

Chapter-13

Probability

- The definition of probability was given by Pierre Simon Laplace in 1795
- J.Cardan, an Italian physician and mathematician wrote the first book on probability named the book of games of chance
- Probability has been used extensively in many areas such as biology, economics, genetics, physics, sociology etc.
- We used probability in forecast of weather, result of an election, population demography, earthquakes, crop production etc.

Random Experiment:

An experiment is said to be a random experiment if its outcome cannot be predicted that is the outcome of an experiment does not obey any rule.

- i. Tossing a coin is a random experiment
- ii. Throwing a die is a random experiment

Sample Space:

The set of all possible outcomes of an experiment are called a sample space (or) probability space

- If coin is tossed, either head or tail may appear

Hence sample space (s) = {H,T}

Number of events $n(s) = 2$

- If a die throw once every face has equal chance to appear (1 or 2 or 3 or 4 or 5 or 6)

Hence sample space (s) = {1, 2, 3, 4, 5, 6}

Number of events $n(s) = 6$

Event: Any sub set E of a sample space is called an event.

Ex: When a coin is tossed getting a head

Elementary Event: An event having only one outcome is called an elementary event

Ex: In tossing two coins {HH},{HT},{TH} and {TT} are elementary events.

Equally Likely Events: Two or more events are said to be equally likely if each one of them has an equal chance of occurrence

Ex: 1. When a coin is tossed, the two possible outcomes, head and tail, are

Equally likely

2. When a die is thrown, the six possible outcomes, 1, 2,3,4,5, and 6 are

Equally likely

Mutually Exclusive Events: Two or more events are mutually exclusive if the occurrence of each event prevents the every other event.

Ex: When a coin is tossed getting a head and getting a tail are mutually exclusive.

Probability: The number of occasions that a particular events is likely to occur in a large population of events is called **probability**

Theoretical Probability: The theoretical probability of an event is written as $P(E)$ and is defined as

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

The sum of the probabilities, of all the elementary events of an experiments is 1

- **Complementary Events:** Event of all other outcomes in the sample survey which are not in the favorable events is called Complementary event.
- For any event E , $P(E) + P(\bar{E}) = 1$, Where \bar{E} stands for 'not E ' and E and \bar{E} are called complementary events

$$P(E) + P(\bar{E}) = 1 \Rightarrow P(\bar{E}) = 1 - P(E)$$

Exhaustive Events: All the events are exhaustive if their union is the sample space

Ex: when a die is thrown the events of getting an odd number, even number are mutually exhaustive.

Impossible Event: An event which will not occur on any account is called an Impossible event.

Ex: Getting '7' when a single die is thrown

Sure Event: The sample space of a random experiment is called sure or certain event.

Ex: When a die is thrown the events of getting a number less than or equal to 6

The probability of an event E is a number $P(E)$ such that $0 \leq P(E) \leq 1$

About Cards

- There are 52 cards in a pack of cards
- Out of these, 26 are in red colour and 26 are in black colour
- Out of 26 red cards, 13 are hearts (♥) and 13 are diamonds (♦)
- Out of 26 black cards, 13 are spades (♠) 13 are clubs (♣)
- Each of four varieties (hearts, diamonds, spades, clubs) has an ace. i.e

A pack of 52 cards has 4 aces. Similarly there are 4 kings, 4 queens and 4 jacks

1Mark Questions

1. **Sangeeta and Reshma, play a tennis match. It is known that the probability of Sangeeta wining the math is 0.62. What is the probability of Reshma winning the match .**

A. The probability of Sangeeta winning chances $P(S) = 0.62$

The probability of Reshmas winning chances $P(R) = 1 - P(S)$

$$= 1 - 0.62$$

$$= 0.38$$

2. **If $P(E) = 0.05$ what is the probability of not E?**

A. $P(E) + P(\text{not } E) = 1$

$$0.05 + P(\text{not } E) = 1$$

$$\therefore P(\text{not } E) = 1 - 0.05$$

$$= 0.95$$

3. **What is the probability of drawing out a red king from a deck of cards?**

A. Number of possible out comes = 52

$$\therefore n(s) = 52$$

The number of red king from a deck of cards = 2

$$\therefore n(E) = 2$$

$$\therefore P(E) = \frac{n(E)}{n(s)} = \frac{2}{52} = \frac{1}{26}$$

4. **What are complementary events?**

A. Consider an event has few outcomes. Event of all other outcomes in the sample survey which are not in the favorable event is called **complementary event**

