Lecture_01

No. 1

PROBABILITY

- **Introduction to Probability**


00
0
3
6
9
27
30
33
36
2 to 1
2
5
32
35
2 to 1
1
31
34
2 to 1
1 to 18
19 to 36
17
18
2
8
10
25
Credits:
Total Bet:
11
Paid:
0
1
5
Spin

PIERRE DE FERMAT
(1601 - 1665)

BLAISE PASCAL
(1623 - 1662)

BUFFON
(1707 - 1788)

PIERRE SIMON LAPLACE
(1749 - 1827)

KARL PEARSON
(1857 - 1936)

Random Experiment :It is an experiment in which all the possible results are known in advance but they cannot be predicted with certainty.

For eg : **Rolling of a Die**

1,2,3,4,5,6 ⟶ **Possible Results**

The result of a random experiment. ⟶ **Outcome**

Number of all possible outcomes = 6

Here, we assume that each outcome is likely to occur equally as other.

Hence,

1, 2, 3, 4, 5, 6 ⟶ **Equally Likely Outcomes**

No. 2

PROBABILITY

- **All possible outcomes of Tossing coin experiment**

A Coin is Tossed

H

T

All possible outcomes are H, T
Number of all possible outcomes = 2

2 Coins are Tossed Together

Result of both experiments are same

1 Coin is tossed twice

Result on second coin

Result on first coin

Result on second coin

Result on second coin

HH, HT, TH, TT

Number of all possible outcomes = 4

Result o Result o Result on

...ner / 1 Coin is tossed thrice

1st coin/ 1st time	2nd coin/ 2nd time	3rd coin/ 3rd time	1st coin/ 1st time	2nd coin/ 2nd time	3rd coin/ 3rd time

Shift the position of T ...nd

Similarly if we start with TTT and shift ... we will get 4 more outcomes

Number of all possible outcomes = 8

RULE TO WRITE POS...

* Write possible outcomes of 2 coins 2 times
* In first time put H as result of 3rd coin
* In second time put T as result of 3rd coin

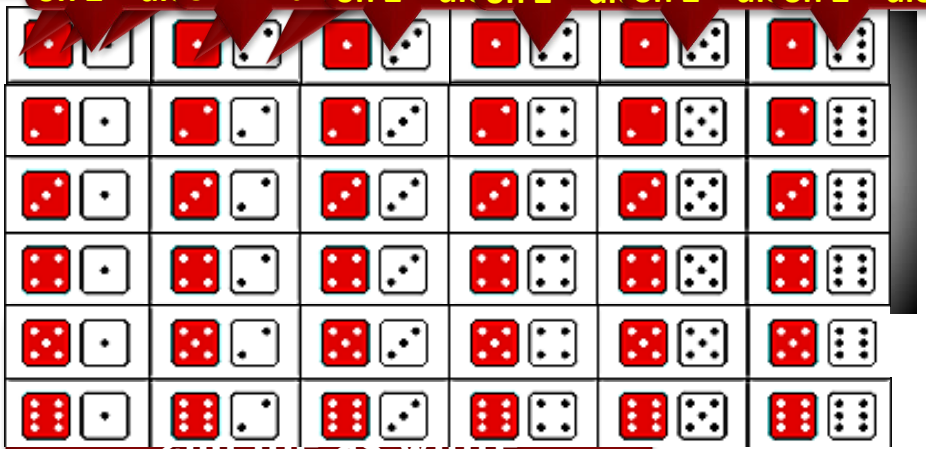
HHH , HTH , THH , TTH ,
HHT , HTT , THT , TTT

No. 3

PROBABILITY

- **All possible outcomes of throwing 2 dice, Game of chance and Playing Cards**

When Two Dice are Thrown together



In this experiment the possible outcomes has to be written as seen here, that is 6 outcomes in every row

(1,1), (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), (3,6),
(4,1), (4,2), (4,3), (4,4), (4,5), (4,6),
(5,1), (5,2), (5,3), (5,4), (5,5), (5,6),
(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)

