probability of getting an odd number less than 3,

$$P(E) = \frac{n(E)}{n(S)} = \frac{1}{6}$$

Thus (a) is correct option.

12. The probability of getting a bad egg in a lot of 400 is 0.035. The number of bad eggs in the lot is

(a) 7 (b) 14

(c) 21 (d) 28

Ans :

We have $n(S) = 400$

$$n(E) = x$$

$$P(E) = \frac{n(E)}{n(S)}$$

$$0.035 = \frac{x}{400}$$

$$x = 0.035 \times 400 = 14$$

Thus (b) is correct option.

13. A girl calculates that the probability of her winning the first prize in a lottery is 0.08. If 6000 tickets are sold, then how many tickets has she bought?

(a) 40 (b) 240

(c) 480 (d) 750

Ans :

Total number of sold tickets are 6000. Let she bought x tickets.

Now $n(S) = 6000$

$$n(E) = x$$

$$P(E) = \frac{n(E)}{n(S)}$$

$$0.08 = \frac{x}{6000}$$

$$x = 0.08 \times 6000 = 480$$

Hence, she bought 480 tickets.

Thus (c) is correct option.

14. One ticket is drawn at random from a bag containing tickets numbered 1 to 40. The probability that the selected ticket has a number which is a multiple of 5 is

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

(c) $\frac{4}{5}$ (d) $\frac{1}{3}$

Ans :

Multiples of 5 are 5, 10, 15, 20, 25, 30, 35 and 40 thus 8 outcome.

$$n(S) = 40$$

$$n(E) = 8$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{8}{40} = \frac{1}{5}$$

Thus (a) is correct option.

15. Someone is asked to take a number from 1 to 100. The probability that it is a prime, is

(a) $\frac{8}{25}$ (b) $\frac{1}{4}$

(c) $\frac{3}{4}$ (d) $\frac{13}{50}$

Ans :

Prime numbers between 1 to 100 are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89 and 97, i.e 25 outcome.

$$n(S) = 100$$

$$n(E) = 25$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{25}{100} = \frac{1}{4}$$

Thus (c) is correct option.

16. The probability of getting a number greater then 3 in throwing a die is

(a) $\frac{1}{3}$ (b) $\frac{1}{4}$

(c) $\frac{3}{4}$ (d) $\frac{2}{3}$

Ans :

$$n(S) = 6$$

$$n(E) = 2$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{4}{6} = \frac{2}{3}$$

Thus (d) is correct option.

17. Out of one digit prime numbers, one number is selected at random. The probability of selecting an even number is

(a) $\frac{1}{3}$ (b) $\frac{1}{4}$

(c) $\frac{3}{4}$ (d) $\frac{2}{3}$

Ans :

One digit prime numbers are 2, 3, 5, 7. Out of these numbers, only the number 2 is even.

$$n(S) = 4$$

$$n(E) = 1$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{1}{4}$$

Thus (b) is correct option.

18. A bag contains 3 red and 2 blue marbles. If a marble is drawn at random, then the probability of drawing a blue marble is:

(a) $\frac{2}{5}$ (b) $\frac{1}{4}$

(c) $\frac{3}{5}$ (d) $\frac{2}{3}$

Ans :

There are 5 marbles in the bag. Out of these 5 marbles one can be choose in 5 ways. Since, the bag contains 2 blue marbles. Therefore, one blue marble can be drawn in 2 ways.

$$n(S) = 5$$

$$n(E) = 2$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{2}{5}$$

Thus (b) is correct option.

19. A single letter is selected at random from the word

PROBABILITY. The probability that the selected letter is a vowel is

(a) $\frac{2}{11}$ (b) $\frac{3}{11}$

(c) $\frac{4}{11}$ (d) 0

Ans :

There are 11 letter in word PROBABILITY. Out of these 11 letter, 4 letter are vowels.

$$n(S) = 11$$

$$n(E) = 4$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{4}{11}$$

Thus (c) is correct option.

20. A fair die is thrown once. The probability of getting a composite number less than 5 is

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

(c) $\frac{2}{3}$ (d) 0

Ans :

The outcomes are 1, 2, 3, 4, 5, 6. Out of these, 4 is the only composite number which is less than 5.

$$n(S) = 6$$

$$n(E) = 1$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{1}{6}$$

Thus (b) is correct option.

21. If a letter is chosen at random from the letter of English alphabet, then the probability that it is a letter of the word DELHI is

(a) $\frac{1}{5}$ (b) $\frac{1}{26}$

(c) $\frac{5}{26}$ (d) $\frac{21}{26}$

Ans :

The English alphabet has 26 letters in all. The word DELHI has 5 letter, so the number of favourable outcomes is 5.

$$n(S) = 26$$

$$n(E) = 5$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{5}{26}$$

Thus (c) is correct option.

22. The probability that a two digit number selected at random will be a multiple of 3 and not a multiple of 5 is

(a) $\frac{2}{15}$ (b) $\frac{4}{15}$

(c) $\frac{1}{15}$ (d) $\frac{4}{90}$

Ans :

24 out of the 90 two digit numbers are divisible by 3 and not by 5.

$$n(S) = 90$$

$$n(E) = 24$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{24}{90} = \frac{4}{15}$$

Thus (b) is correct option.

23. If in a lottery, there are 5 prizes and 20 blanks, then the probability of getting a prize is

(a) $\frac{2}{5}$ (b) $\frac{4}{5}$

(c) $\frac{1}{5}$ (d) 1

Ans :

We have $n(S) = 20 + 5 = 25$

$$n(E) = 5$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{5}{25} = \frac{1}{5}$$

Thus (c) is correct option.

24. If a number x is chosen at random from the numbers $-2, -1, 0, 1, 2$. Then, the probability that $x^2 < 2$ is

(a) $\frac{2}{5}$ (b) $\frac{4}{5}$

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

Ans :

Total number of possible outcomes are 5.

We observe that $x^2 < 2$ when x takes anyone of the following three values -1, 0 and 1.

We have $n(S) = 5$

$$n(E) = 3$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{3}{5}$$

Thus (d) is correct option.

25. Which of the following relationship is the correct?

(a) $P(E) + P(\overline{E}) = 1$ (b) $P(\overline{E}) - P(E) = 1$

(c) $P(E) = 1 + P(\overline{E})$ (d) None of these

Ans :

$$P(E) + P(\overline{E}) = 1$$

Thus (a) is correct option.

26. Two dice are thrown together. The probability that sum of the two numbers will be a multiple of 4, is:

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

(c) $\frac{1}{8}$ (d) $\frac{1}{4}$

Ans :

Total number of outcomes is 36.

Here, all possible outcome is (1, 3), (2, 2), (2, 6), (3, 1), (3, 5), (4, 4), (5, 3), (6, 2) and (6, 6),

$$n(S) = 36$$

$$n(E) = 9$$

P(sum of two numbers will be multiple of 4)

$$P(E) = \frac{n(E)}{n(S)} = \frac{9}{36} = \frac{1}{4}$$

Thus (d) is correct option.

27. A letter is chosen at random from the letters of the word ASSASSINATION, then the probability that the letter chosen is a vowel is in the form of $\frac{6}{2x+1}$, then x is equal to

(a) 5 (b) 6

(c) 7 (d) 8

Ans :

There are 13 letters in the word ASSASSINATION out of which one letter can be chosen in 13 ways. Hence, total number of outcomes are 13. There are 6 vowels in the word ASSISSINATION. So, there are 6 ways of selecting a vowel.

$$n(S) = 13$$

$$n(E) = 6$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{6}{13}$$

But given that, $\frac{6}{2x+1} = \frac{6}{13}$

$$2x+1 = 13 \Rightarrow x = 6$$

Thus (b) is correct option.

28. Ramesh buys a fish from a shop for his aquarium. The shopkeeper takes out one fish at random a tank containing 5 male fish and 9 female fish. Then, the probability that the fish taken out is a male fish, is

(a) $\frac{5}{13}$ (b) $\frac{5}{14}$

(c) $\frac{6}{13}$ (d) $\frac{7}{13}$

Ans :

There are $14 = (5+9)$ fish out of which one can be chosen in 14 ways.

There are 5 male fish out of which one male fish can be chosen in 5 ways.

$$n(S) = 14$$

$$n(E) = 5$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{5}{14}$$

Thus (b) is correct option.

29. A number x is selected from the numbers 1, 2, 3 and then a second number y is randomly selected from the numbers 1, 4, 9 then the probability that the product xy of the two numbers will be less than 9 is

(a) $\frac{3}{7}$ (b) $\frac{4}{9}$

(c) $\frac{5}{9}$ (d) $\frac{7}{9}$

Ans :

Number x can be selected in three ways and corresponding to each such way there are three ways of selecting number y.

Therefore two numbers can be selected in 9 ways as (1, 1), (1, 4), (1, 9), (2, 1), (2, 4), (2, 9), (3, 1), (3, 4), (3, 9) So, total numbers of possible outcomes are 9.

The product xy will be less than 9, if x and y are chosen in one of the following ways: (1, 1), (1, 4), (2, 1), (2, 4), (3, 1)

$$n(S) = 9$$

$$n(E) = 5$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{5}{9}$$

Thus (c) is correct option.

30. There are 1000 sealed envelopes in a box. 10 of them contain a cash prize of ₹ 100 each, 100 of them contain a cash prize of ₹ 50 each and 200 of them contain a cash prize of ₹ 10 each and rest do not contain any cash prize. If they are well-shuffled and an envelope is picked up out, then the probability that is contains no cash prize is

(a) 0.65 (b) 0.69

(c) 0.54 (d) 0.57

Ans :

Total number of envelopes in the box = 1000

Number of envelopes containing cash prize

$$= 10 + 100 + 200 = 310$$

Number of envelopes containing no cash

$$= 1000 - 310 = 690$$

Now $n(S) = 1000$

$$n(E) = 690$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{690}{1000} = 0.69$$

Thus (b) is correct option.

Fill in the Blank Questions

31. The probability of an event that is certain to happen is .... Such an event is called ....

Ans :

1, sure or certain event

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

Ans :

1

33. On a single roll of a die, the probability of getting a number 8 is ....

Ans :

zero

34. The probability of an event is greater than or equal to .... and less than or equal to ....

Ans :

0, 1

35. On a single roll of a die, the probability of getting a number less than 7 is ....

Ans :

one

36. A number is chosen at random from the numbers $-5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5$. Then the probability that square of this number is less than or equal to 1 is ....

Ans : [Board 2020 SQP Standard]

Given numbers are $-5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5$ and their squares are 25, 16, 9, 4, 1, 0, 1, 4, 9, 16, 25.

Total number of outcomes $n(S) = 11$.

Favourable outcome are -1, 0, 1, thus number of favourable outcomes is $n(E) = 3$.

Required probability, $P(E) = \frac{n(E)}{n(S)} = \frac{3}{11}$

Very Short Answer Questions

37. Find the probability of an impossible event.

Ans : [Board Term-2, 2012]

Probability of impossible event is 0.

38. A card is drawn at random from a well shuffled pack of 52 cards. Find the probability of getting a red king.

Ans : [Board 2020 OD Basic]

Total no. of cards, $n(S) = 52$

Number of red kings, $n(E) = 2$

P(a red king), $P(E) = \frac{n(E)}{n(S)} = \frac{2}{52} = \frac{1}{26}$

39. A card drawn at random from a well shuffled deck of 52 playing cards. What is the probability of getting a black king?