5. **A die is thrown once find the probability of getting a even prime number**

A. Total no of outcomes = 6

$$n(s) = 6$$

No of outcomes favorable to a even prime number $E = 1$

$$\therefore n(E)=1$$

$$\therefore \text{Probability of getting a even prime } P(E) = \frac{n(E)}{n(s)} = \frac{1}{6}$$

6. Can $\frac{7}{2}$ be the probability of an event? Explain?

A. $\frac{7}{2}$ Can't be the probability of any event

Reason: probability of any event should be between 0 and 1

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

A. Number of outcomes favorable to the queen = 4

$$\therefore n(E) = 4$$

Number of all possible outcomes in drawing a card at random = 52

$$\therefore n(s) = 52$$

$$\text{Probability of event } P(E) = \frac{n(E)}{n(s)} = \frac{4}{52}$$

8. If $P(E) = \frac{1}{13}$ then find out p (not E)?

A. $P(E) = \frac{1}{13}$

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

$$\frac{1}{13} + P(\bar{E}) = 1$$

$$P(\bar{E}) = 1 - \frac{1}{13}$$

$$\frac{13-1}{13} = \frac{12}{13}$$

9. If a coin is tossed once what is the probability of getting a tail?

A. Number of all possible outcomes $s = 2$

$$\therefore n(s) = 2$$

Number of outcomes getting a tail $E = 1$, $\therefore n(E) = 1$

$$\therefore \text{Probability of event } P(E) = \frac{n(E)}{n(s)} = \frac{1}{2}$$

10. The probability of an event -1. In it true? Explain?

A. False. The probability of an event can never be negative it lies in between 0 and 1

11. A bag contain 3red and 2blue marbles. A marble is drawn at random. What is the probability of drawing a blue marbles

A. Total number of marbles = 3red + 2blue

$$n(s) = 5 \text{ marbles}$$

Favorable no of blue marbles = 2

$$n(E) = 2$$

Probability of getting blue marble

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

12. What is a sample space?

A. The set of all possible outcomes of an event is called a sample space

13. What is the sum of fall probabilities of all elementary events of an experiment?

A. The sum of all probabilities of al elementary even of an experiment is 1.

14. Write an example for impossible event

A. When die is thrown the probability of getting 8 on the face.

2 Mark Questions

1. Suppose we throw a die once.

(i) What is the probability of getting a number getting a number greater than 4?

(ii) What is the probability of getting a number getting a number less than or equal to 4?

A. i) In rolling an unbiased dice

Sample space $s = \{1, 2, 3, 4, 5, 6\}$

No of outcomes $n(s) = 6$

Favorable outcomes for number greater than 4, $E = \{5,6\}$

No o favorable outcomes $n(E) = 2$

Probability $p(E) = \frac{2}{6} = \frac{1}{3}$

ii. Let F be the event getting a number less than or equal to 4

Sample space $s = \{1,2,3,4,5,6\}$

No of outcomes $n(s) = 6$

Favorable outcomes for number less or Equal to 4, $F = \{1,2,3,4\}$

No o favorable outcomes $n(F) = 4$

Probability $p(F) = P(F) = \frac{4}{6} = \frac{2}{3}$

2. One card is drawn from a well shuffled deck of 52 cards calculate the probability that the card will (i) be an ace (ii) not be an ace

A. Well shuffling ensures equally likely outcomes

i. There are 4 aces in a deck

Let E be the event the card is an ace

The number of the outcomes favorable to E = 4

The number of possible outcomes = 52

$$\therefore P(E) = \frac{4}{52} = \frac{1}{13}$$

- ii. Let F be the event card drawn is not an ace the number of outcomes favorable to the event $F = 52 - 4 = 48$

The number of possible outcomes = 52

$$\therefore P(E) = \frac{48}{52} = \frac{12}{13}$$

Alternate method: Note that F is nothing but \bar{E} .

Therefore can also calculate $P(F)$ as follows:

$$P(F) = P(\bar{E}) = 1 - P(E) = 1 - \frac{1}{13} = \frac{12}{13}$$

- 3. A bag contains lemon flavoured candies only Malini takes out one candy without locking in to the bag. What is the probability that she takes out**

i) An orange flavoured candy? ii) A lemon flavoured candy?

- A. Bag contains only lemon flavoured candies

- i. Taking an orange flavoured candy is an impossible event and hence the probability is zero
- ii. Also taking a lemon flavoured candy is a sure event and hence its probability is 1

- 4. A box contains 3blue, 2white and 4red marbles if a marble is drawn at random from the box, what is the probability that it will be**

i) White? ii) Blue? iii) Red?