Number of all possible outcomes = 36

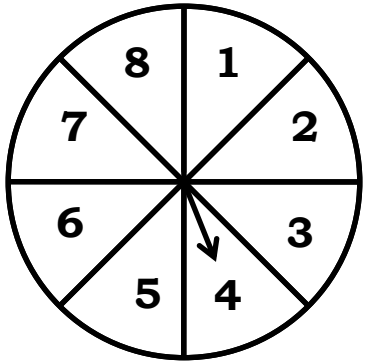
For Coin and dice to know total no. of outcomes we can remember as follows :

Total no. of outcomes in 1 coin = 2
Total no. of outcomes in 2 coins = 2 × 2 = 4
Total no. of outcomes in 3 coins = 2 × 2 × 2 = 8

Outcome of 1st die

Total no. of outcomes in 1 die = 6
Total no. of outcomes in 2 dice = 6 × 6 = 36

Game Of Chance :



On whichever number the arrow points that number is taken as an outcome of that experiment.

, 2, 3, 4, 5, 6, 7, 8
outcomes = 8

No. 4

PROBABILITY

- Playing Card Video
- Event and finding probability of an Event

Event - Set of Favourable outcomes.

Something that you wish should happen / should not happen

For example: Let us assume a situation we are watching an India v/s Australia match. And 1 ball is remaining and 5 runs are required to win.

PROBABILITY OF AN EVENT

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

An event is denoted by capital letter.

No. 5

PROBABILITY

- **Different types of events**

Types of Events

Rolling of a Die

All possible outcomes 1, 2, 3, 4, 5, 6

E is the event that a number less than 7 comes up

Favorable outcomes → **1, 2, 3, 4, 5, 6**

All possible outc **t,**
such an event is **VENT**

Number less than 7 means 1, 2, 3, 4, 5, 6 ...

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

Probability of Sure Or Certain Event = 1

Types of Events

Rolling of a Die

All possible outcomes 1, 2, 3, 4, 5, 6

F is the event of getting multiple of 4

Favourable ou

Multiple of 4 means
4, 8, 12 .....

Only one o vent
such an event EVENT

$$P(F) = \frac{1}{6}$$

Sum of Probabilities of all Elementary events of an experiment = 1

F i

Sum of all probabilities

$$= \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6}$$

$$= \frac{6}{6}$$

$$= 1$$

Types of Events

Rolling of a Die

All possible outcomes 1, 2, 3, 4, 5, 6

G is the event of getting number greater than 8

No of Favour

Number greater than 8 means 9, 10, 11 .....

No outcome **h**
an event is called IMPOSSIBLE EVENT

$$P(G) = \frac{0}{6} = 0$$

Probability of Impossible event = 0

Types of Events

Rolling of a Die

All possible outcomes 1, 2, 3, 4, 5, 6

X is the event of getting odd number

Odd numbers are favourable

Favourable outcomes to X → **1, 3, 5**

Y is the event of getting even number

Favourable outcomes to Y → **2, 4, 6**

Outcomes of X & Y are not same and together their outcomes gives all possible outcomes of the experiment

Hence, X & Y are said to be Complementary events

$P(X) = \frac{3}{6} = \frac{1}{2}$

$P(Y) = \frac{3}{6} = \frac{1}{2}$

$P(X) + P(Y) = \frac{1}{2} + \frac{1}{2} = 1$

i.e. P (X) + P (not X) = 1

Sum of Probabilities of Complementary events is equal to 1.

NOTE :

- **Probability of impossible event = 0**
- **Probability of certain event = 1**
- **Probability of any event lies between 0 and 1**
- **Probability of any event cannot be negative or it cannot be greater than 1**

No. 6

PROBABILITY

- **Objective Questions based on different types of events & Equally likely Outcomes**

Q. Complete the following statements.

(i) Probability of an event E + Probability of the event 'not E' = **1**.