Ans : [Board 2020 OD Basic]

Total no. of cards, $n(S) = 52$

Number of black kings, $n(E) = 2$

P(black king), $P(E) = \frac{n(E)}{n(S)} = \frac{2}{52} = \frac{1}{26}$

40. A die is thrown once. What is the probability of getting a number less than 3?

Ans : [Board 2020 Delhi Standard]

There are 6 possible outcome for a die.

$$n(S) = 6$$

Favourable outcome are 1 and 2 i.e. two outcomes.

$$n(E) = 2$$

P(number less than 3)

$$P(E) = \frac{n(E)}{n(S)} = \frac{2}{6} = \frac{1}{3}$$

41. If the probability of wining a game is 0.07, what is the probability of losing it?

Ans : [Board 2020 Delhi Standard]

P(winning the game), $P(E) = 0.07$

P(number less game), $P(\overline{E}) = 1 - P(E)$

$$= 1 - 0.07$$

$= 0.93$

42. A die is thrown once. Find the probability of getting "at most 2."

Ans : [Board Term-2 OD Compt 2017]

All possible outcome i.e. sample space,

$$S = \{1, 2, 3, 4, 5, 6$$

Number of all possible outcome,

$$n(S) = 6$$

Favourable outcomes,

$$E = \{1,\ 2\}$$

Number of favourable outcome,

$$n(E) = 2$$

Thus $P(E) = \frac{n(E)}{n(S)} = \frac{2}{6} = \frac{1}{3}$

43. If $P(E) = 0.20$, then what is the probability of 'not E'?

Ans : [Board Term-2, 2012]

We have $P(E) = 0.20$

$$P(\text{not}E) = 1 - P(E)$$

$$= 1 - 0.20 = 0.80$$

44. If the probability of winning a game is $\frac{5}{11}$, find the probability of losing the game.

Ans : [Board Term-2, 2014]

Probability of winning the game,

$$P(E) = \frac{5}{11}$$

Probability of losing the game

$$P(\overline{E}) = 1 - P(E)$$

$$= 1 - \frac{5}{11} = \frac{6}{11}$$

45. If E be an event such that $P(E) = \frac{3}{7}$, what is P(not E) equal to?

Ans : [Board Term-2, 2014]

We have $P(E) = \frac{3}{7}$

$$P(\text{not } E) = 1 - P(E)$$

$$= 1 - \frac{3}{7} = \frac{4}{7}$$

46. A bag contains lemon flavoured candies only. Shalini takes out one candy without looking into the bag. What is the probability that she takes out an orange flavoured candy?

Ans : [Board Term-2, 2012]

Bag contains only lemon flavoured candies.
So, getting an orange flavoured candy is an impossible.

$$P(E) = 0$$

47. If a number x is chosen a random from the number $-3,\ -2,\ -1,\ 0,\ 1,\ 2,\ 3$. What is probability that $x^2 \leq 4$?

Ans : [Board 2020 Delhi Standard]

We have 7 possible outcome. Thus

$$n(S) = 7$$

Favourable outcomes are $-2,\ -1,\ 0,\ 1,\ 2$ i.e. 5.

$$n(E) = 5$$

$P(x^2 \leq 4)$, $P(E) = \frac{n(E)}{n(S)} = \frac{5}{7}$

48. Out of 200 bulbs in a box, 12 bulbs are defective. One bulb is taken out at random from the box. What is the probability that the drawn bulb is not defective?

Ans : [Board Term-2 SQP 2016]

Total number of bulbs,

$$n(S) = 200$$

Number of favourable cases,

$$n(E) = 200 - 12 = 188$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{188}{200} = \frac{47}{50}$$

49. A card is drawn at random from a well shuffled pack of 52 cards. Find the probability of getting neither a red card nor a queen.

Ans : [Board Term-2 OD 2016]

There are 26 red cards out of total 52 cards and 2 black queen also.

Total number of cards, $n(S) = 52$

Cards which are neither red nor queen,

$$n(E) = 52 - (26 + 2) = 24$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{24}{52} = \frac{6}{13}$$

50. A letter of English alphabet is chosen at random. Determine the probability that the chosen letter is a consonant.

Ans : [Board Term-2 Delhi 2015, 2020 Delhi STD]

In the English language there are 26 alphabets. Consonant are 21. The probability of chosen a consonant

$$n(S) = 26$$

$$n(E) = 21$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{21}{26}$$

51. Cards marked with number 3, 4, 5, ..., 50 are placed in a box and mixed thoroughly. A card is drawn at random from the box. Find the probability that the selected card bears a perfect square number.

Ans : [Board Term-2 2016]

Total number of outcomes,

$$n(S) = 48$$

Favourable outcomes are 4, 9, 16, 25, 36 and 49.

No. of favourable outcomes,

$$n(E) = 6$$

P(perfect square number),

o151

$$P(E) = \frac{n(E)}{n(S)} = \frac{6}{48} \text{ or } = \frac{1}{8}$$

52. 20 tickets, on which numbers 1 to 20 are written, are mixed thoroughly and then a ticket is drawn at random out of them. Find the probability that the number on the drawn ticket is a multiple of 3 or 7.

Ans : [Board Term-2 Foreign 2016]

Total number of cases,

$$n(S) = 20$$

Favourable outcome,

$$E = \{3, 6, 7, 9, 12, 14, 15, 18\}$$

Number of favourable cases,

$$n(E) = 8$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{8}{20} = \frac{2}{5}$$

53. What is the probability that a non-leap year has 53 Mondays ?

Ans : [Board Term-2, 2015]

There are 365 days in a non-leap year.

365 days = 52 weeks + 1 day

One day can be M, T, W, Th, F, S, S i.e. total 7 possible outcomes and only one favourable outcome.

Thus $n(S) = 7$ and $n(E) = 1$

P(53 Mondays in non-leap year)

$$P(E) = \frac{n(E)}{n(S)} = \frac{1}{7}$$

54. Two different dice are tossed together. Find the probability that the product of the number on the top of the dice is 6.

Ans : [Board Term-2 OD 2015]

Total number of possible outcomes,

$$n(S) = 6 \times 6 = 36$$

Product of 6 are (1, 6), (2, 3), (6, 1) and (3, 2).

Number of favourable outcomes,

$$n(E) = 4$$

Total number of chances

$$n(S) = 6 \times 6 = 36$$

P(Product of 6)

$$P(E) = \frac{n(E)}{n(S)} = \frac{4}{36} = \frac{1}{9}$$

55. 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. Find the probability that the arrow will point at any factor of 8 ?

Ans : [Board Term-2 Foreign 2015]

Total number of points are 8. Thus, total number of possible outcomes

$$n(S) = 8$$

Favourable outcomes are 1, 2, 4, and 8

No. of favourable outcomes,

$$n(E) = 3$$

P(factor of 8)

$$P(E) = \frac{n(E)}{n(S)} = \frac{2}{8} = \frac{1}{2}$$

56. A bag contains cards numbered from 1 to 25. A card is drawn at random from the bag. Find the probability that number is divisible by both 2 and 3.

Ans : [Board Term-2 Foreign 2014]

Since bag contains 25 cards,

$$n(S) = 25$$

The numbers divisible by 2 and 3 both are 6, 12, 18, 24 which are 4 numbers.

Thus $n(E) = 4$

P(number divisible by 2 and 3)

$$P(E) = \frac{n(E)}{n(S)} = \frac{4}{25}$$

57. A number is selected at random from 1 to 30. Find the probability that it is a prime number.

Ans : [Board Term-2, 2014]

Number of possible outcomes,

$$n(S) = 30$$

Prime numbers are 2, 3, 5, 7, 11, 13, 17, 19,

23 and 29.

Number of favourable outcomes, $n(E) = 10$

P(prime), $\quad P(E) = \frac{n(E)}{n(S)} = \frac{10}{30} = \frac{1}{3}$

58. A box contains 90 discs, numbered from 1 to 90. If one disc is drawn at random from box, find the probability that it bears a prime number less than 23.

Ans : [Board Term-2, 2012]

Number of possible outcomes,

$$n(S) = 90$$

Prime numbers less than 23 are 2, 3, 5, 7, 11, 13

Number of favourable outcomes

$$n(E) = 8$$

P(prime no. less than 23)

$$P(E) = \frac{n(E)}{n(S)} = \frac{8}{90} = \frac{4}{45}$$

59. From the number 3, 5, 5, 7, 7, 7, 9, 9, 9, 9, one number is selected at random, what is the probability that the selected number is mean?

Ans : [Board Term-2, 2012]

Total outcomes, $\quad n(S) = 10$

Mean,

$$M = \frac{3+5+5+7+7+7+9+9+9+9}{10} = \frac{70}{10} = 7$$

Thus 7 is the mean of given numbers and frequency of 7 is 3 in given data.

Number of favourable outcomes,

$$n(E) = 3$$

P(mean), $\quad P(E) = \frac{n(E)}{n(S)} = \frac{3}{10}$

60. A die is thrown once. Find the probability of getting a prime number.

Ans : [Board Term-2, 2012]

Total outcomes, $\quad n(S) = 6$

Prime numbers are 2, 3, 5.

$$n(E) = 3$$

P(prime no.), $\quad P(E) = \frac{n(E)}{n(S)} = \frac{3}{6} = \frac{1}{2}$

61. A girl calculates the probability of her winning the game in a match and find it 0.08. What is the probability of her losing the game?

Ans : [Board Term-2, 2012]

P(winning the game), $\quad P(E) = 0.08$

P(losing the game), $\quad P(\overline{E}) = 1 - P(E)$

$$= 1 - 0.08 = 0.92$$

62. The probability of getting a bad egg in a lot of 400 eggs is 0.035. Find the number of bad eggs in the lot.

Ans : [Board Term-2, 2012]

Number x be number of bad eggs.

$$n(E) = x$$

Total eggs, $n(S) = 400$

P(bad eggs) $P(E) = 0.035$

P(bad eggs), $P(E) = \frac{n(E)}{n(S)}$

$$0.035 = \frac{x}{400}$$

$$x = 400 \times 0.035 = 14$$

Thus there are 14 bad eggs in lot.

63. In tossing a die, what is the probability of getting an odd number or number less than 4 ?

Ans : [Board Term-2, 2012]

Total outcome, $n(S) = 6$

Odd numbers are 1, 3, 5 and number less than 4 are 1, 2, 3. Thus there are 4 favourable outcome.

$$n(E) = 4$$

P(an odd no. or a no. <4),

$$P(E) = \frac{n(E)}{n(S)} = \frac{4}{6} = \frac{2}{3}$$

64. A card is drawn from a well shuffled deck of playing cards. Find the probability of drawing a red face card.

Ans : [Board Term-2, 2012]

Total outcomes, $n(S) = 52$

Red face card, $n(E) = 6$

P(red face card), $P(E) = \frac{n(E)}{n(S)}$

$= \frac{6}{52} = \frac{3}{26}$

65. Find the probability of getting a sum of 9, when two dice are thrown simultaneously.

Ans : [Board Term-2, 2012]

If two dice are thrown there are $6 \times 6 = 36$ possible outcomes. Thus there are 4 favourable outcome (3, 6), (6, 3), (4, 5) and (5, 4). In these case sum of both faces are 9.

Number of total outcomes,

$$n(S) = 36$$

Number of favourable outcomes

$$n(E) = 4$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{4}{36} = \frac{1}{9}$$

66. Can 1.1 be probability of an event ?

Ans : [Board Term-2, 2012]

No. Since the probability of an event cannot be more than 1.

67. A bag contains 3 red and 5 black balls. A ball is drawn at random from the bag. What is the probability that the drawn ball is not red ?

Ans : [Board Term-2 Delhi 2017]

There are total $3 + 5 = 8$ balls in bag. Thus total possible outcomes,

$$n(S) = 8$$

5 black balls are not red. Thus favourable outcome

$$n(E) = 5$$

P(drawn ball is not red),

$$P(E) = \frac{n(E)}{n(S)} = \frac{5}{8}$$

68. If three different coins are tossed together, then find the probability of getting two heads.

Ans : [Board Term-2 OD Compt. 2017]

All possible outcomes are {HHH, THH, HTH, HHT, TTT, TTH, THT, HTT}.

Number of possible outcomes,

$$n(S) = 8$$

Number of favourable outcomes,

$$n(E) = 3$$

P(getting two heads),

$$P(E) = \frac{n(E)}{n(S)} = \frac{3}{8}$$

69. A number is chosen at random from the numbers $-3, -2, -1, 0, 1, 2, 3$. What will be the probability that square of this number is less than or equal to 1.

Ans : [Board Term-2 Delhi 2017]

No. of all possible outcomes,

$$n(S) = 7$$

No. of favourable outcomes are $-1, 0, 1$.

$$n(E) = 3$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{3}{7}$$

70. The probability of selecting a rotten apple randomly from a heap of 900 apples is 0.18. What is the number of rotten apples in the heap ?

Ans :

Let E be the event of getting a rotten apple.

Total apples, $n(S) = 900$

Probability of selecting a rotten apple,

$$n(E) = 0.18$$

Let $n(E)$ be number of rotten apples,

Then, $$P(E) = \frac{n(E)}{n(S)}$$

$$0.18 = \frac{n(E)}{900}$$

$$0.18 \times 900 = n(E)$$

$$n(E) = 162$$

So, there are 162 rotten apples in the heap.

TWO MARKS QUESTIONS

71. A number x is chosen from 25, 24, 23, $-2, -1$, 0, 1, 2, 3. Find the probability that $|x| < 3$.

Ans : [Board Term-2, 2015]

Total possible outcomes,

$$n(S) = 9$$

Favourable outcome are $-2, -1$, 0, 1, and 2.

Favourable outcomes $n(E) = 5$

$$P(|x| < 3) = \frac{n(E)}{n(S)} = \frac{5}{9}$$

72. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball at random from the bag is three times that of a red ball, find the number of blue balls in the bag.