- A. Saying that a marble is drawn at random means all the marbles are equally likely to be drawn

$$\therefore \text{The number of possible outcomes} = 3 + 2 + 4 = 9$$

Let W denote the event 'the marble is white', B denote the event 'the marble is blue' and R denote the event 'the marble is red'.

- i. The number of outcomes favourable to the event $W = 2$

$$\text{So, } p(w) = \frac{2}{9}$$

$$\text{Similarly, ii) } P(B) = \frac{3}{9} = \frac{1}{3} \text{ and } P(R) = \frac{4}{9}$$

$$\text{Note that } P(W) + P(B) + P(R) = 1$$

5. Harpreet tosses two different coins simultaneously (say one is of one Rupee and other of two Rupee) . What is the probability that she gets at least one head?

- A. We write H for 'head' and T for 'Tail' when two coins are tossed simultaneously, The possible outcomes are (H,H),(H,T) ,(T,H) (T,T), which are all equally likely. Here (H,H) means heads on the first coin (say on 1Rupee) and also heads on the second coin (2Rupee) similarly (H,T) means heads up on the first coin and tail up on the second coin and so on

The outcomes favourable to the even E, at least one head are (H,H) , (H,T) and (T,H) so, the number of outcomes favourable to E is 3.

$$\therefore P(E) = \frac{3}{4} \text{ [Since the total possible outcomes = 4]}$$

i.e. the probability that Harpreet gets at least one head is $\frac{3}{4}$

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

- A. One shirt is drawn at random from the carton of 100 shirts . Therefore, there are 100equally likely outcomes.

- i. The number of outcomes favorable (i.e acceptable) to Jhony = 88

$$\therefore p(\text{shirt is acceptable to Jhony}) = \frac{88}{100} = 0.88$$

ii. The number of outcomes favourable to Sujatha = $88 + 8 = 96$

$$\text{so, } p(\text{shirt is acceptable to Sujatha}) = \frac{96}{100} = 0.96$$

7. 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?

A. i) Total number of balls in the bag = 3 red + 5 black = 8 balls

Number of total outcomes when a ball is drawn at random = $3 + 5 = 8$

Now, number of favourable outcomes of the red ball = 3

\therefore Probability of getting a red ball

$$= P(E) = \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}} = \frac{3}{8}$$

ii. If $P(\bar{E})$ is the probability of drawing no red ball then $P(E) + P(\bar{E}) = 1$

$$P(\bar{E}) = 1 - P(E) = 1 - \frac{3}{8} = \frac{5}{8}$$

8. 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?

A. Number of male fishes = 5

Total number female fishes = 8

Total number of fishes = $5m + 8f = 13$ fishes

\therefore Number of total outcomes in taking a fish at random from the aquarium = 13

\therefore Number of outcomes favourable to male fish = 5

\therefore The probability of taking a male fish

$$= P(E) = \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}}$$

No. of favourable outcomes / No. of total outcomes

$$\frac{5}{13} = 0.38$$

9. A bag contains 5 red and 8 white balls. If a ball is drawn at random from a bag, what is the probability that it will be i) white ball ii) not a white ball?

A. No. of red balls $n(R) = 5$

No. of white balls $n(w) = 8$

Total no. of balls = $5 + 8 = 13$

\therefore Total no. of outcomes $n(s) = 13$

i. No. of white balls $n(w) = 8$

No. of favourable outcome in drawing a white ball = 8

Probability of drawing white ball

$$= P(E) = \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}} = \frac{8}{13}$$

ii. No. of balls which are not white balls = $13 - 8 = 5$

No. of favourable outcomes in drawing a ball which is not white balls = 5

$$P(\bar{W}) = \frac{5}{13}$$

10. Define i) equally likely events

ii) Mutually exclusive events

A. **i. Equally likely events:**

Two or more events are said to be equally likely if each one of them has an equal chance of occurrence

When a coin is tossed, getting a head and getting a tail are equally likely

ii. Mutually exclusive events:

Two events are mutually exclusive if the occurrences of one event precludes the occurrence of another event

When a coin is tossed getting a head and getting a tail are mutually exclusive

11. 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

A. Number of good pens = 132

Number of defective pens = 12

Total numbers of pens = $132 + 12 = 144$

\therefore Total number of outcomes in taking a pen at random = 144

No. of favourable outcomes in taking a good pen = 132

\therefore Probability of taking a good pen

$$= \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}} = \frac{132}{144} = \frac{11}{12}$$