(ii) The probability of an event that cannot happen is **0**. Such an event is called **Impossible event**.

(iii) The probability of an event that is certain to happen is **1**. Such an event is called **sure / certain event**.

(iv) The sum of the probabilities of all the elementary events of an experiment is **1**.

(v) The probability of an event is greater than or equal to **0** and less than or equal to **1**

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

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

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

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

(iv) A baby is born. It is a boy or a girl.

Sol. (iii) and (iv) have equally likely outcomes.

This experiment has equally likely outcomes

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

(A) $\frac{2}{3}$ (B) -1.5 (C) 15% (D) 0.7

Probability of an event can never be negative

Sol. (B) -1.5

4. If P(E) = 0.05, what is the probability

Sol. $P(E) = 0.05$

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

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

$= 1 - 0.05$

$= 0.95$

$\therefore$ The probability of not E is 0.95

Thank You

Lecture_02

No. 7

PROBABILITY

- **Finding Probability : Complementary Events and Sum based on Marbles**

Q. **It is given that in a group of 3 students , the probability of 2 students not having the same birthday is 0.992. What is the probability that the 2 students have the same birthday?**

Sol. Let P(E) be the probability of 2 students having the same birthday.

$\therefore$ $P(\overline{E})$ is probability of 2 Students not having the same birthday.

$$\therefore \quad P(\overline{E}) = 0.992$$

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

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

$$= 1 - 0.992$$

$$= 0.008$$

We know sum of probabilities of two complementary events is 1.

$\therefore$ **Probability of 2 students having the same birthday is 0.008**

Q. **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?

How many red marbles are there?

Sol. As the box contains 5 red ma

green marbles

Total no of possible outcomes = 5 + 8 + 4 = 17

(i) Let A be the event that a red marble is drawn

∴ No. of outcomes favourable to A = 5

$$\therefore \mathbf{P(A) = \frac{5}{17}}$$

Q. **A box contains 5 red marbles, 8 white marbles and 4 green marbles. One marble is taken out of the box at random. What is the probability that the marble taken out will be**

(i) red ? (ii) white ? (iii) not green?

Sol. (ii) Let B be the event that a white marble is drawn

$\therefore$ No of outcomes favourable to B = 8

$$\therefore \mathbf{P(B)} = \frac{8}{17}$$

Total no. of. possible outcomes = 5+ 8+ 4= **17**

(iii) Let C be the event that the marble drawn is not green

$\therefore$ No of outcomes favourable to C = 13

$$\therefore \mathbf{P(C)} = \frac{13}{17}$$

No. 8

PROBABILITY

- **Finding Probability : Sum based on Piggy Bank**

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

Sol.

A piggy bank contains hundred 50p coins,
Fifty Re. 1 coins,
Twenty Rs. 2 coins and ten Rs. 5 coins.
Total no. of coins in the piggy bank
$= 100 + 50 + 20 + 10 = 180$
Total no. of possible outcomes = 180

$$P(A) = \frac{\text{No of favourable outomes}}{\text{No of possible outcomes}}$$

Which coin will fall out ?

f coins
bank

(i) Let A be the event that the coin will a 50p coin

$\therefore$ No. of outcomes favorable to A = 100

$$\therefore P(A) = \frac{100}{180} = \frac{5}{9}$$

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

Sol.

(ii) Let B be the event that it is not a Rs. 5 coin

$\therefore$ No. of outcomes favorable to B = 100 + 50 + 20 = 170

$$\therefore \text{ P (B)} = \frac{170}{180} = \frac{17}{18}$$

Total no. of. possible outcomes
= 100 + 50 + 20 + 10 = 180

$$\text{P (B)} = \frac{\text{No of favourable outomes}}{\text{No of possible outcomes}}$$