Ans : [Board 2020 Delhi Basic]

Let x be blue balls.

Total balls, $n(S) = 5 + x$

$$n(R) = 5 \text{ and } n(B) = x$$

P (red ball), $$P(R) = \frac{n(R)}{n(S)} = \frac{5}{5+x}$$

P (blue ball), $$P(R) = \frac{n(B)}{n(S)} = \frac{x}{5+x}$$

As per question we have

$$\frac{x}{5+x} = \frac{3 \times 5}{5+x}$$

Thus $x = 15$

Hence, bag contains 15 blue balls.

73. If a pair of dice is thrown once, then what is the probability of getting a sum of 8?

Ans : [Board 2020 Delhi Basic]

Number of possible outcomes,

$$n(S) = 6^2 = 36$$

The favourable outcomes are (sum of getting 8) {(2, 6), (3, 5), (4, 4), (5, 3), (6, 2)} i.e. 5 outcomes.

Number of favourable outcome,

$$n(E) = 5$$

Probability (getting sum of 8),

$$P(E) = \frac{n(E)}{n(S)} = \frac{5}{36}$$

74. A die thrown once. What is the probability of getting an even prime number?

Ans : [Board 2020 Delhi Standard]

Total possible outcomes of die is 6.

$$n(S) = 6$$

Favourable outcomes is only 2 i.e. there is one possible outcome.

$$n(E) = 1$$

P (getting an even prime number),

$$P(E) = \frac{n(E)}{n(S)} = \frac{1}{6}$$

75. Two different dice are thrown together, find the probability that the sum of the numbers appeared is less than 5.

Ans : [Board 2020 OD Basic]

Number of possible outcomes,

$$n(S) = 6^2 = 36$$

The favourable outcomes are (sum less than 5) {(1, 1), (1, 2), (1, 3), (2, 1), (2, 2) and (3, 1)} i.e. 6 outcomes.

Number of favourable outcome,

$$n(E) = 6$$

P (have sum less than 5)

$$P(E) = \frac{n(E)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

76. In a lottery, there are 10 prizes and 25 blanks. What is the probability of getting a prize?

Ans : [Board 2020 OD Basic]

Total number of possible outcomes,

$$n(S) = 10 + 25 = 35$$

Total number of prizes,

$$n(E) = 10$$

Probability of getting a prize,

$$P(E) = \frac{n(E)}{n(S)} = \frac{10}{35} = \frac{2}{7}$$

77. Two different coins are tossed simultaneously, What is the probability of getting at least one head?

Ans : [Board 2020 Delhi OD Basic]

All possible outcomes are {HH, HT, TH, TT}.

Thus $\quad n(S) = 4$

Favourable outcomes are {HT, TH, HH}.

$$n(E) = 3$$

Probability of getting at least one head,

$$P(E) = \frac{n(E)}{n(S)} = \frac{3}{4}$$

78. A pair of dice is thrown once. What is the probability of getting a doublet?

Ans : [Board 2020 Delhi Standard]

There are total $6^2 = 36$ possible outcomes. Thus

$$n(S) = 36$$

Favourable outcomes are (1, 1), (2, 2), (3, 3), (4, 4), (5, 5) and (6, 6).

Number of favourable outcomes,

$$n(E) = 6$$

P(getting doublet),

$$P(E) = \frac{n(E)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

79. A die is thrown once. What is the probability of getting a prime number.

Ans : [Board 2020 OD Standard]

There are 6 possible outcome for a die.

$$n(S) = 6$$

Favourable outcome are 1 and 2 i.e. two outcome.

$$n(E) = 2$$

P (number less than 3),

$$P(E) = \frac{n(E)}{n(S)} = \frac{2}{6} = \frac{1}{3}$$

80. If a number x is chosen at random from the numbers $-3,\ -2,\ -1.\ 0,\ 1,\ 2,\ 3$, then find the probability of $x^2 < 4$.

Ans : [Board 2020 OD Standard]

Possible outcome are $-3,\ -2,\ -1.\ 0,\ 1,\ 2,\ 3$ i.e 7 outcomes.

Thus $\quad n(S) = 7$

Favourable outcomes are $x^2 < 4$ i.e. $= -1,\ 0,\ 1$.

$$n(E) = 3$$

$P(x^2 < 4)$, $\quad P(E) = \frac{n(E)}{n(S)} = \frac{3}{7}$

81. A bag contains cards with numbers written on it from 1–80. A card is pulled out at random. Find the probability that the card shows a perfect square.

Ans : [Board Term-2 2016]

We have $\quad S = \{1,\ 2..........80\}$

Number of possible outcomes,

$$n(S) = 80$$

Favourable outcome are $\{1, 4, 9, 16, 25, 36, 49, 64\}$

Number of favourable outcomes,

$$n(E) = 8$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{8}{80} = \frac{1}{10}$$

82. A bag contains 6 red and 5 blue balls. Find the probability that the ball drawn is not red.

Ans : [Board Term-2, 2014, 2015]

No. of possible outcomes,

$$n(S) = 6 + 5 = 11$$

Since 5 blue balls are favourable outcome,

$$n(E) = 5$$

P(not red), $\quad P(E) = \frac{n(E)}{n(S)} = \frac{5}{11}$

83. There are 30 cards of the same size in a bag in which the numbers 1 to 30 are written. One card is taken out of the bag at random. Find the probability that the number on the selected card is not divisible by 3.

Ans : [Board Term-2 Foreign 2014]

Total cards $n(S) = 30$

Number divisible by 3 are 3, 6, 9, 12, 15, 18, 21, 24, 27 and 30 i.e 10 numbers.

Number of favourable outcomes,

$$n(E) = 30 - 10 = 20$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{20}{30} = \frac{2}{3}$$

84. Two different dice are tossed together. Find the probability :

(i) that the number on each die is even.

(ii) that the sum of numbers appearing on the two dice is 5.

Ans : [Board Term-2 OD 2014]

In both case, $n(S) = 36$

(i) Even numbers events are (2, 2) (2, 4) (2, 6) (4, 2) (4, 4) (4, 6) (6, 2), (6,4) and (6, 6) which are 9 event.

$$n(E_1) = 9$$

P(number of each die is even),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{9}{36} = \frac{1}{4}$$

(ii) Sum of numbers is 5 in (1, 4) (2, 3) (3, 2) (4, 1)

$$n(E_2) = 4$$

P(sum of numbers appearing on two dice is 5)

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{4}{36} = \frac{1}{9}$$

85. A letter of English alphabet is chosen at random, find the probability that the letter so chosen is :

(i) a vowel,

(ii) a consonant.

Ans : [Board Term-2 Delhi 2014]

Since total number in English alphabet is 26, in which 5 vowels and 21 consonants.

In both case total possible outcome

$$n(S) = 26$$

(i) a vowel,

$$n(E_1) = 5$$

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{5}{26}$$

(ii) a consonant.

$$n(E_2) = 21$$

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{21}{26}$$

86. Harpreet tosses two different coins simultaneously. What is the probability that she gets :

(i). at least one head ?

(ii) one head and one tail ?

Ans : [Board Term-2 Foreign 2014]

All possible outcomes are {HH, TT, TH, HT}

$$n(S) = 4$$

(i) At least one head,

All favourable outcome are {HH, TH, HT}

$$n(E_1) = 3$$

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{3}{4}$$

(ii) One head and one tail

All favourable outcome are {TH, HT}

$$n(E_2) = 2$$

$$P\ E_2 = \frac{n(E_2)}{n\ S} = \frac{2}{4} = \frac{1}{2}$$

87. A bag contains cards bearing numbers from 11 to 30. A card is taken out from the bag at random. Find the probability that the selected card has multiple of 5 on it.

Ans : [Board Term-2 Delhi 2014, 2012]

No. of cards $n(S) = 20$

Multiples of 5 from 11 to 30 are 15, 20, 25 and 30 i.e 4 numbers .

Thus number of favourable outcomes,

$$n(E) = 4$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{4}{20} = \frac{1}{5}$$

88. A bag contains 5 red, 8 green and 7 white balls. One ball is drawn at random from the bag, find the probability of getting :

(i) not a white ball,

(ii) neither a green nor a red ball.

Ans : [Board Term-2, 2012, 2014]

Bag contains 5 red, 8 green and 7 white balls i.e. total 20 ball.

Total number of possible outcomes,

$$n(S) = 20$$

(i) not a white ball,

There are 5 red and 8 green balls which are not white.

Thus number of favourable outcome,

$$n(E_1) = 13$$

P (not a white ball),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{13}{20}$$

(ii) neither a green nor a red ball.

There are 7 white balls which are neither a green nor a red ball.

$$n(E_2) = 7$$

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{7}{20}$$

89. Two dice are rolled simultaneously. Find the probability that the sum of numbers appearing is 10.

Ans : [Board Term-2 Foreign 2014]

When two dice are thrown, we have $6 \times 6 = 36$ possible outcomes.

$$n(S) = 36$$

Favourable outcomes are (4, 6), (6, 4) and (5, 5). In these outcomes, sum of numbers appearing is 10.

No. of favourable outcomes

$$n(E) = 3$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{3}{36} = \frac{1}{12}$$

90. A bag contains 3 red, 4 green and 5 white candles, one candle is drawn at random from the bag, find the probability that candle is not red.

Ans : [Board Term-2 2014]

Total number of possible outcomes are $3 + 4 + 5 = 12$.

$$n(S) = 12$$

When candles not red, there are 9 possibilities,

$$n(E) = 9$$

P(candle is not red),

$$P(E) = \frac{n(E)}{n(S)} = \frac{9}{12} = \frac{3}{4}$$

91. In a family of two children find the probability of having at least one girl.

Ans : [Board Term-2, 2012]

All possible outcomes,

$$S = \{\text{GG, GB, BG, BB}\}$$

Total number of possible outcomes,

$$n(S) = 4$$

Favourable outcomes are GG, GB and BG.

Thus $n(E) = 3$

P(at least one girl),

$$P(E) = \frac{n(E)}{n(S)} = \frac{3}{4}$$

92. Find the probability that a leap year has 53 Sundays

Ans : [Board Term-2, 2012]

366 days = 52 weeks + 2 days

2 days can be MT, TW, WTh, ThF, FS, SS, SM out of which SS and SM are favourable outcome.

Total number of possible outcomes,

$$n(S) = 7$$

Thus number of favourable outcome,

$$n(E) = 2$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{2}{7}$$

93. Two dice, one blue and one grey, are thrown at the same time. What is the probability that the sum of the two numbers appearing on the top of the dice is

8 ?

Ans : [Board Term-2, 2012]

There are 36 possible outcomes of rolling two dices.

$$n(S) = 36$$

We have 5 favourable outcomes are (2, 6), (3, 5), (4, 4), (5, 3), (6, 2).

$$n(E) = 5$$

Required probability,

$$P(E) = \frac{n(E)}{n\ S} = \frac{5}{36}$$

94. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball from the bag is thrice that of the red ball, find the number of blue balls in the bag.

Ans : [Board Term-2, 2012]

Let x be blue balls in bag.

Total balls $n(S) = 5 + x$

$$n(R) = 5 \text{ and } n(B) = x$$

P(red ball), $P(R) = \frac{n(R)}{n(S)} = \frac{5}{5+x}$

P(blue ball), $P(B) = \frac{n(B)}{n(S)} = \frac{x}{5+x}$

As per question we have

$$\frac{x}{5+x} = \frac{3 \times 5}{5+x}$$

Thus $x = 15$

95. Two coins are tossed together. Find the probability of getting both heads or both tails.

Ans : [Board Term-2, 2012]

Possibilities are HH, HT TH, TT out of which HH and TT are favourable.

$$n(S) = 4$$

$$n(E) = 2$$

P(HH or TT), $P(E) = \frac{n(E)}{n(S)} = \frac{2}{4} = \frac{1}{2}$

96. One card is drawn from a well shuffled deck of 52 cards. Find the probability of getting :

(i) a non face card,

(ii) a black king.

Ans : [Board Term-2, 2012]

Total cards, $n(S) = 52$

(i) There are 12 face cards and thus 40 non-face cards.

$$n(E_1) = 40$$

P(non-faces), $P(E_1) = \frac{n(E_1)}{n(S)} = \frac{40}{52} = \frac{10}{13}$

(ii) There are 2 black king

$$n(E_2) = 2$$

P(black king), $P(E_2) = \frac{n(E_2)}{n(S)} = \frac{2}{52} = \frac{1}{26}$

97. Two dice are thrown together. What is the probability of getting a doublet ?

Ans : [Board Term-2, 2012]

When two dice are thrown, we have $6 \times 6 = 36$ possible outcomes.

$$n(S) = 36$$

Doublets are (1, 1), (2, 2), (3, 3), (4, 4), (5, 5) and (6, 6). Thus we have 6 favourable outcomes.

$$n(E) = 6$$

P(a doublet), $P(E) = \frac{n(E)}{n(S)} = \frac{6}{36} = \frac{1}{6}$

98. A lot consists of 144 ball pens of which 20 are defective and 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 ?