12. What is the probability of drawing out a red king from a deck of cards?

A. Numbers of favourable outcomes to red king = 2

Number of total outcomes = 52

(\therefore Number of cards in a deck of cards = 52)

\therefore Probability of getting a red king p (red king)

$$= \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}}$$

$$= \frac{2}{52} = \frac{1}{26}$$

13. A girl thrown a die with sides marked as A, B, C, D, E, F. what is the probability of getting i) A and d i)d

A. Faces of die are A, B, C, D, E, F. so the total outcomes = 6

$$n(s) = 6$$

i. Let the outcomes of getting 'A' $n(E) = 1$

$$\text{Probability of getting 'A'} \quad P(E) = \frac{n(E)}{n(S)} = \frac{1}{6}$$

Similarly let the outcomes of getting 'D' $n(E) = 1$

$$n(E) = 1$$

$$\text{Probability of getting D} \quad P(E) = \frac{n(E)}{n(S)} = \frac{1}{6}$$

14. Shyam and Ramulu visit a shop from Tuesday to Saturday. They may visit

The shop on a same day or another day. Then find the probability they have to visit on the same day

A. There are 5 days from Tuesday to Saturday so each visit the shop 5 times a

Week. So both are visit the shop in a week , $n(s) = 5 \times 5 = 25$

Suppose they visited the shop on the same day like (Tuesday, Tuesday) (Wednesday, Wednesday) (Thursday, Thursday) (Friday, Friday) and (Saturday, Saturday) $n(E) = 5$

$$\text{Probability of} \quad P(E) = \frac{n(E)}{n(S)} = \frac{5}{25} = \frac{1}{5}$$

4Mark Questions

1. Give examples of 5 experiments that have equally likely outcomes and five more examples that do not have equally likely outcomes

A. Equally likely events:

- a) Getting an even or odd number when a die is rolled.
- b) Getting a tail or head when a coin is tossed.
- c) Getting an even or odd number when a card is drawn at random from a pack of cards numbered from 1 to 10
- d) Drawing a green or black ball from a bag containing 8 green balls and 8 black balls.
- e) Selecting a boy or girl from a class of 20 boys and 20 girls

Events which are not equally likely:

- a) Getting a prime or composite number when a die is thrown.
- b) Getting an even or odd number when a card is drawn at random from a pack of cards numbered from 1 to 5.
- c) Getting a number which is a multiple of 3 or not a multiple of 3 from numbers 1, 2, ..., 10.
- d) Getting a number less than 5 or greater than 5.
- e) Drawing a white ball or green balls from a bag containing 5 green balls and 8 white balls.

2. Write a few new pair of events that are complementary.

- A.
- a) When a die is thrown, getting an even number is complementary to getting an odd number.
 - b) Drawing a red card from a deck of cards is complementary to getting a black card
 - c) Getting an even number is complementary to getting an odd number from number 1, 2, ..., 8.
 - d) Getting a Sunday is complementary to getting any day other than Sunday in a week.

e) Winning a running race is complementary to losing it.

3. Sarada and Hamida are friends. What is the probability that both will have i) different birthdays? ii) The same birthday? (Ignoring a leap year)

A. Out of the two friends, one girl, say, Sarada's birthday can also be any day of 365 days in the year. We assume that these 365 days in the year we assume that these 365 days in the year. We assume that these 365 outcomes are equally likely.

i) If Hamida's birthday is different from Sarada's the number of favourable outcomes for her birthday is $365 - 1 = 364$

So, $p(\text{Hamida's birthday is different from Sarada's birthday}) = \frac{364}{365}$

ii) $p(\text{Sarada and Hamida have the same birthday})$

$= 1 - p(\text{both have different birthdays})$

$= 1 - \frac{364}{365}$ (Using $p(\bar{E}) = 1 - P(E)$) $= \frac{1}{365}$

4. There are 40 students in X class of a school of whom 25 are girls and 15 are boys. The class teacher has to select one student as a class representative. She writes the name of each student on a separate card, the cards being identical. Then she puts cards in a box and stirs them thoroughly. She then draws one card from the box. What is the probability that the name written on the card is the name of i) a girl? ii) a boy?