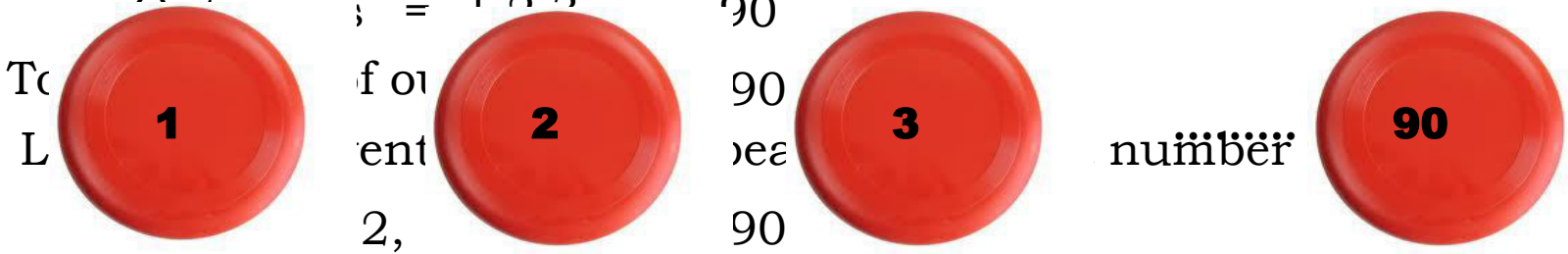
No. 9

PROBABILITY

- **Finding Probability : Sum based on Discs**

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

Sol :



No. of favourable outcomes = 90 - 9 = 81

$$P(A) = \frac{\text{No. of outcomes favourable to A}}{\text{No.}}$$

Total no. of outcome – No. of outcomes in single digit

$$\therefore \quad \mathbf{P(A) = \frac{81}{90} = \frac{9}{10}}$$

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

Sol : (ii) A perfect square number

Let B be the event disc drawn bears a perfect square number

Outcomes favourable to B are 1, 4, 9, 16, 25, 36, 49, 64, 81.

No. of outcomes favorable to B = 9

0

able to B

tcomes

1,	2,	3,	4,	5,	6,	7,	8,	9,	10
11,	12,	13,	14,	15,	16,	17,	18,	19,	20
21,	22,	23,	24,	25,	26,	27,	28,	29,	30
31,	32,	33,	34,	35,	36,	37,	38,	39,	40
41,	42,	43,	44,	45,	46,	47,	48,	49,	50
51,	52,	53,	54,	55,	56,	57,	58,	59,	60
61,	62,	63,	64,	65,	66,	67,	68,	69,	70
71,	72,	73,	74,	75,	76,	77,	78,	79,	80
81,	82,	83,	84,	85,	86,	87,	88,	89,	90

$\therefore$

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

Sol : (iii) A number divisible by 5

Let C be the event disc drawn bears a number divisible by 5.

Outcomes favourable to C are

5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90.

No. of outcomes favorable to C

1,	2,	3,	4,	5,	6,	7,	8,	9,	10
11,	12,	13,	14,	15,	16,	17,	18,	19,	20
21,	22,	23,	24,	25,	26,	27,	28,	29,	30
31,	32,	33,	34,	35,	36,	37,	38,	39,	40
41,	42,	43,	44,	45,	46,	47,	48,	49,	50
51,	52,	53,	54,	55,	56,	57,	58,	59,	60
61,	62,	63,	64,	65,	66,	67,	68,	69,	70
71,	72,	73,	74,	75,	76,	77,	78,	79,	80
81,	82,	83,	84,	85,	86,	87,	88,	89,	90

The number is divisible by 5 means the number is in 5's table

$\therefore$

No. 10

PROBABILITY

- **Finding Probability : Sum based on Candies**
  : Sum based on balls

Q. **A bag contains lemon flavoured candies only, Malini takes out one candy without looking into the bag. What is the probability that she takes out**
(i) an orange flavoured candy?
(ii) a lemon flavoured candy?

Sol. Let the number of of lemon flavoured candies be x.