Ans : [Board Term-2, 2012]

Total no. of pens, $n(S) = 144$

No. of good pen, $n(E) = 144 - 20 = 124$

Probability of purchasing pen,

$$P(E) = \frac{n(E)}{n(S)} = \frac{124}{144} = \frac{31}{36}$$

Probability of not purchasing pen,

$$P(\overline{E}) = 1 - P(E)$$

$$= 1 - \frac{5}{36} = \frac{31}{36}$$

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

Ans : [Board Term-2, 2012]

Let x be blue balls in bag.

Total balls, $n(S) = 5 + x$

$$n(R) = 5 \text{ and } n(B) = x$$

P(red ball), $P(R) = \frac{n(R)}{n(S)} = \frac{5}{5+x}$

P(blue ball), $P(R) = \frac{n(B)}{n(S)} = \frac{x}{5+x}$

As per question we have

$$\frac{x}{5+x} = \frac{2 \times 5}{5+x}$$

Thus $x = 10$

100. Two different dice are thrown together. Find the probability that the product of the number appeared is less than 18.

Ans : [Board Term-2 Foreign 2017]

There are $6 \times 6 = 36$ possible outcomes.

$$n(S) = 36$$

Favourable outcomes are (4, 2), (4, 3), (4, 5), (5, 1), (5, 2), (5, 3), (5, 3), (6, 1), (6, 2), (1, 1), (1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 3), (2, 4), (2, 5), (2, 6), (3, 1), (3, 2), (3, 3), (3, 4), (2, 5) and (4, 1).

No. of favourable outcomes,

$$n(E) = 26$$

P(Product appears is less than 18)

$$P(E) = \frac{n(E)}{n(S)} = \frac{26}{36} = \frac{13}{18}$$

101. A box contains cards numbered 11 to 123. A card is drawn at random from the box. Find the probability that the number of the drawn card is

(i) A perfect square number

(ii) A multiple of 7.

Ans : [Board Term-2 SQP 2017]

Total number of all possible outcomes,

$$n(S) = 113$$

(i) Perfect square numbers between 11 to 123 are 16, 25, 36, 49, 64, 81, 100 and 121.

No. of all favourable outcomes

$$n(E_1) = 8$$

P(Number drawn is perfect square),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{8}{113}$$

(ii) No. of multiples of 7 from 11 to 123 is 16 i.e 14, 21, 28, 35, 42, 49, 56, 63, 70, 77, 84, 91, 98, 105, 112 and 119.

No. of all favourable outcomes.

$$n(E_2) = 16$$

P(number drawn card is multiple of 7)

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{16}{113}$$

102. A box contains 12 balls of which some are red in colour. If 6 more red balls are put in the box and a ball is drawn at random the probability of drawing a red ball doubles than what it was before. Find the number of red balls in the bag.

Ans : [Board Term-2 SQP 2017]

Let x be red balls in the box out of 12 balls.

$$P(R) = \frac{x}{12}$$

After putting 6 red balls in the bag, total numbers of balls in box is $12 + 6 = 18$ and red ball are $x + 6$.

$$P'(R) = \frac{x+6}{18}$$

According to the problem

$$2 \times \frac{x}{12} = \frac{x+6}{18}$$

$$18x = 6x + 36 \Rightarrow x = 3$$

Hence there were 8 red ball.

103. A bag contains 15 white and some black balls. If the probability of drawing a black ball from the bag is thrice that of drawing a white ball, find the number of blackballs in the bag.

Ans :

Let x be black balls and 15 white balls.

Total balls, $n(S) = 15 + x$

Let $P(B)$ be the probability of drawing black ball and

$P(W)$ be the probability of drawing white ball.

Now $P(B) = 3 \times P(W)$

$$\frac{x}{(15+x)} = 3 \times \frac{15}{(15+x)}$$

$$x = 45$$

Thus there are 45 black balls in the bag.

THREE MARKS QUESTIONS

104. An integer is chosen between 70 and 100. Find the probability that it is

(i) a prime number (ii) divisible by 7

Ans : [Board 2020 SQP Standard]

There are 29 integer from 70 to 100. Total number of outcomes are 29 in both case.

$$n(S) = 29$$

(i) There are 6 prime numbers between 70 and 100 as 71, 73, 79, 83, 89 and 97 i.e. 6 favourable outcome.

$$n(E_1) = 6$$

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{6}{29}$$

(ii) There are 4 numbers between 70 and 100 which are divisible by 7 as 77, 84, 91 and 98 i.e. 4 favourable outcome.

$$n(B) = 4$$

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{4}{29}$$

105. Find the probability that 5 Sundays occur in the month of November of a randomly selected year.

Ans : [Board 2020 Delhi Basic]

Total no. of days in November = 30

So, it has 4 weeks and 2 days. 4 weeks have 4 Sundays. The two remaining days should be

1. Sunday, Monday
2. Monday, Tuesday
3. Tuesday, Wednesday
4. Wednesday, Thursday
5. Thursday, Friday
6. Friday, Saturday
7. Saturday, Sunday

Thus number of possible outcomes,

$$n(S) = 7$$

Number of favourable outcome,

$$n(E) = 2$$

So, the probability of getting 5 Sunday in the month of November,

$$P(E) = \frac{n(E)}{n(S)} = \frac{2}{7}$$

106. Two dice are tossed simultaneously. Find the probability of getting

(i) an even number on both dice.

(ii) the sum of two numbers more than 9.

Ans : [Board 2020 OD Basic]

There are 36 possible outcomes of rolling two dices.

$$n(S) = 36$$

(i) an even number on both dice.

Favourable outcome are (2, 2), (2, 4), (2, 6), (4, 2) (4, 4), (4, 6), (6, 2), (6, 4) and (6, 6).

Number of favourable outcomes

$$n(E_1) = 9$$

P(an even number on both dice),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{9}{36} = \frac{1}{4}$$

(ii) sum of two numbers more than 9

Favourable outcome are (4, 6), (5, 5), (5, 6), (6, 4), (6, 5) and (6, 6).

Number of favourable outcomes

$$n(E_2) = 6$$

P (sum of two numbers more than 9),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

107. In a family of three children, find the probability of having at least two boys.

Ans : [Board 2020 OD Basic]

If there are three children in family all possible outcome are {BBB, BBG, BGB, GBB, GGB, GBG, BGG, GGG}.

So, the total number of outcomes,

$$n(S) = 2^3 = 8$$

At-least two of them are boys means all those cases in which we have either 2 or 3 boys. Thus favourable outcome are {BBB, BBG, BGB, GBB}

Number of favourable outcome,

$$n(E) = 4$$

The probability of having at least two boys

$$P(E) = \frac{n(E)}{n(S)} = \frac{4}{8} = \frac{1}{2}$$

108. A child has a die whose six faces show the letters as shown below:

$\boxed{A}$ $\boxed{B}$ $\boxed{C}$ $\boxed{D}$ $\boxed{E}$ $\boxed{A}$

The die is thrown once. What is the probability of getting (i) A, (ii) D?

Ans : [Board 2020 OD Standard]

Total possible outcomes, $n(S) = 6$

(i) Probability of getting letter A,

$$n(E_1) = 2.$$

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{2}{6} = \frac{1}{3}$$

(ii) Probability of getting letter D,

$$n(E_2) = 1$$

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{1}{6}$$

109. A child has a die whose six faces show the letters as shown below:

$\boxed{A}$ $\boxed{A}$ $\boxed{B}$ $\boxed{C}$ $\boxed{C}$ $\boxed{C}$

The die is thrown once. What is the probability of getting (i) A, (ii) C?

Ans : [Board 2020 OD Standard]

Total possible outcomes, $n(S) = 6$

(i) Probability of getting letter A,

$$n(E_1) = 2.$$

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{2}{6} = \frac{1}{3}$$

(ii) Probability of getting letter C,

$$n(E_2) = 3$$

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{1}{6}$$

110. A game consists of tossing a coin 3 times and noting the outcome each time. If getting the same result in all the tosses is a success, find the probability of losing the game.

Ans : [Board 2019 Delhi Standard]

Possible outcomes are {HHH, HHT, HTH, THH, TTH, THT, HTT, TTT}.

Total possible outcomes,

$$n(S) = 2^3 = 8$$

Number of outcomes where the game lost,

$$n(E) = 8 - 2 = 6$$

Probability of losing the game,

$$P(E) = \frac{n(E)}{n(S)} = \frac{6}{8} = \frac{3}{4}$$

111. A die is thrown once. Find the probability of getting a number which (i) is a prime number (ii) lies between 2 and 6.

Ans : [Board 2019 Delhi Standard]

Total outcomes $n(S) = 6$

(i) is a prime number

Prime numbers are 2, 3 and 5.

$$n(E_1) = 3$$

P(prime no.),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{3}{6} = \frac{1}{2}$$

(ii) lies between 2 and 6

$$n(E_2) = 3$$

P(lies between 2 and 6),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{3}{6} = \frac{1}{2}$$

112. A die is thrown twice. Find the probability that
(i) 5 will come up at least once.
(ii) 5 will not come up either time.

Ans : [Board 2019 OD Standard]

There are $6 \times 6 = 36$ possible outcome. Thus sample space for two die is

$$n(S) = 36$$

(i) 5 will come up at least once

Favourable case are $(5,1),(5,2),(5,3),(5,4),(5,5),(5,6)(1,5),(2,5),(3,5),(4,5)$ and (6, 5)thus 11 case. Number of favourable outcome,

$$n(E_1) = 11$$

Probability that 5 will come up at least once,

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{11}{36}$$

(ii) 5 will not come up either time

Probability that 5 will come up either time

$$P(\overline{E}) = 1 - P(E)$$

$$= 1 - \frac{11}{36} = \frac{36-11}{36} = \frac{25}{36}$$

113. Two different dice are tossed together. Find the probability:
(i) of getting a doublet
(ii) of getting a sum 10, of the numbers on the two dice.

Ans : [Board 2018]

There are 36 possible outcomes of rolling two dices.

$$n(S) = 36$$

(i) of getting a doublet

Doublets are (1, 1), (2, 2), (3, 3), (4, 4), (5, 5) and (6, 6) which are 6 doublets.

Number of favourable outcomes,

$$n(E_1) = 6$$

$$P(\text{doublet}), \quad P(E_1) = \frac{n(E_1)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

(ii) of getting a sum 10, of the numbers on the two dice.

Favourable outcomes are (4, 6), (5, 5), (6, 4) i.e., 3.

Number of favourable outcomes,

$$n(E_2) = 3$$

$$P(\text{sum } 10), \quad P(E_2) = \frac{n(E_2)}{n(S)} = \frac{3}{36} = \frac{1}{12}$$

114. An integer is chosen at random between 1 and 100. Find the probability that it is:
(i) divisible by 8.
(ii) not divisible by 8.

Ans : [Board 2018]

Total number of outcomes,

$$n(S) = 100 - 2 = 98$$

(i) divisible by 8.

Favourable outcomes are 8, 16, 24, ..., 96, i.e., 12.

Number of favourable outcomes,

$$n(E_1) = 12$$

$P(\text{Divisible by } 8)$,

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{12}{98} = \frac{6}{49}$$

(ii) not divisible by 8.

$P(\text{not divisible by } 8)$,

$$P(\overline{E}) = 1 - P(E)$$

$$= 1 - \frac{6}{49} = \frac{43}{49}$$

115. From a pack of 52 playing cards, Jacks, Queens and Kings of red colour are removed. From the remaining, a card is drawn at random. Find the probability that drawn card is
(i) a black king,
(ii) a card of red colour,
(iii) a card of black colour.

Ans : [Board Term-2 OD 2015]

There are total 52 cards out of which 6 cards are removed.

Total number of all possible outcomes,

$$n(S) = 52 - 6 = 46$$

Number of black king,

$$n(E_1) = 2$$

(i) a black king,

Probability of drawing black king

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{2}{46} = \frac{1}{23}$$

(ii) a card of red colour,

Total red card,

$$n(E_2) = 26 - 6 = 20$$

Probability of drawing red colour card

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{20}{46} = \frac{10}{23}$$

(iii) a card of black colour.