A. There are 40 students and only one name card has to be chosen the number of all possible outcomes is 40.

i) The no. of all possible outcomes (favourable for a card with the name of a girl) = 25

$\therefore p(\text{card with name of a girl}) = p(\text{Girl}) = \frac{25}{40} = \frac{5}{8}$

ii) The no. of outcomes favourable for a card with the name of a boy = 15

$\therefore p(\text{card of name of a boy}) = p(\text{boy}) = \frac{15}{40} = \frac{3}{8}$

$$(Or) p(\text{boy}) = 1 - p(\text{not boy}) = 1 - p(\text{Girl}) = 1 - \frac{5}{8} = \frac{3}{8}$$

5. Rahim takes out all the hearts from the cards what is the probability of

i) Picking out an ace from the remaining pack

ii) Picking out a diamonds.

iii) Picking out a card that is not a heart

iv) Picking out the ace of hearts

A. Total number of cards in the deck = 52

Total number of hearts in the deck and of cards = 13

When hearts are removed, remaining cards = $52 - 13 = 39$

i) Picking an ace:

No of outcomes favourable to ace = 3

Total no of possible outcomes from the remaining cards = 39-after removing hearts

$$\text{Probability } p(A) = \frac{\text{No. of favourable outcomes}}{\text{total no of outcomes}}$$

$$\frac{3}{39} = \frac{1}{13}$$

ii) Picking a diamond:

No of favourable outcomes to diamonds = 13

Total no of possible outcomes = 39 (♦)

$$\therefore p(\text{♦}) = \frac{13}{39} = \frac{1}{3}$$

iii) Picking a card not heart

As all hearts are removed it is an impossible event and hence it's probability is zero

$$\text{Heart } p(\heartsuit) = \frac{0}{39} = 0$$

iv) Picking out the ace of hearts:

a) If drawn from the removed cards

No of favourable outcomes = 1

Total no of possible outcomes = 13

$$\therefore P(E) = \frac{1}{13}$$

b) If the picking from the rest of the cards, it is an impossible event and hence probability is zero

6. 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?

A. Total number of marbles in the box

$$5\text{red} + 8\text{wht} + 4\text{green}$$

$$= 5 + 8 + 4 = 17$$

\therefore No of total outcomes in drawing a marble at random from the box = 17

i) No of red marbles = 5

No of favourable outcomes in drawing a red ball = 5

$$\therefore P(R) = \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}}$$

$$P(R) = \frac{5}{17}$$

ii) No of white marbles = 8

No of favourable outcomes in drawing a white marble = 8

\therefore probability of getting a white marble

$$= P(W) = \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}}$$

$$P(w) = \frac{8}{17}$$

iii) No of “non green” marbles = 5red + 8white

$$= 5 + 8 = 13$$

No of outcomes favourable to drawing a non green marble = 13

∴ Probability of getting a non-green marble

$$P(\text{non-green}) = \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}}$$

$$P(\text{non-green}) = \frac{13}{17}$$

7. A kiddy bank contains hundred 50p coins, fifty 1Rupee coins, twenty 2rupee coins and ten 5rupee coins. If it is equally likely that one of the coins will fall out when the kiddy bank is turned upside down, what is the probability of that the coin i) will be a 50p coins ?

ii) will not be a 5rupee coin?

A. i) No of 50p coins = 100

No of 1 rupee cons = 50

No of 2 rupee cons = 20

No of 5 rupee coins = 10

Total no of coins = 180

∴ No of total outcomes for a coin to fall down = 180

No of outcomes favourable to 50p coins to fall down =

$$\frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}} = \frac{100}{180} = \frac{5}{9}$$

ii) Let $P(E)$ be the probability for a 5Rupee coin to fall down.

No of outcomes favourable to 5Rupee coin = 10

Probability for a 5Rupee coins to fall down

$$\frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}}$$

$$\frac{10}{180} = \frac{1}{18}$$

Then the $P(\bar{E})$ is the probability of a coin which fall down is not a 5Rupee coin

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

Again

$$\therefore P(\bar{E}) = 1 - P(E)$$

$$= 1 - \frac{1}{18} = \frac{17}{18}$$

8. A game of chance consists of spinning an arrow which comes to rest pointing at one of the number 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?