$\therefore$ Total number of possible outcomes = x

Let A be event that the candy taken out is orange flavoured candy

Numbers of outcomes favourable to A = 0

$$\therefore \text{ P (A)} = \frac{0}{x} = 0$$

Let B be the event that the candy taken ou

Numbers of outcomes favourable to B = x

$$\therefore \text{ P (B)} = \frac{x}{x} = 1$$

How many lemon flavoured candies are there ?

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

Sol. A bag contains 3 red ball and 5 black balls.

Total no. of possible outcomes = 8

Let A be the event that the ball drawn is red.

No of outcomes favourable to A = 3

$\therefore$ **P (A) =** $\frac{3}{8}$

How many black balls are there ?

Let B be the event that the ball drawn is not red.

No of outcomes favourable to B = 5

$\therefore$ **P (B) =** $\frac{5}{8}$

No. 11

PROBABILITY

- **Finding Probability : Sum based on Game of Chance**

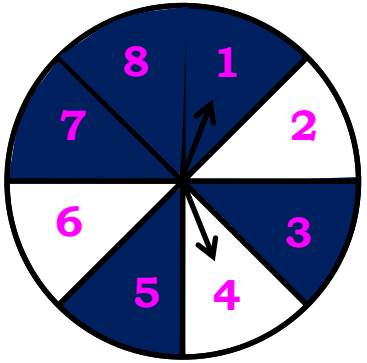
Q. A game of chance consists of spinning an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8 and these are equally likely outcomes. What is the probability that it will point at

(i) 8 ?

(ii) an odd number ?

(iii) a number greater than 2 ?

(iv) a number less than 9 ?



Sol. All possible outcomes are 1, 2, 3, 4, 5, 6, 7, 8

$\therefore$ Total no. of possible outcomes = 8

(i) Let A be the event that the number is 8

Outcome favourable to A is 8

$\therefore$ No. of outcomes favourable to A = 1

$$\therefore \ P(A) = \frac{1}{8}$$

(ii) Let B be the event that it is an odd number

Outcomes favourable to B are 1, 3, 5, 7

$\therefore$ No. of outcomes favourable to B = 4

$$\therefore \ P(B) = \frac{4}{8} = \frac{1}{2}$$

On whichever number the arrow points that number is taken as an outcome of that experiment

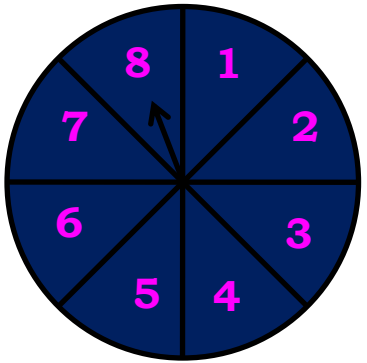
Q. A game of chance consists of spinning an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8 and these are equally likely outcomes. What is the probability that it will point at

(i) 8 ?

(ii) an odd number ?

(iii) a number greater than 2 ?

(iv) a number less than 9 ?



Sol.