Total card of black colour,

$$n(E_3) = 26$$

Probability of drawing black colour card

$$P(E_3) = \frac{n(E_3)}{n(S)} = \frac{26}{46} = \frac{13}{23}$$

116. A bag contains 6 red balls and some blue balls. If the probability of drawing a blue ball from the bag is twice that of a red ball, find the number of blue balls in the bag.

Ans : [Board Term-2 2012]

Let x be blue balls.

Total balls $\quad n(S) = 6 + x$

$$n(R) = 5 \text{ and } n(B) = x$$

$$P(\text{red ball}) \quad P(R) = \frac{n(R)}{n(S)} = \frac{6}{6+x}$$

$$P(\text{blue ball}) \quad P(R) = \frac{n(B)}{n(S)} = \frac{x}{6+x}$$

As per question we have

$$\frac{x}{6+x} = \frac{2 \times 6}{6+x} \Rightarrow x = 12$$

Thus there are 12 blue balls.

117. A bag contains cards numbered 1 to 49. Find the probability that the number on the drawn card is :

(i) an odd number
(ii) a multiple of 5
(iii) Even prime

Ans : [Board Term-2 2014]

Total cards, $n(S) = 49$

(i) an odd number

Odd number are 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47 and 49.

Total odd number, $n(E_1) = 25$

P(odd number), $P(E_1) = \frac{n(E_1)}{n(S)} = \frac{n(O)}{n(S)} = \frac{25}{49}$

(ii) a multiple of 5

Multiple of 5 are 5, 10, 15, 20, 25, 30, 35, 40 and 45.

Total multiple of 5 number,

$$n(E_2) = 5$$

P(multiple of 5), $P(E_2) = \frac{n(E_2)}{n(S)} = \frac{9}{49}$

(iii) Even prime

Only 2 is even prime number. Therefore

$$n(E_3) = 1$$

P(even prime), $P(E_3) = \frac{n(E_3)}{n(S)} = \frac{1}{49}$

118. Two unbiased coins are tossed simultaneously. Find the probability of getting :

(i) at least one head,
(ii) almost one head,
(iii) no head.

Ans : [Board Term-2, 2012, 2014]

There are 4 possible outcome when two unbiased coins are tossed simultaneously.

Sample space S ={HH, HT, TH, TT}

$$n(S) = 4$$

(i) at least one head,

Favourable outcomes are {HT, TH, HH}.

$$n(E_1) = 3$$

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{3}{4}$$

(ii) almost one head,

Favourable outcomes are {HT, TH, HH}.

$$n(E_2) = 3$$

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{3}{4}$$

(iii) no head.

Favourable outcomes is {TT} only.

$$n(E_3) = 1$$

$$P(E_3) = \frac{n(E_3)}{n(S)} = \frac{1}{4}$$

119. Three different coins are tossed together. Find the probability of getting

(i) exactly two heads.
(ii) at least two heads
(iii) at least two tails.

Ans : [Board Term-2 OD 2016]

Sample space for three coins tossed is {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT}

$$n(S) = 8$$

(i) Exactly two heads

Sample space E_1 ={HHT, HTH, THH}

$$n(E_1) = 3$$

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{3}{8}$$

(ii) At least two heads.

Sample space E_2 = {HHT, HTH, THH, HHH}

$$n(E_2) = 4$$

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{4}{8} = \frac{1}{2}$$

(iii) At least two tails,

Sample space E_3 ={TTH, THT, HTT, TTT}

$$n(E_3) = 4$$

$$P(E_3) = \frac{n(E_3)}{n(S)} = \frac{4}{8} = \frac{1}{2}$$

120. A game consists of tossing a one-rupee coin 3 times and noting the outcome each time. Ramesh will win the game if all the tosses show the same result, (i.e either all three heads or all three tails) and loses the game otherwise. Find the probability that Ramesh will lose the game.

Ans : [Board Term-2 Foreign 2016, Delhi 2017]

There are 8 possible outcome when one coin is tossed three times : {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT}.

$$n(S) = 8$$

In the case of same result on all the tosses,

$$E = \{\text{HHH, TTT}\}$$

$$n(E) = 2$$

P(Ramesh will win the game)

$$P(E) = \frac{n(E)}{n(S)} = \frac{2}{8} = \frac{1}{4}$$

P(Ramesh will loose the game)

$$P(\overline{E}) = 1 - P(E)$$

$$= 1 - \frac{1}{4} = \frac{3}{4}$$

121. In a single throw of a pair of different dice, what is the probability of getting

(i) a prime number on each dice ?

(ii) a total of 9 or 11 ?

Ans : [Board Term-2 Delhi 2016]

When two dice are thrown there are $6 \times 6 = 36$ possible outcomes.

$$n(S) = 36$$

(i) a prime number on each dice ?

Favourable outcomes are (2, 2) (2, 3) (2, 5) (3, 2) (3, 3) (3, 5) (5, 2) (5, 3) and (5, 5) i.e. 9 outcomes.

$$n(E_1) = 9$$

P(a prime number on each die)

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{9}{36} = \frac{1}{4}$$

(ii) a total of 9 or 11 ?

Favourable outcomes are (3, 6) (4, 5) (5, 4) (6, 3) (5, 6) and (6, 5) i.e. 6 outcomes.

$$n(E_1) = 6$$

P(a total of 9 or 11)

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

122. A box consists of 100 shirts of which 88 are good, 8 have minor defects and 4 have major defects. Ramesh, a shopkeeper will buy only those shirts which are good but 'Kewal' another shopkeeper will not buy shirts with major defects. A shirt is taken out of the box at random. What is the probability that :

(i) Ramesh will buy the selected shirt ?

(ii) Kewal will buy the selected shirt ?

Ans : [Board Term-2 Delhi 2016]

Since box consists of 100 shirts, there are 100 possible outcomes.

$$n(S) = 100$$

(i) Ramesh will buy the selected shirt ?

Number of good shirts

$$n(E_1) = 88$$

P(Ramesh buys the shirt)

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{88}{100} = \frac{22}{25}$$

(ii) Kewal will buy the selected shirt ?

Number of shirts without major defect,

$$n(E_2) = 88 + 8 = 96$$

P(Kewal buys a shirt)

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{96}{100} = \frac{24}{25}$$

123. A box contains 100 cards marked from 1 to 100. If one card is drawn at random from the box, find the probability that it bears :

(i) a single digit number

(ii) a number which is a perfect square

(iii) a number which is divisible by 7

Ans : [Board Term-2 2016]

Since box consists of 100 cards, there are 100 possible outcomes.

$$n(S) = 100$$

(i) a single digit number

Number of favourable outcomes,

$$n(E_1) = 9$$

P(single digit number),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{9}{100}$$

(ii) a number which is a perfect square

Perfect square number are 1, 4, 9, 16, 25, 36, 49, 64, 81 and 100.

No. of favourable outcomes,

$$n(E_2) = 10$$

P(perfect square),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{10}{100} = \frac{1}{10}$$

(iii) a number which is divisible by 7

Number divisible by 7 are 7, 14, 21, 28, 35, 42, 49, 56, 63, 70, 77, 84, 91 and 98 i.e. 14 numbers.

No. of favourable outcomes,

$$n(E_3) = 14$$

P(a number divisible by 7),

$$P(E_3) = \frac{n(E_3)}{n(S)} = \frac{14}{100}$$

124. There are 100 cards in a bag on which numbers from 1 to 100 are written. A card is taken out from the bag at random. Find the probability that the number on the selected card.

(i) is divisible by 9 and is a perfect square.

(ii) is a prime number greater than 80.

Ans : [Board Term-2 OD 2016]

Since bag consists of 100 cards, there are 100 possible outcomes.

$$n(S) = 100$$

(i) is divisible by 9 and is a perfect square.

Number divisible by 9 and perfect square are 9, 36 and 81 i.e. 3 numbers.

$$n(E_1) = 3$$

Required probability,

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{3}{100}$$

(ii) is a prime number greater than 80.

Prime numbers greater than 80 and less than 100 are 83, 89 and 97 i.e 3 numbers.

$$n(E_2) = 3$$

Required probability,

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{3}{100}$$

125. Cards numbered 2 to 101 are placed in a box. A card is selected at random from the box, find the probability that the card selected :

(i) has a number which is a perfect square.

(ii) has an odd number which is not less than 70.

Ans : [Board Term-2 2012]

Since box consists of 100 cards, there are 100 possible outcomes.

$$n(S) = 100$$

(i) has a number which is a perfect square.

Perfect squares are 4, 9, 16, 25, 36, 49, 64, 81 and 100.

Number of favourable outcomes,

$$n(E_1) = 9$$

P(Perfect square),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{9}{100}$$

(ii) has an odd number which is not less than 70.

Favourable outcomes are 71, 73, 75, ...101.

Number of favourable outcomes,

$$n(E_2) = 16$$

P(odd number not less than 70),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{16}{100} = \frac{4}{25}$$

126. All red face cards are removed from a pack of playing cards. The remaining cards are well shuffled and then a card is drawn at random from them. Find the probability that the drawn card is :

(i) a red card

(ii) a face card

(iii) a card of clubs

Ans : [Board Term-2 Delhi 2015]

Since red face cards are removed, number of all possible outcomes are $52 - 6 = 46$

$$n(S) = 46$$

(i) a red card

No. of remaining red cards,

$$n(E_1) = 26 - 6 = 20$$

$$P(\text{red card}), \quad P(E_1) = \frac{n(E_1)}{n(S)} = \frac{20}{46} = \frac{10}{26}$$

(ii) a face card

Number of remaining face cards,

$$n(E_2) = 12 - 6 = 6$$

P(a face card),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{6}{46} = \frac{3}{23}$$

(iii) a card of clubs

Number of cards clubs

$$n(E_3) = 13$$

P(a card of clubs),

$$P(E_3) = \frac{n(E_3)}{n(S)} = \frac{13}{46}$$

127. The probability of selecting a red ball at random from a jar that contains only red, blue and orange balls is $\frac{1}{4}$. The probability of selecting a blue ball at random from the same jar is $\frac{1}{3}$. If the jar contains 10 orange balls, find the total number of ball in the jar.

Ans : [Board Term-2 OD 2015]

Probability of red ball, $\quad P(R) = \frac{1}{4}$

Probability of blue ball, $\quad n(B) = \frac{1}{3}$

Probability of orange,

$$P(O) = 1 - [P(R) + P(B)]$$
$$= 1 - \left(\frac{1}{4} + \frac{1}{3}\right) = \frac{5}{12}$$

Now $\quad P(O) = \frac{n(O)}{n(S)}$

$$\frac{5}{12} = \frac{10}{n(S)}$$

Total numbers of balls,

$$n(S) = \frac{10 \times 12}{5} = 24$$

128. Two different dice are thrown together. Find the probability of :

(i) getting a number greater than 3 on each die.

(ii) getting a total of 6 or 7 of the numbers on two dice.

Ans : [Board Term-2 Delhi 2016]

When two dice are thrown there are $6 \times 6 = 36$ possible outcomes.

$$n(S) = 36$$

(i) getting a number greater than 3 on each die.

Favourable outcomes are (4, 5), (4, 4), (4, 6), (5, 4), (5, 5), (5, 6), (6, 4), (6, 5) and (6, 6).

No. of favourable outcomes,

$$n(E_1) = 9$$

P(a number $>$ 3 on each die)

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{9}{36} = \frac{1}{4}$$

(ii) getting a total of 6 or 7 of the numbers on two dice.

Favourable outcomes are (1, 5), (2, 4), (3, 3), (4, 2), (5, 1), (1, 6), (2, 5), (3, 4), (4, 3), (5, 2) and (6, 1).

No. of favourable outcomes $\quad n(B) = 11$

P(a total of 6 to 7),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{11}{36}$$

129. One card is drawn from a well shuffled deck of 52 cards. Find the probability of getting

(i) Non face card,

(ii) Black king or a Red queen,

(iii) Spade card.

Ans : [Board Term-2 SQP 2016]

Total cards $\quad n(S) = 52$

(i) Non face card

Total number of non-face card,

$$n(E_1) = 52 - 12 = 40$$

P(non-face cards),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{40}{52} = \frac{10}{13}$$

(ii) Black king or a red queen,

Number of black kings = 2

Number of red queens = 2

Thus there are 4 favourable outcome.

$$n(E_2) = 4$$

P(a black Kind or a red queen),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{4}{52} = \frac{1}{13}$$

(iii) Spade card

Number of spade cards,

$$n(E_3) = 13$$

P(Spade cards),

$$P(E_3) = \frac{n(E_3)}{n(S)} = \frac{13}{52} = \frac{1}{4}$$

130. Three coins are tossed simultaneously once. Find the probability of getting :

(i) at least one tail,

(ii) no tail.