A. No of total outcomes are $(1,2..8) = 8$

i) No of outcomes favourable to 8 = 1

$$\therefore P(S) = \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}} = \frac{1}{8}$$

ii. No of odd number on the spinning wheel = $(1,3,5,7) = 4$

\therefore No of outcomes favourable to an odd number

\therefore Probability of getting an odd number

$$P(\text{odd}) = \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}} = \frac{4}{8} = \frac{1}{2}$$

iii) No of chances greater than 2 are (3,4,5,6,7,8)

No of outcomes favourable to greater than 2 are = 6

∴ Probability of pointing a number greater than 2

$$P(E) = \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}}$$

$$= \frac{6}{8} = \frac{3}{4}$$

iv) No of less than 9 are (1,2,3,4,5,6,7,8) = 8

∴ No of outcomes favourable to pointing a number less than 9 = 8

$$P(E) = \frac{\text{No. of outcomes favourable to less than 9}}{\text{No. of total outcomes}}$$

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

Note: This is a sure event and hence probability is 1.

9. 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.

A. Total no of cards = 52

∴ No of all possible outcomes in drawing a card at random = 52

i) No of outcomes favourable to the king of red colour.

$$= \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}}$$

$$= \frac{2}{52} = \frac{1}{26}$$

ii) No of face cards in deck of cards = $4 \times 3 = 12$ (K, Q, J)

No of outcomes favourable to draw a face card = 12

Probability of getting a face card

$$= \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}}$$

$$= \frac{12}{52} = \frac{3}{13}$$

iii) No of red face card = $2 \times 3 = 6$

∴ No of outcomes favourable to draw a red face card = 6

∴ Probability of getting a red face card

$$= \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}}$$

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

iv) No of outcomes favourable to the jack of hearts = 1

∴ Probability of getting jack of hearts

$$= \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}}$$

$$= \frac{1}{52}$$

v) No of spade cards = 13

∴ No of outcomes favourable to a spade card = 13

∴ Probability of drawing a spade card

$$= \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}} = \frac{13}{52} = \frac{1}{4}$$

vi) No of outcomes favourable to the queen of diamonds = 1

∴ Probability of drawing the queen of diamonds

$$= \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}} = \frac{1}{52}$$

10. Five cards the ten, jack, queen, king, 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 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?

A. Total no of cards = 5

∴ No of total outcomes in drawing a card at random = 5

i) No of outcomes favourable to queen = 1

∴ Probability of getting the queen

$$= \frac{\text{No. of favourable outcomes 'Q'}}{\text{No. of total outcomes}} = \frac{1}{5}$$

ii) When queen is drawn and put aside, remaining cards one four

∴ No of total outcomes in drawing a card at random = 4

a) No of favourable outcomes to ace = 1

probability of getting an ace =

$$= \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}} = \frac{1}{4}$$

b) No of favourable outcomes to 'Q' = 0 (as it was already drawn and put aside)

∴ Probability that the card is Q = $\frac{0}{4} = 0$

11. 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.

A. Total number of discs in the box = 90

∴ No of total outcomes in drawing a disc at random from the box = 90

i) No of 2-digit numbers in the box = 81 i.e No of favourable outcomes in drawing a disc bearing a 2-digit number

$$= \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}} = \frac{81}{90} = \frac{9}{10} = 0.9$$

ii) No of favourable perfect squares in the box

$$(1^2 = 1, 2^2 = 4, 3^2 = 9, 4^2 = 16, 5^2 = 25, 6^2 = 36, 7^2 = 49, 8^2 = 64, 9^2 = 81)$$

i.e no of favorable outcomes in drawing a disc with a perfect square

$$= \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}} = \frac{9}{90} = \frac{1}{10}$$

iii) No of multiples of 5 from 1 to 90 are (5, 10, ..., 90) = 18

i.e no of favourable outcomes in drawing a disc with a multiple of 5 = 18

∴ Probability of drawing a disc bearing a number multiple by 5

$$= \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}}$$

$$= \frac{18}{90} = \frac{1}{5}$$

12. Two dice are rolled simultaneously and counts are added i) complete the table given below

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

ii) A student argues that there are 11 possible outcomes 2, 3, 4, 5, 6, 7, 8, 9, 11, 12.

