Probability

1. **Experiment:**
   An operation which can produce some well-defined outcomes is called an experiment.

2. **Random Experiment:**
   An experiment in which all possible outcomes are know and the exact output cannot be predicted in advance, is called a random experiment.
   Examples:
   i. Rolling an unbiased dice.
   ii. Tossing a fair coin.
   iii. Drawing a card from a pack of well-shuffled cards.
   iv. Picking up a ball of certain colour from a bag containing balls of different colours.
   Details:
   i. When we throw a coin, then either a Head (H) or a Tail (T) appears.
   ii. A dice is a solid cube, having 6 faces, marked 1, 2, 3, 4, 5, 6 respectively. When we throw a die, the outcome is the number that appears on its upper face.
   iii. A pack of cards has 52 cards.
   It has 13 cards of each suit, name **Spades, Clubs, Hearts and Diamonds**.
   Cards of spades and clubs are **black cards**.
   Cards of hearts and diamonds are **red cards**.
   There are 4 honours of each unit.
   There are **Kings, Queens and Jacks**. These are all called **face cards**.

3. **Sample Space:**
   When we perform an experiment, then the set S of all possible outcomes is called the **sample space**.
   Examples:
   1. In tossing a coin, S = {H, T}
   2. If two coins are tossed, the S = {HH, HT, TH, TT}.
   3. In rolling a dice, we have, S = {1, 2, 3, 4, 5, 6}.

4. **Event:**
   Any subset of a sample space is called an event.

5. **Probability of Occurrence of an Event:**
   Let S be the sample and let E be an event.
   Then, $E \subseteq S$.
   $\therefore P(E) = \frac{n(E)}{n(S)}$.

6. **Results on Probability:**
   i. P(S) = 1
   ii. $0 \le P(E) \le 1$
   iii. $P(\phi) = 0$
   iv. For any events A and B we have : $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
   v. If $\bar{A}$ denotes (not-A), then $P(\bar{A}) = 1 - P(A)$.

Exercise 15A

Question 1:

Total numbers of trials = 500
Numbers of heads = 285
Numbers of tails = 215
(i) Let E be the event of getting a head

$$\therefore P(\text{getting ahead}) = P(E) = \frac{\text{numbers of heads coming up}}{\text{total number of trials}} = \frac{285}{500} = 0.57$$

(ii) Let F be the event of getting a tail

$$\therefore P(\text{getting a tail}) = P(F) = \frac{\text{numbers of tails coming up}}{\text{total number of trials}} = \frac{215}{500}$$

$= 0.43$

Question 2:

Total numbers of trials = 400
Numbers of times 2 head appears = 112
Number of times 1 head appears = 160
Number of times 0 head appears = 128
In a random toss of two coins , Let E_1, E_2, E_3, be the events of
P(getting 2 heads)

$$= P(E_1) = \frac{\text{numbers of times 2 heads appear}}{\text{total number of trials}} = \frac{112}{400} = 0.28$$

P(getting 1 head) = $P(E_2)$ =

$$\frac{\text{numbers of times 1 head appears}}{\text{total number of trials}} = \frac{160}{400} = 0.4$$

P(getting 0 head) = $P(E_3)$ =

$$\frac{\text{numbers of times 0 head appears}}{\text{total number of trials}} = \frac{128}{400} = 0.32$$

Question 3:

Total number of trials=200

Number of times 3 heads appeared=39

Number of times 2 heads appeared = 58

Number of times 1 head appeared =67

Number of times 0 head appeared=36

The random toss of 3 coins , Let E1, E2, E3 and E4 be the events of getting 3 heads , 1 head and 0 head and 2 heads respectively . Then;