Ans : [Board Term-2 2012]

Sample space for three coins tossed is {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT}

$$n(S) = 2^3 = 8$$

(i) at least one tail,

Number of favourable outcomes,

$$n(E_1) = 7$$

P(at least one tail),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{7}{8}$$

(ii) no tail.

Number of favourable outcomes,

$$n(E_2) = 1$$

P(no tail), $P(E_2) = \frac{n(E_2)}{n(S)} = \frac{1}{8}$

131. A game consists of tossing a one-rupee coin three times and noting its outcome each time. Find the probability of getting :

(i) three heads,

(ii) at least two tails.

Ans : [Board Term-2 Foreign 2015]

Sample space for three coins tossed is {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT}.

$$n(S) = 2^3 = 8$$

(i) three heads,

Favourable outcome is {HHH} i.e. only one outcome.

Thus $n(E_1) = 1$

P(three heads), $P(E_1) = \frac{n(E_1)}{n(S)} = \frac{1}{8}$

(ii) at least two tails.

Favourable outcome are {TTT, TTH, THT, HTT}.

Number of favourable outcomes,

$$n(E_2) = 4$$

P (at least two tails), $P(E_2) = \frac{n(E_2)}{n(S)} = \frac{4}{8} = \frac{1}{2}$

132. One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting :

(i) a red face card,

(ii) a spade,

(iii) either a king or a black cards.

Ans : [Board Term-2 2012, 2015]

Total cards, $n(S) = 52$

(i) Red face card

Total number of red-face card,

$$n(E_1) = 6$$

P(red face cards)

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{6}{52} = \frac{3}{26}$$

(ii) Spade card

Number of spade cards

$$n(E_2) = 13$$

P(Spade cards),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{13}{52} = \frac{1}{4}$$

(iii) Black king or a red queen,

$$\text{Number of kings} = 4$$

$$\text{Number of black cards} = 26 - 2 = 24$$

Thus there are 4 favourable outcome.

$$n(E_3) = 24 + 4 = 28$$

P(a black Kind or a red queen)

$$P(E_3) = \frac{n(E_3)}{n(S)} = \frac{28}{52} = \frac{7}{13}$$

133. Two dice are numbered 1, 2, 3, 4, 5, 6 and 1, 1, 2, 2, 3, 3 respectively. They are thrown and the sum of the numbers on them is noted. What is the probability of getting even sum :

Ans :

Total number of outcomes $= 6 \times 6 = 36$

Possible sum of two numbers on the two dice are 2, 3, 4, 5, 6, 7, 8, 9. i.e. outcomes favourable to event are (1, 1), (1, 1), (2, 2), (3, 1), (3, 1), (1, 3), (1, 3), (3, 3), (4, 2), (4, 2), (5, 1), (5, 1), (5, 3), (5, 3), (6, 2), (6, 2)

Hence, number of outcomes favourable to E is 18.

$$n(S) = 36$$

$$n(E) = 18$$

Required probability,

$$P(E) = \frac{n(E)}{n(S)} = \frac{18}{36} = \frac{1}{2}$$

134. Three unbiased coins are tossed together. Find the probability of getting :

(i) at least two heads,

(ii) almost two heads.

Ans : [Board Term-2 2015]

Sample space for three coins tossed is {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT}.

$$n(S) = 8$$

(i) Sample space for at least 2 heads is {HHH, HHT, HTH, THH}

Number of favourable outcomes,

$$n(E_1) = 4$$

P(at least two heads).

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{4}{8} = \frac{1}{2}$$

(ii) Sample space for almost two heads is {HHT, HTH, TTT, THH, THT, TTH, HTT}

Number of favourable outcomes,

$$n(E_2) = 7$$

P(almost 2 heads), $P(E_2) = \frac{n(E_2)}{n(S)} = \frac{7}{8}$

135. A bag contains, white, black and red balls only. A ball is drawn at random from the bag. If the probability of getting a white ball is $\frac{3}{10}$ and that of a black ball is $\frac{2}{5}$, then find the probability of getting a red ball. If the bag contains 20 black balls, then find the total number of balls in the bag.

Ans : [Board Term-2 OD 2015]

We have $P(W) = \frac{3}{10}$

$$P(B) = \frac{2}{5}$$

$$P(R) = 1 - \left(\frac{3}{10} + \frac{2}{5}\right) = \frac{3}{10}$$

Now $P(B) = \frac{n(B)}{n(S)}$

Substituting $P(B) = \frac{2}{5}$ and $n(B) = 20$ in above equation we have

$$\frac{2}{5} = \frac{20}{n(S)} \Rightarrow n(S) = \frac{20 \times 5}{2} = 50$$

Thus there are 50 total balls.

136. A bag contains 18 balls out of which x balls are red.

(i) If one ball is drawn at random from the bag, what is the probability that it is not red ?

(ii) If 2 more red balls are put in the bag, the probability of drawing a red ball will be $\frac{9}{8}$ times the probability of drawing a red ball in the first case. Find the value of x.

Ans : [Board Term-2 Foreign 2015]

Total ball, $n(S) = 18$

Red ball $n(R) = x$

(i) not red

P(red ball), $P(R) = \frac{n(R)}{n(S)} = \frac{x}{18}$

P(no red ball),

$$P(\overline{R}) = 1 - \frac{x}{18} = \frac{18 - x}{18}$$

(ii) Now two more red balls are added.

Now total ball $n'(S) = 18 + 2 = 20$

There are total $x + 2$ red ball.

$$n'(R) = x + 2$$

P(red balls), $P'(R) = \frac{n'(R)}{n'(S)} = \frac{x+2}{20}$

Now, according to the question,

$$\frac{x+2}{20} = \frac{9}{8} \times \frac{x}{18}$$

$$180x = 144x + 288$$

$$36x = 288$$

$$x = \frac{288}{36} = 8$$

Now substituting $x = 8$ we have

$$P(\overline{R}) = \frac{18-8}{18} = \frac{10}{18} = \frac{5}{9}$$

137. Cards numbered 1 to 30 are put in a bag. A card is drawn at random. Find the probability that the drawn card is

(i) prime number > 7

(ii) not a perfect square

Ans : [Board Term-2, 2014]

We have 30 cards and thus there are 30 possible outcomes.

$$n(S) = 30$$

(i) prime number > 7

Favourable outcomes are 11, 13, 17, 19, 23, 29. Thus number of favourable outcomes,

$$n(E_1) = 6$$

P(prime no. > 7) $P(E_1) = \frac{n(E_1)}{n(S)} = \frac{6}{30} = \frac{1}{5}$

(ii) not a perfect square

Favourable outcomes are 1, 4, 9, 16, 25. Thus number of favourable outcomes,

P(not a perfect square),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{25}{30} = \frac{5}{6}$$

138. Two dice are thrown at the same time. Find the probability of getting :

(i) same number on both dice

(ii) sum of two numbers appearing on both the dice is 8.

Ans : [Board Term-2 2012]

There are 36 possible outcomes of rolling two dices.

$$n(S) = 36$$

(i) same number on both dice

Favourable outcome are (1, 1), (2, 2), (3, 3), (4, 4), (5, 5) and (6, 6).

Thus number of favourable outcome

$$n(E_1) = 6$$

P(Same number on both dice)

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

(ii) sum of two numbers appearing on both the dice is 8.

Favourable outcome are (2, 6), (3, 5), (4, 4), (6, 2) and (5, 3). Thus number of favourable outcomes,

$$n(E_2) = 5$$

P(Sum is 8),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{5}{36}$$

139. Five cards, ten, Jack, Queen, King and Ace of diamonds are well shuffled. One card is picked up from them.

(i) Find the probability that the drawn card is Queen.

(ii) If Queen is put aside, then find the probability that the second card drawn is an ace.

Ans : [Board Term-2 2014]

We have 5 cards and thus there are 5 possible outcomes.

$$n(S) = 5$$

(i) drawn card is queen

No. of favourable outcomes,

$$n(E_1) = 1$$

P(queen), $\quad P(E_1) = \frac{n(E_1)}{n(S)} = \frac{1}{5}$

(ii) second card drawn is an ace

Since, queen was kept, number of all possible outcomes

$$n(S) = 5 - 1 = 4$$

Number of favourable outcomes

$$n(E_2) = 1$$

P(second card drawn is an ace),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{1}{4}$$

140. From all the two digit numbers a number is chosen at random. Find the probability that the chosen number is a multiple of 7.

Ans : [Board Term-2 OD Compt. 2017]

All possible outcomes are 10, 11, 12 ...., 98 and 99.

No. of all possible outcomes

$$n(S) = 90$$

All favourable outcomes are 14, 21, 28, 35, 42, 49, 56, 63, 70, 77, 84, 91 and 98 i.e 13 outcome.

No. of favourable outcomes

$$n(E) = 13$$

P(getting a number multiple of 7),

$$P(E) = \frac{n(E)}{n(S)} = \frac{13}{90}$$

141. A box contains cards, number 1 to 90. A card is drawn at random from the box. Find the probability that the selected card bears a :

(i) Two digit number.

(ii) Perfect square number

Ans : [Board Term-2 Delhi Compt. 2017]

We have 90 cards and thus there are 90 possible outcomes.

$$n(S) = 90$$

(i) No. of cards having 2 digit number $90 - 9 = 81$.

Number of favourable outcomes,

$$n(E_1) = 81$$

P(selected card bears two digit number)

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{81}{90} = \frac{9}{10}$$

(ii) Perfect square number between 1 to 90 are 1, 4, 9, 16, 25, 36, 49, 64 and 81 i.e. 9 numbers.

No. of favourable outcomes,

$$n(E_2) = 9$$

P(perfect square numbers)

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{9}{90} = \frac{1}{10}$$

142. Two different dice are thrown together. Find the

probability that the number obtained :
(i) have a sum less than 7.
(ii) have a product less than 16.
(iii) is a doublet of odd numbers.

Ans : [Board Term-2 Delhi 2017]

There are 36 possible outcomes of rolling two dices.

$$n(S) = 36$$

(i) have a sum less than 7.
Favourable outcome are (1, 1), (1, 2), (1, 3), (1, 4), (1,5) (2, 1), (2, 2), (2, 3), (2, 4), (3, 1), (3, 2), (3, 3), (4, 1), (4, 2) and (5, 1).
Number of favourable outcomes

$$n(E_1) = 15$$

P(have sum less than 7),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{15}{36} = \frac{5}{12}$$

(ii) have a product less than 16.
Favourable outcome are (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), (4, 1), (4, 2), (4, 3), (5, 1), (5, 2), (5, 3), (6, 1) and (6, 2).
No. of favourable outcomes,

$$n(E_2) = 24$$

P(have a product less than 16),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{24}{36} = \frac{2}{3}$$

(iii) is a doublet of odd numbers.
Favourable outcome are (1, 1), (1, 3), (1, 5), (3, 1), (3, 3), (3, 5), (5, 1), (5, 3) and (5, 5).
No. of favourable outcomes,

$$n(E_3) = 9$$

P(a doublet of odd number),

$$P(E_3) = \frac{n(E_3)}{n(S)} = \frac{9}{36} = \frac{1}{4}$$

FOUR MARKS QUESTIONS

143. What is the probability that a randomly taken leap year has 52 Sundays?

Ans : [Board 2020 OD Standard]

Number of days in a leap year = 366

$$\text{Number of weeks} = \frac{366}{7} = 52.28$$

So, there will be 52 weeks and 2 days
So, every leap year has 52 Sundays
Now, the probability depends on remaining 2 days
The Possible pairing of days are
Sunday – Monday
Monday – Tuesday
Tuesday – Wednesday
Wednesday – Thursday
Thursday – Friday
Friday – Saturday
Saturday – Sunday
There are total 7 pairs and out of 7 pairs, only 2 pairs have Sunday. The remaining 5 pairs does not include Sunday.

$$n(S) = 7$$

$$n(A) = 5$$

$$P(A) = \frac{n(A)}{n(S)} = \frac{5}{7}$$

Therefore, the probability of only 52 Sunday in a Leap year is $\frac{5}{7}$.

144. Jayanti throws a pair of dice and records the product of the numbers appearing on the dice. Pihu throws 1 dice and records the squares the number that appears on it. Who has the better chance of getting the number 36? Justify?