Therefore each of the has a probability $\frac{1}{11}$. Do you agree with this argument? Justify your answer

A. When two dice are rolled, total number of outcomes = 36

	1	2	3	4	5	6
1	1,1	1,2	1,3	1,4	1,5	1,6
2	2,1	2,2	2,3	2,4	2,5	2,6
3	3,1	3,2	3,3	3,4	3,5	3,6
4	4,1	4,2	4,3	4,4	4,5	4,6
5	5,1	5,2	5,3	5,4	5,5	5,6
6	6,1	6,2	6,3	6,4	6,5	6,6

Sum on 2dice	Favourable outcomes	No. of favourable outcomes	Probability
2	(1,1)	1	$\frac{1}{36}$
3	(1,2)(2,1)	2	$\frac{2}{36} = \frac{1}{18}$
4	(1,3)(2,2)(3,1)	3	$\frac{3}{36} = \frac{1}{12}$
5	(1,4)(2,3)(3,2)(4,1)	4	$\frac{4}{36} = \frac{1}{9}$
6	(1,5)(2,4)(3,3)(4,2)(5,1)	5	$\frac{5}{36}$
7	(1,6)(2,5)(3,4)(4,3)(5,2)(6,1)	6	$\frac{6}{36} = \frac{1}{6}$
8	(2,6)(3,5)(4,4)(5,3)(6,2)	5	$\frac{5}{36}$
9	(3,6)(4,5)(5,4)(6,3)	4	$\frac{4}{36} = \frac{1}{9}$
10	(4,6)(5,5)(6,4)	3	$\frac{3}{36} = \frac{1}{12}$

11	(5,6)(6,5)	2	$\frac{2}{36} = \frac{1}{18}$
12	(6,6)	1	$\frac{1}{36}$

ii) The above argument is wrong. The sum 2,3,4...& 12 have different no of favourable outcomes, moreover total number of outcomes are 36

13. A game consists of tossing a one rupee coin 3 times and noting it's outcome each time. Hanif wins if all the tosses give the same result . i.e three heads or three tails and losses otherwise calculate the probability that Hanif will lose the game

A. When a coin is tossed for n times the total number of outcomes = 2^n

∴ If a coin is tossed for 3-times, then the total number of outcomes = $2^3 = 8$

Note the following:

T T T
 T T H
 T H T
 H T T
 H H T
 H T H
 T H H
 H H H

Of the above no of outcomes with different results = 6

probability of losing the game

$$= \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}} = \frac{6}{8} = \frac{3}{4}$$

14. 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? (Hint: Throwing a die twice and throwing two dice simultaneously are treated as the same experiment)

A. If a die is thrown n-times or n-dice are thrown simultaneously then the total number of outcomes = $6 \times 6 \times 6 \dots \times 6$ (n-times) = 6^n

No of total outcomes in throwing a die for two times = $6^2 = 36$

	1	2	3	4	5	6
1	1,1	1,2	1,3	1,4	1,5	1,6
2	2,1	2,2	2,3	2,4	2,5	2,6
3	3,1	3,2	3,3	3,4	3,5	3,6
4	4,1	4,2	4,3	4,4	4,5	4,6
5	5,1	5,2	5,3	5,4	5,5	5,6
6	6,1	6,2	6,3	6,4	6,5	6,6

Let E be the event that 5 will not come up either time, then the favorable outcomes are (1,1)(1,2)(1,3)(1,4)(1,6)(2,1)(2,2)(2,3)(2,4)(2,6)(3,1)(3,2)(3,3)(3,4)(3,6)(4,1)4,2(4,3)4,4(4,6)(6,1)(6,2)(6,3)(6,4)(6,5)(6,6) = 25

$$P(E) = \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}} = \frac{25}{36}$$

ii) Let E be the event that 5 will come up at least once then the favourable outcomes are (1,5)(2,5)(3,5)(4,5)(5,5)(6,5)(5,1)(5,2)(5,3)(5,4)(5,5)(5,6) = 11

$$P(E) = \frac{\text{No. of favourable outcomes}}{\text{No. of total outcomes}} = \frac{11}{36}$$

Multiple Choice Questions

1. The probability of getting king or queen card from the play card (1 deck) []
(a) $\frac{1}{52}$ (b) $\frac{1}{13}$
(c) 45 (d) 28

2. Among the numbers 1,2,3....15 the probability of choosing a number which is a multiple of 4? []
(a) $\frac{4}{52}$ (b) $\frac{2}{52}$ (c) $\frac{1}{5}$ (d) $\frac{3}{5}$

3. Gita said that the probability of impossible events is 1. Pravallika said that probability of sure events is 0 and Atiya said that the probability of any event lies in between 0 & 1. In above with whom you will agree? []
(a) Gita (b) Pravallilka
(c) Aliya (d) All the three