(iii) Let C be the event that the number is greater than 2

Outcome favourable to C are 3, 4, 5, 6, 7, 8

$\therefore$ No. of outcomes favourable to C = 6

$$\therefore \ P(C) = \frac{6}{8} = \frac{3}{4}$$

(iv) Let D be the event that the number is less than 9

Outcomes favourable to D are 1, 2, 3, 4, 5, 6, 7, 8

$\therefore$ No. of outcomes favourable to D = 8

$$\therefore \ P(D) = \frac{8}{8} = 1$$

No. 12

PROBABILTY

- **Finding Probability : Sum based on Number Die**
  Sum based on alphabet Die

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

Sol. All the possible outcomes are 1, 2, 3, 4, 5, 6

Total no. of possible outcomes = 6

(ii) Let A be the event of getting a prime number

Outcomes favourable to A are 2, 3, 5

∴ No. of outcomes favourable to A = 3

$$\therefore \ P(A) = \frac{3}{6} = \frac{1}{2}$$

(ii) Let B be the event of getting a number lying between 2 and 6

Outcomes favourable to B are 3, 4, 5

∴ No. of outcomes favourable to B = 3

$$\therefore \ P(B) = \frac{3}{6} = \frac{1}{2}$$

(iii) Let C be the event of getting an odd number

Outcomes favourable to C are 1, 3, 5

∴ No. of outcomes favourable to C = 3

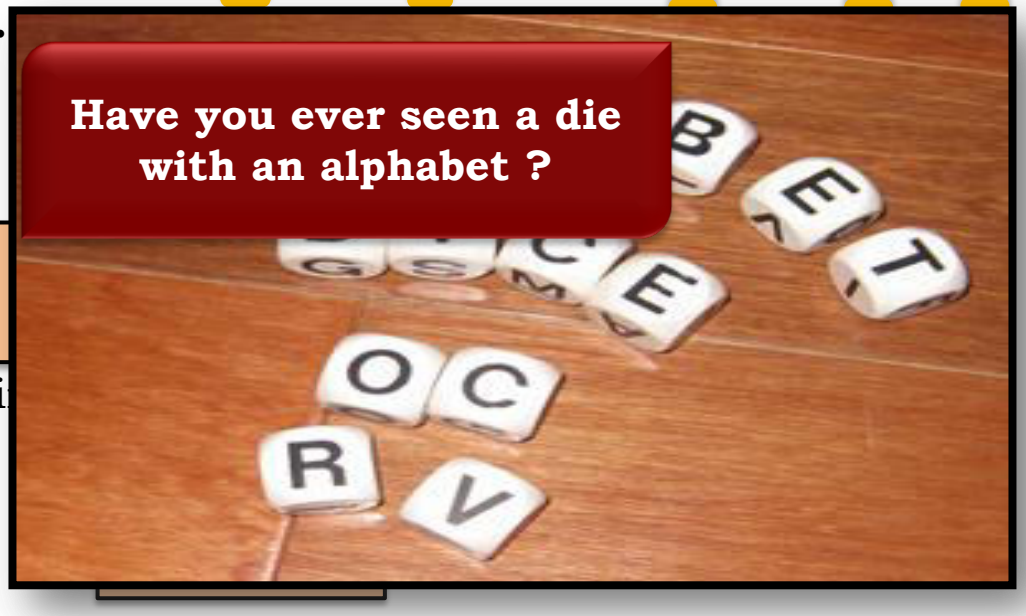
$$\therefore \ P(C) = \frac{3}{6} = \frac{1}{2}$$

Q. A child has a die whose six faces show the letters as given below

A	B	C	D	E	A

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

Sol.



(i

Thank You

Lecture_03

No. 13

PROBABILTY

- **Finding Probability : Sum based on 2 Dice**

Q. **Two dice, one blue and one grey are thrown at the same time (i) Complete the following table :**

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

Sol. When two dice are thrown,
Different possible outcomes are
Total number of possible outcomes = 36
(a)When the sum on 2 dice is 3,
favourable cases are(1, 2), (2, 1)
∴ No. of favourable outcomes = 2

∴ P(

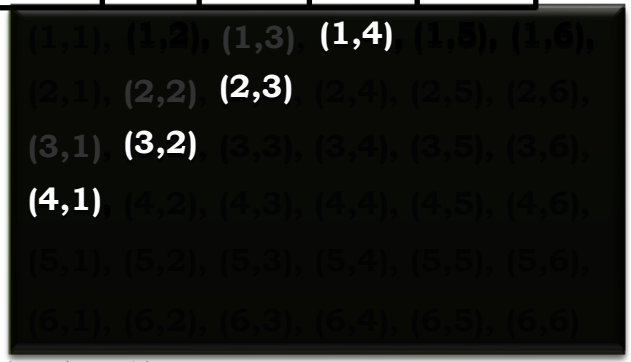
So sum of the scores will be between 2 & 12 including 2 and 12