Ans : [Board 2020 SQP Standard]

Jayanti throws two dice together. There are $6^2 = 36$ total number of possible outcomes.

$$n(S) = 36$$

She get 36 only when she gets (6, 6),

No. of favourable outcomes,

$$n(E_1) = 1$$

P(getting the numbers of product 25)

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{1}{36}$$

Pihu throws one dice. There are 6 total number of all possible outcomes.

$$n(S) = 6$$

The number where square is 36 is 6.

No. of favourable outcomes,

$$n(E_2) = 1$$

P(getting a number whose square is 36)

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{1}{6}$$

$$P(E_2) > P(E_1)$$

Hence, Pihu has better chances to the number square 36.

145. Peter throws two different dice together and finds the product of the two numbers obtained. Rina throws a die and squares the number obtained. Who has the better chance to get the numbers 25.

Ans : [Board Term-2 Delhi 2017]

Peter throws two dice together. There are $6^2 = 36$ total number of possible outcomes.

$$n(S) = 36$$

He get 25 only when he gets (5, 5),

No. of favourable outcomes,

$$n(E_1) = 1$$

P(getting the numbers of product 25),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{n(A)}{n(S)} = \frac{1}{36}$$

Rina throws one dice. There are 6 total number of all possible outcomes.

$$n(S) = 6$$

The number where square is 25 is 5.

No. of favourable outcomes,

$$n(E_2) = 1$$

P (getting a number whose square is 25)

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{1}{6}$$

$$P(E_2) > P(E_1)$$

Hence, Rina has better chances to the number square 25.

146. The probability of selecting a blue marble at random from a jar that contains only blue, black and green marbles is $\frac{1}{5}$. The probability of selecting a black marble at random from the same jar is $\frac{1}{4}$. If the jar contains 11 green marbles, find the total number of marbles in the jar.

Ans : [Board 2019 OD]

Let x and y be the number of blue and black marbles.

No of green marbles $= 11$

Total number of marbles $= x + y + 11$

According to the problem,

$$P(\text{black marbles}) = \frac{1}{4}$$

$$\frac{y}{x+y+11} = \frac{1}{4}$$

$$x = 3y - 11 \qquad ...(1)$$

Again, $P(\text{blue marble}) = \frac{1}{5}$

$$\frac{x}{x+y+11} = \frac{1}{5}$$

$$5x = x + y + 11$$

$$x = \frac{y+11}{4} \qquad ...(2)$$

From equation (1) and (2), we have

$$3y - 11 = \frac{y+11}{4}$$

$$12y - 44 = y + 11$$

$$12y - y = 11 + 44$$

$$11y = 55 \Rightarrow y = 5$$

From equation (1) we have

$$x = 3 \times 5 - 11 = 4$$

Hence, total number of marbles in the jar,

$$x + y + 11 = 4 + 5 + 11 = 20$$

147. Cards marked with numbers 3, 4, 5, ...50 are placed in a bag and mixed thoroughly. One card is drawn at random from the bag. Find the probability that number on the card drawn is :

(i) Divisible by 7.

(ii) A perfect square.

(iii) A multiple of 6.

Ans : [Board Term-2 SQP 2016]

We have 48 cards and thus there are 48 possible outcomes.

$$n(S) = 48$$

(i) Divisible by 7.

Number of cards divisible by 7 are 7, 14, 21, 35, 42 and 49.

No. of favourable outcomes,

$$n(E_1) = 7$$

P(cards divisible by 7),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{7}{48}$$

(ii) A perfect square.

Number of cards having a perfect square are 4, 9, 16, 25, 36 and 49.

No. of favourable outcomes,

$$n(E_2) = 6$$

P(cards having a perfect square),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{6}{48} = \frac{1}{8}$$

(iii) A multiple of 6.

Number of multiples of 6 from 3 to 50 are 6, 12, 24, 30, 36, 42, and 48.

No. of favourable outcomes,

$$n(E_3) = 6$$

P(multiple of 6 from 3 to 50),

$$P(E_3) = \frac{n(E_3)}{n(S)} = \frac{8}{48} = \frac{1}{6}$$

148. All the red face cards are removed from a pack of 52 playing cards. A card is drawn at random from the remaining cards, after reshuffling them. Find the probability that the drawn card is

(i) of red colour

(ii) a queen

(iii) an ace

(iv) a face card.

Ans : [Board Term-2 OD 2015]

There are $52 - 6 = 46$ cards after removing black face cards. We have 46 cards and thus there are 48 possible outcomes.

$$n(S) = 46$$

(i) red colour

Number of red cards, $n(E_1) = 26 - 6 = 20$

P(red colour), $P(E_1) = \frac{n(E_1)}{n(S)} = \frac{20}{46} = \frac{10}{23}$

(ii) a queen

No. of queen, $n(E_2) = 4 - 2 = 2$

P(a queen), $P(E_2) = \frac{n(E_2)}{n(S)} = \frac{2}{46} = \frac{1}{23}$

(iii) an ace

No. of ace, $n(E_3) = 4$

P(an ace), $P(E_3) = \frac{n(E_3)}{n(S)} = \frac{4}{46} = \frac{2}{23}$

(iv) a face card

Number of face cards, $n(E_4) = 12 - 6 = 6$

P(a face card) $P(E_4) = \frac{n(E_4)}{n(S)} = \frac{6}{46} = \frac{3}{23}$

149. All the black face cards are removed from a pack of 52 cards. Find the probability of getting a

(i) face card

(ii) red card

(iii) black card

(iv) king

Ans : [Board Term-2 2014]

There are $52 - 6 = 46$ cards after removing black face cards. We have 46 cards and thus there are 48 possible outcomes.

$$n(S) = 46$$

(i) face card

Number of red cards, $n(E_1) = 12 - 6 = 6$

P(face card), $P(E_1) = \frac{n(E_1)}{n(S)} = \frac{6}{46} = \frac{3}{23}$

(ii) red card

Number of red card, $n(E_2) = 26$

P(red card), $P(E_2) = \frac{n(E_2)}{n(S)} = \frac{26}{46} = \frac{13}{23}$

(iii) black card

Number of black card, $n(E_3) = 26 - 6 = 20$

P(black card), $P(E_3) = \frac{n(E_3)}{n(S)} = \frac{20}{46} = \frac{10}{23}$

(iv) king

Number of king, $n(E_4) = 4 - 2 = 2$

P(king), $P(E_4) = \frac{n(E_4)}{n(S)} = \frac{2}{46} = \frac{1}{23}$

150. A box contains 20 cards from 1 to 20. A card is drawn at random from the box. Find the probability that the number on the drawn card is

(i) divisible by 2 or 3

(ii) a prime number

Ans : [Board Term-2, 2015]

We have 20 cards and thus there are 20 possible outcomes.

$$n(S) = 20$$

(i) divisible by 2 or 3

Number divisible by 2 or 3 are 6, 12, 18.

Number of favourable outcomes,

$$n(E_1) = 3$$

P(divisible by 2 or 3),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{3}{20}$$

(ii) a prime number

Prime numbers are 2, 3, 5, 7, 11, 13, 17 and 19 i.e 8 numbers.

Number of favourable outcomes,

$$n(E_2) = 8$$

P(a prime no.),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{8}{20} = \frac{2}{5}$$

151. A box contains cards bearing numbers from 6 to 70. If one card is drawn at random from the box, find the probability that it bears,

(i) a one digit number.

(ii) a number divisible by 5.

(iii) an odd number less than 30.

(iv) a composite number between 50 and 70.

Ans : [Board Term-2 Foreign 2015]

We have $70 - 5 = 65$ cards and thus there are 65 possible outcomes.

$$n(S) = 65$$

(i) a one digit number.

One digit numbers are 6, 7, 8 and 9.

Number of favourable outcomes

$$n(E_1) = 4$$

P(one digit number),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{4}{65}$$

(ii) a number divisible by 5.

Number divisible by 5 are 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65 and 70 i.e. 13 numbers.

Number of favourable outcomes,

$$n(E_2) = 13$$

P(a number divisible by 5),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{13}{65} = \frac{1}{5}$$

(iii) an odd number less than 30.

Odd number less than 30 are 7, 9, 11, 13, 15, 17, 19 23, 25, 27 and 29.

Number of favourable outcomes,

$$n(E_3) = 12$$

P(a odd number less than 30),

$$P(E_3) = \frac{n(E_3)}{n(S)} = \frac{12}{65}$$

(iv) a composite number between 50 and 70

Composite number between 50 and 70 are 51, 52, 54, 55, 56, 57, 58, 60, 62, 63, 64, 65, 66, 68 and 69.

Number of favourable outcomes,

$$n(E_4) = 15$$

P(a composite number between 50 and 70)

$$P(E_4) = \frac{n(E_4)}{n(S)} = \frac{15}{65} = \frac{3}{13}$$

152. A card is drawn at random from a well-shuffled deck of playing cards. Find the probability that the card drawn is :

(i) a card of spade or an ace.

(ii) a black king.

(iii) neither a jack nor a king.

(iv) either a king or a queen.

Ans : [Board Term-2 OD 2015]

We have 52 cards and thus there are 52 possible outcomes.

$$n(S) = 52$$

(i) a card of spade or an ace

Cards of spade or an ace,

$$n(E_1) = 13 + 3 = 16$$

P(spade or an ace),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{16}{52} = \frac{4}{13}$$

(ii) a black king

Number of black kings,

$$n(E_2) = 2$$

P(a black king),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{2}{52} = \frac{1}{26}$$

(iii) neither a jack nor a king

There are $4 + 4 = 8$ Jack or king.

Number of neither jack nor a king,

$$n(E_3) = 52 - 8 = 44$$

P(neither jack nor a king),

$$P(E_3) = \frac{n(E_3)}{n(S)} = \frac{44}{52} = \frac{11}{13}$$

(iv) either a king or a queen

There are $4 + 4 = 8$ king or queen.

$$n(E_4) = 8$$

P(either a king or a queen),

$$P(E_4) = \frac{n(E_4)}{n(S)} = \frac{8}{52} = \frac{2}{13}$$

153. A bag contains 15 balls of which x are blue and the remaining are red. If the number of red balls are increased by 5, the probability of drawing the red balls doubles. Find :

(i) P(red ball)

(ii) P(blue ball)

(iii) P(blue ball if of 5 extra red balls are actually added)

Ans : [Board Term-2, 2015]

Total ball, $n(S) = 15$

Blue ball $n(B) = x$

Red ball $n(R) = 15 - x$

Now probability of drawing red ball,

$$P(R) = \frac{n(R)}{n(S)} = \frac{15-x}{15} \quad ...(1)$$

If the number of red balls are increased by 5, i.e. total the probability of drawing the red balls doubles.

In this case, number of total ball,

$$n(S') = 15 + 5 = 20$$

and number of red ball,

$$n(R') = 15 - x + 5 = 20 - x.$$

Now in this case probability of drawing red ball,

$$P(R') = \frac{n'(R)}{n'(S)} = \frac{20-x}{20}$$

According to the question, we have

$$P(R') = 2P(R)$$

$$\frac{20-x}{20} = 2\left(\frac{15-x}{15}\right)$$

$$1 - \frac{x}{20} = 2 - \frac{2x}{15}$$

$$\frac{2x}{15} - \frac{x}{20} = 2 - 1$$

$$\frac{8x - 3x}{60} = 1$$

$$5x = 60 \Rightarrow x = 12$$

(i) P(red ball)

$$P(R) = \frac{n(R)}{n(S)} = \frac{15-12}{15} = \frac{3}{15} = \frac{1}{5}$$

(ii) P(blue ball)

$$P(R) = \frac{n(B)}{n(S)} = \frac{12}{15} = \frac{4}{5}$$

(iii) P(blue ball if of 5 extra red balls are actually added)

$$P'(R) = \frac{n'(R)}{n'(S)} = \frac{3+5}{15+5} = \frac{8}{20} = \frac{2}{5}$$

154. Three digit number are made using the digits 4, 5, 9 (without repetition). If a number among them is selected at random, what is the probability that the number will :

(i) be a multiple of 5 ?

(ii) be a multiple of 9 ?

(iii) will end with 9 ?

Ans : [Board Term-2, 2014]

Total number of three digit numbers are 459, 495, 549, 594, 945 and 954. Thus we have 6 possible outcomes.

$$n(S) = 6$$

(i) be a multiple of 5

Multiple of 5 are 495 and 945.

$$n(E_1) = 2$$

P(multiple of 5),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{2}{6} = \frac{1}{3}$$

(ii) be a multiple of 9

All are multiple of 9.

$$n(E_2) = 6$$

P(multiple of 9),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{6}{6} = 1$$

(iii) will end with 9

Numbers 459 and 549 ends with 9.

$$n(E_3) = 2$$

P(ending with 9),

$$P(E_3) = \frac{n(E_2)}{n(S)} = \frac{2}{6} = \frac{1}{3}$$

155. A number x is selected at random from the numbers 1, 2, 3 and 4. Another number y is selected at random from the numbers 1, 4, 9 and 16. Find the probability that product of x and y is less than 16.