(i) P(getting 3 heads)=$P(E_1)=$

$$\frac{\text{numbers of times 3 head appeared}}{\text{total number of trials}}$$

$$=\frac{39}{200}$$

$$=0.195$$

(ii) P (getting 1 head)= $P(E_2)=$

$$\frac{\text{numbers of times 1 head appeared}}{\text{total number of trials}}$$

$$=\frac{67}{200}$$

$$=0.335$$

(iii) P(getting 0head)= $P(E_3)=$

$$\frac{\text{numbers of times 0 head appeared}}{\text{total number of trials}}$$

$$=\frac{36}{200}$$

$$=0.18$$

(iii) P(getting 2heads)= $P(E_4)=$

$$\frac{\text{numbers of times 2head appeared}}{\text{total number of trials}}$$

$$=\frac{58}{200}$$

$$=0.29$$

Question 4:

Total number of trials = 300

In a random throw of a die let E_1, E_2, E_3, and E_4 be the events of 3,6,5, and 1 respectively .Then;

(i) P(getting 3)= P(E_1)=

$$\frac{\text{numbers of times 3 appeared}}{\text{total number of trials}}$$

$$= \frac{54}{300}$$

$$=0.18$$

(ii) P(getting 6)= P(E_2)=

$$\frac{\text{numbers of times 6 appeared}}{\text{total numberof trials}}$$

$$= \frac{33}{300}$$

$$=0.11$$

(iii) P(getting 5)= P(E_3)=

$$\frac{\text{numbers of times 5 appeared}}{\text{total number of trials}}$$

$$= \frac{39}{300}$$

$$=0.13$$

(iv) P(getting 1)= P(E_4)=

$$\frac{\text{numbers of times 2 head appeared}}{\text{total number of trials}}$$

$$= \frac{60}{300}$$

$$=0.2$$

Question 5:

The number of ladies =200

Number of ladies who like coffee =142

Number of ladies who do not like coffee=58

Let E1= event that the selected lady likes coffee.

$$\therefore P(E1) = \frac{\text{numbers of ladies who like coffee}}{\text{total number of trials}} = \frac{142}{200} = 0.71$$

Let (E2)= event that the selected lady dislikes coffee. Then

$$\therefore P(E2) = \frac{\text{numbers of ladies who dislike coffee}}{\text{total number of trials}} = \frac{58}{200} = 0.29$$

Question 6:

Number of tests in which he gets more than 60% marks =2

Total numbers of tests =6

∴ Required probability

$= \frac{\text{numbers of tests in which he gets more than 60\% marks}}{\text{total number of trials}}$

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

Question 7:

Total numbers of vehicles = 240

Numbers of two wheelers = 84

∴ Required probability

$= \frac{\text{numbers of two wheelers}}{\text{total number of vehicles}}$

$= \frac{84}{240}$

$= 0.35$

Question 8:

Total phone numbers = 200

Numbers of phone numbers with unit digit 5 = 24

∴ Required probability

$= \frac{\text{numbers of phone numbers with units digits 5}}{\text{total number of numbers}}$

$= \frac{24}{200}$

$= 0.12$

Numbers of phone numbers with units digit 8 = 16

∴ Required probability

$= \frac{\text{numbers of phone numbers with units digits 8}}{\text{total number of phone numbers}}$

$= \frac{16}{200}$

$= 0.08$

Question 9:

Total number of students=40

(i)Numbers of students having blood groupO = 14

∴ Required probability

$= \frac{\text{numbers of students having blood group O}}{\text{total number of students}} = \frac{14}{40} = 0.35$

(ii) Numbers of students having blood groupAB = 6

∴ Required probability

$= \frac{\text{numbers of students having blood group AB}}{\text{total number of students}} = \frac{6}{40} = 0.15$

Question 10:

Total numbers of students =30

Numbers of students who lie in the interval21-30=6

∴ Required probability

$= \frac{\text{numbers of students in the interval}}{\text{total number of students}} = \frac{6}{30} = 0.2$

Question 11:

Total number of patients=360

(i)P (getting a patient of age 30 years or more but less than 40 years)= $\frac{60}{360}=\frac{1}{6}$

(ii)P (getting a patient of age 50 years or more but less than 70 years)

$=\left(\frac{50+30}{360}\right)=\frac{80}{360}=\frac{2}{9}$

(iii) P (getting a patient of age less than 10 years) = $\frac{0}{360}=0$

(iv) P (getting a patient of age 10 years or more) = $\frac{360}{360}=1$