4. The probability of a sure event is []
(a) -1 (b) 1
(c) 2 (d) 3

5. If a die is rolled then the probability of getting an even number is..... []
(a) -1 (b) 1
(c) 2 (d) $\frac{1}{2}$

6. $P(E) = 0.2$ then $P(\bar{E})$ []
(a) 2.7 (b) 8.1
(c) 0.008 (d) 0.8

7. No of playing cards in a deck of cards is []
(a) 52 (b) 25 (c) 18 (d) 110

8. In a single throw of two dice the probability of getting distinct number is ... []
- (a) $\frac{1}{6}$ (b) $\frac{5}{6}$
- (c) 2 (d) None
9. A card is pulled from a deck of 52 cards, the probability of obtaining a club is []
- (a) $-\frac{1}{2}$ (b) 3
- (c) $\frac{1}{4}$ (d) 1
10. which of the following cannot be the probability of an event? []
- (a) 2.3 (b) -1.5
- (c) -1 (d) All the above
11. $P(X) + P(\bar{X}) = \dots$ []
- (a) 0 (b) 1
- (c) -1 (d) 2
12. $P(E) = \frac{1}{2}$, then $P(\text{not } E) = \dots$ []
- (a) $-\frac{1}{2}$ (b) $\frac{1}{2}$
- (c) -1 (d) 1
13. If two dice are rolled at a time then the probability that the two faces show same number is []
- (a) $\frac{1}{2}$ (b) $\frac{1}{3}$
- (c) $\frac{1}{6}$ (d) $\frac{5}{6}$
14. If three coins are tossed simultaneously then the probability of getting at least two heads is []
- (a) 1 (b) $\frac{1}{2}$ (c) $\frac{3}{2}$ (d) 4

15. What is probability that a leap year has 53 Mondays []
- (a) $\frac{1}{4}$ (b) $\frac{2}{7}$
- (c) $\frac{1}{7}$ (d) $\frac{5}{7}$
16. $P(E) + P(\bar{E}) = \dots$ []
- (a) 0 (b) -1
- (c) 8 (d) 1
17. A number is selected from numbers 1 to 25. The probability that it is prime is []
- (a) $\frac{1}{10}$ (b) $\frac{9}{25}$
- (c) $\frac{1}{2}$ (d) $\frac{1}{3}$

Answers

- 1) B 2) C 3) C 4) B 5) D
- 6) D 7) A 8) B 9) C 10) D
- 11) B 12) B 13) C 14) B 15) B
- 16) D 17) B

Fill in the blanks

1. R = Red, Y = yellow. From the figure, the probability to get yellow colour ball is _____
2. A game of chance consists of spinning an arrow which comes to rest at one of the number 1,2,3,4,5,6,7,8 and these are equally likely outcomes the possibilities that the arrow will point at a number greater than 2 is _____
3. For any event E, $P(E) + P(\bar{E}) =$ _____
4. When a die is thrown once, the possible number of outcomes is _____
5. The probability of an event lies between _____ and _____
6. If two events have same chances to happen then they are called _____
7. In a single throw of two dice, the probability of getting distinct numbers is _____
8. $P(E) = \frac{1}{3}$ then $p(\bar{E}) =$ _____
9. "The book of games of chance" was written by _____
10. Getting "7" when a single die is throw is an example of _____
11. The probability of a baby born either boy (or) girl is _____
12. When a die is thrown the event of getting numbers less than are equal to 6 is an example _____ event
13. If a card is drawn from a pack the probability that it is a king is _____
14. The probability of an event that cannot happen is _____
15. The probability of an event is 1.5. Is it true (or) false _____
16. If a two digit number is chosen at random that the probability that the number chosen is a multiple of 3 is _____

17. A number is selected at random from the 3,5,5,7,7,7,9,9,9,9. Then the probability that the selected number is their average is _____
18. If a number X is chosen from the number 1,2,3 and a number Y is selected from the numbers 1,4,9 then $p(XY < 9)$ is _____
19. A card is drawn dropped from a pack of 52 playing cards the probability that it is an ace is _____
20. Suppose you drop a die at random in the rectangular region shown in the figure what is the probability that it will land inside the circle with diameter 1m_____

Answers

1) $\frac{2}{5}$

2) $\frac{3}{4}$

3) 1

4) 6

5) 0,1

6) Equally

7) $6^2 = 36$

8) $\frac{2}{3}$

9) j.cardon 10) impossible

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

12) sure

13) $\frac{1}{13}$

14) 0

15) false

16) $\frac{1}{3}$

17) $\frac{3}{10}$

18) $\frac{5}{6}$

19) $\frac{1}{13}$

20) $\frac{11}{84}$