Ans : [Board Term-2 OD 2016]

We have,

Total possible outcome are 1, 2, 3, 4, 4, 8, 9, 12, 16, 16, 18, 27, 32, 36 48 and 64 which are shown in following table.

$\times$	1	2	3	4
1	1	2	3	4
4	4	8	12	16
9	9	18	27	36
16	16	32	48	64

There are 16 possible outcomes,

$$n(S) = 16$$

Total favourable number having product less than 16 are 1, 2, 3, 4, 4, 8, 9 and 12.

Number of favourable outcomes

$$n(E) = 8$$

P(product of x and y is less than 16),

$$P(E) = \frac{n(E)}{n(S)} = \frac{8}{16} = \frac{1}{2}$$

156. Two different dice are rolled together once. Find the probability of numbers coming on the tops whose product is a perfect square.

Ans : [Board Term-2 OD Compt. 2017]

There are 36 possible outcomes of rolling two dices.

$$n(S) = 36$$

Favourable outcome are (2, 2), (3, 3), (4, 4) (5, 5), (6, 6), (1, 1), (4, 1) and (1, 4).

Number of favourable outcomes

$$n(E) = 8$$

P(product is a prefect square),

$$P(E) = \frac{n(E)}{n(S)} = \frac{8}{36} = \frac{2}{9}$$

157. A box contains 125 shirts of which 110 are good 12 have minor defects and 3 have major defects. Ram Lal will buy only those shirts which are good while Naveen will reject only those which have major defects. A shirt is taken out at random from the box. Find the probability that :

(i) Ram Lal will buy it

(ii) Naveen will buy it

Ans : [Board Term-2 OD 2017]

For both case total shirt,

$$n(S) = 125$$

(i) Ram Lal will buy it

Ramlal will buy only a good shirt.

No. of all possible outcomes,

$$n(E_1) = 110$$

P(Ramlal will buy a shirt),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{110}{125} = \frac{22}{25}$$

(ii) Naveen will buy it

Naveen will reject the shirt which have major defects and will buy all other shirts.

No. of favourable outcomes,

$$n(E_2) = 125 - 3 = 122$$

P(Naveen will buy the shirt)

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{122}{125}$$

158. The king, queen and jack of clubs are removed from a deck of 52 cards. The remaining cards are mixed together and then a card is drawn at random from it. Find the probability of getting

(i) a face card,

(ii) a card of heart,

(iii) a card of clubs

(iv) a queen of diamond

Ans : [Board Term-2 Delhi Compt. 2017]

There are $52-3=49$ cards in deck. Thus we have 44 possible outcomes.

$$n(S) = 49$$

(i) a face card,

Number of face cards, $n(E_1) = 12-3 = 9$

P(a face card), $P(E_1) = \frac{n(E_1)}{n(S)} = \frac{9}{49}$

(ii) a card of heart,

No. of card of heart in the deck

$$n(E_2) = 13$$

P(a card of heart), $P(E_2) = \frac{n(E_2)}{n(S)} = \frac{13}{49}$

(iii) a card of clubs

Number of cards of clubs

$$n(E_3) = 13-3 = 10$$

P(a card of clubs), $P(E_3) = \frac{n(E_3)}{n(S)} = \frac{10}{49}$

(iv) a queen of diamond.

There is only one queen of diamond.

$$n(E_4) = 1$$

P(queen of diamond), $P(E_4) = \frac{n(E_4)}{n(S)} = \frac{1}{49}$

159. A box contains 90 discs which are numbered 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) number divisible by 5.

Ans : [Board Term-2 Foreign 2017]

Total number of discs in the box are 90.

Thus we have 90 possible outcomes.

$$n(S) = 90$$

(i) a two digit number,

Discs with two digit number are 10, 11, ...89 and 90 which are 81 numbers.

No. of favourable outcomes,

$$n(E_1) = 81$$

P(a disc with two digit number)

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{81}{90} = \frac{9}{10}$$

(ii) number divisible by 5

The numbers divisible by 5 between 1 to 90 are 5, 10, 15 ..... 85 and 90 which are 18 numbers.

No. of favourable outcomes,

$$n(E_2) = 18$$

P (a disc with a number divisible by 5)

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{18}{90} = \frac{1}{5}$$

160. Two different dice are thrown together. Find the probability that the numbers obtained have

(i) even sum, and

(ii) even product.

Ans :

There are 36 possible outcomes of rolling two dices.

$$n(S) = 36$$

(i) even sum

Favourable outcome are (1, 3), (1, 5), (1, 1), (2, 2), (2, 4), (2, 6), (3, 1) (3, 3), (3, 5), (4, 2), (4, 4), (4, 6), (5, 1), (5, 3) (5, 5) (6, 2), (6, 4) and (6, 6).

Number of favourable outcomes,

$$n(E_1) = 18$$

P(even sum),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{18}{36} = \frac{1}{2} \text{ or } 0.5$$

(ii) even product

Favourable outcome are (1, 2), (1, 4), (1, 6), (2, 1), (2,2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 2), (3, 4), (3, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 2) (5, 4), (5, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5) and (6, 6).

Number of favourable outcomes

$$n(E_2) = 27$$

P(have a product less than 16),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{27}{36} = \frac{3}{4} = 0.75$$

Probability of getting even product is $\frac{3}{4}$ or 0.75.

161. From a deck of 52 playing cards, Jacks and kings of red colour and Queen and Aces of black colour are removed. The remaining cards are mixed and a card is drown at random. Find the probability that the drawn card is

(i) a black queen

(ii) a card of red colour

(iii) a Jack of black colour

(iv) a face card

Ans : [Board Term-2 OD Compt 2017]

There are $52-(2+2+2+2) = 44$ cards in deck. Thus we have 44 possible outcomes.

$$n(S) = 44$$

(i) a black queen

Number of black Queens in the deck,

$$n(E_1) = 0$$

P(getting a black queen),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{0}{44} = 0$$

Hence it is an impossible event

(ii) a card of red colour

Number of red cards,

$$n(E_2) = 26 - 4 = 22$$

P(getting a red card),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{22}{44} = \frac{1}{2}$$

(iii) a Jack of black colour

Number of Jacks (black),

$$n(E_3) = 2$$

P(getting a black coloured Jack),

$$P(E_3) = \frac{n(E_3)}{n(S)} = \frac{2}{44} = \frac{1}{22}$$

(iv) a face card

Number of face cards in the deck,

$$n(E_4) = 12 - 6 = 6$$

P(getting a face card),

$$P(E_4) = \frac{n(E_4)}{n(S)} = \frac{6}{44} = \frac{3}{22}$$

162. Cards on which numbers 1, 2, 3 .... 100 are written (one number on one card and no number is repeated), put in a bag and are mixed thoroughly. A card is drawn at random from the bag. Find the probability that card taken out has

(i) an even number

(ii) a number which is a multiple of 13.

(iii) a perfect square number.

(iv) a prime number less than 20.

Ans : [Board Term-2 Delhi Compt 2017]

There are 100 cards in bags. Thus we have 100 possible outcomes.

$$n(S) = 100$$

(i) an even number

Even numbers 1 to 100 are 50.

Number of favourable outcomes,

$$n(E_1) = 50$$

P(an even number),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{50}{100} = \frac{1}{2}$$

(ii) A number which is a multiple of 13

Numbers multiples of 13, 26, 39, 52, 65, 78 and 91.

No. of favourable outcomes,

$$n(E_2) = 7$$

P(card taken out has multiple of 13),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{7}{100}$$

(iii) a perfect square number

Perfect square number in 1 to 100 are 1, 4, 9, 16, 25, 36, 49, 64, 81 and 100.

No. of all favourable outcomes,

$$n(E_3) = 10$$

P(perfect square number),

$$P(E_3) = \frac{n(E_3)}{n(S)} = \frac{10}{100} = \frac{1}{10}$$

(iv) a prime number less than 20

Prime numbers less than 20 are 2, 3, 5, 7, 11, 13, 17 and 19.

No. of all favourable outcomes,

$$n(E_4) = 8$$

P(prime number less than 20),

$$P(E_4) = \frac{n(E_4)}{n(S)} = \frac{8}{100} = \frac{2}{25}$$

163. A bag contains 20 balls out of which x balls are red.

(i) If one ball is drawn at random from the bag, find the probability that it is not red.

(ii) If 4 more red balls are out into the bag, the probability of drawing a red ball will be $\frac{5}{4}$ times the probability of drawing a red ball in the first case. Find the value of x.

Ans : [Board Term-2 Foreign 2015]

Total ball, $n(S) = 20$

Red ball $n(R) = x$

(i) not red

P(red ball), $P(R) = \frac{n(R)}{n(S)} = \frac{x}{20}$

P(no red ball),

$$P(\overline{R}) = 1 - \frac{x}{20} = \frac{20 - x}{20} \quad ...(1)$$

(ii) Now two more red balls are added.

Total ball $n'(S) = 20 + 4 = 24$

There are total $x+4$ red ball.

$$n'(R) = x+4$$

P(red balls), $$P'(R) = \frac{n'(R)}{n'(S)} = \frac{x+4}{24}$$

Now, according to the question,

$$\frac{x+4}{24} = \frac{5}{4}\times\frac{x}{20}$$

$$\frac{x+4}{24} = \frac{x}{16}$$

$$16x+64 = 24x$$

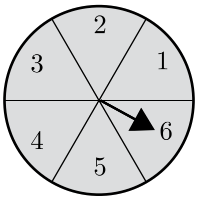
$$64 = 8x \Rightarrow x = 8$$

For first case, substituting $x=8$ in equation (1) we have

$$P(\overline{R}) = \frac{20-8}{20} = \frac{12}{20} = \frac{3}{5}$$

164. In Figure a disc on which a player spins an arrow twice. The fraction $\frac{a}{b}$ is formed, where a is the number of sector on which arrow stops on the first spin and 'b' is the number of the sector in which the arrow stops on second spin, On each spin, each sector has equal chance of selection by the arrow.

Find the probability that the fraction $\frac{a}{b} > 1$



Ans : [Board Term-2 Foreign 2016]

For $\frac{a}{b} > 1$, when $a=1$, b can not take any value.

For $a=2$, b can take 1 value i.e. 1.

For $a=3$, b can take 2 values, i.e. 1 and 2.

For $a=4$, b can take 3 values i.e. 1, 2, and 3.

For $a=5$, b can take 4 values i.e. 1, 2, 3 and 4.

For $a=6$, b can take 5 values i.e. 1, 2, 3, 4 and 5

Total possible outcomes,

$$n(S) = 36$$

Favourable outcomes,

$$n(E) = 0+1+2+3+4+5 = 15$$

$p\left(\frac{a}{b}>1\right)$, $$P(E) = \frac{n(E)}{n(S)} = \frac{15}{36} = \frac{5}{12}$$

165. A bag contains 25 cards numbered from 1 to 25. A card is drawn at random from the bag. Find the probability that the number on the drawn card is :

(i) divisible by 3 or 5

(ii) a perfect square number.

Ans : [Board Term-2, 2015]

Total cards $n(S) = 25$

(i) divisible by 3 or 5

Number divisible by 3 are 3, 6, 9, 12, 15, 16, 21, 24, and number divisible by 5 are 5, 10, 15, 20 and 25.

Thus number divisible by 3 or 5,

$$n(E_1) = 12$$

P(divisible by 3 or 5),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{12}{25}$$

(ii) a perfect square number.

Perfect square number are 1, 4, 9, 16 and 25.

$$n(E_2) = 5$$

P(a perfect square no.),

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{5}{25} = \frac{1}{5}$$

166. A dice is rolled twice. Find the probability that :

(i) 5 will not come up either time.

(ii) 5 will come up exactly one time.

Ans : [Board Term-2 Delhi 2014]

When a dice is rolled twice, total number of outcomes,

$$n(S) = 6^2 = 36$$

There are 25 outcomes when 5 not come up either time.

Thus $n(E_1) = 25$

P(5 will not come up either time),

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{25}{36}$$

(ii) 5 will come up exactly one time.

Possible outcomes are (1, 5), (2, 5), (3, 5), (4, 5), (5, 1), (5, 2), (5, 3), (5, 4), (5, 6) and (6, 5).

$$n(E_2) = 10$$

P(5 will come up exactly one time)

$$P(E_2) = \frac{n(E_2)}{n(S)} = \frac{10}{36} = \frac{5}{18}$$