(1,1), (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), (3,6),
(4,1), (4,2), (4,3), (4,4), (4,5), (4,6),
(5,1), (5,2), (5,3), (5,4), (5,5), (5,6),
(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)

2
3
4
5
6
7
8
9
10
11
12

Q. **Two dice, one blue and one grey are thrown at the same time (i) Complete the following table :**

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



Sol. (b) When the sum on 2 dice is 4,
favourable cases are (1, 3), (2, 2), (3, 1)
∴ No. of favourable outcomes = 3

∴ P (sum on 2 dice is 4) = $\frac{3}{36}$

(c) When the sum on 2 dice is 5,
favourable cases are (1, 4) , (2, 3), (3, 2), (4, 1)
∴ No. of favourable outcomes = 4

∴ P (sum on 2 dice is 5) = $\frac{4}{36}$

Q. **Two dice, one blue and one grey are thrown at the same time (i) Complete the following table :**

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

Sol. d) When the sum on 2 dice is 6,
favourable cases are (1, 5) , (2, 4),
∴ No. of favourable outcomes =

∴ P (sum on 2 dice is 6) = $\frac{5}{36}$

(1,1), (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), (3,6),
(4,1), (4,2), (4,3), (4,4), (4,5), (4,6),
(5,1), (5,2), (5,3), (5,4), (5,5), (5,6),
(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)

e) When the sum on 2 dice is 7,
favourable cases are (1, 6), (2,
∴ No. of favourable outcome

∴ P (sum on 2 dice is 7) = $\frac{6}{36}$

(4,1), (4,2), (4,3), (4,4), (4,5), (4,6),
(5,1), (5,2), (5,3), (5,4), (5,5), (5,6),
(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)

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11
12

No. 14

PROBABILITY

- **Finding Probability : Sum based on 2 Dice contd…**

Q. Two dice, one blue and one grey are thrown at the same time (i) Complete the following table :

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

Sol. f) When the sum on 2 dice is 9,
favourable cases are (3, 6) , (4, 5), (5, 4), (6, 3)
$\therefore$ No. of favourable outcomes = 4

$\therefore$ **P (sum on 2 dice is 9) = $\frac{4}{36}$**

g) When the sum on 2 dice is 10,
favourable cases are (4, 6), (5, 5), (6, 4)
$\therefore$ No. of favourable outcomes = 3

$\therefore$ **P (sum on 2 dice is 10) = $\frac{3}{36}$**

(1,1), (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), (3,6),
(4,1), (4,2), (4,3), (4,4), (4,5), (4,6),
(5,1), (5,2), (5,3), (5,4), (5,5), (5,6),
(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)

2
3
4
5
6
7
8
9
10
11
12

Q. **Two dice, one blue and one grey are thrown at the same time (i) Complete the following table :**

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

Sol.

h) When the sum on 2 dice is 11,
favourable cases are (5, 6), (6, 5)
$\therefore$ No. of favourable outcomes = 2

$\therefore$ **P (sum on 2 dice is 11) = $\frac{2}{36}$**

(1,1), (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), (3,6),
(4,1), (4,2), (4,3), (4,4), (4,5), (4,6),
(5,1), (5,2), (5,3), (5,4), (5,5), (5,6),
(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)

2
3
4
5
6
7
8
9
10
11
12

(ii) A student argues that 'there are 11 possible outcomes 2,3,4,5, 6, 7, 8,9,10,11 and 12. Therefore, each of them has $\frac{1}{11}$ probability

Do you agree with this argument? Justify your answer.

Sol.

No. The eleven sums are not equally likely

e.g. : For getting sum on two dice as 2
there is only 1 favourable outcome which is (1, 1)
But for getting sum on 2 dice as 3 there are 2 favourable outcomes which are (1, 2) and (2, 1).

For getting sum on 2 dice as 4 there are 3 favourable outcomes which are (1,3), (2, 2) and (3, 1)

So we understand that these events are not elementary events

and hence their probability cannot be equal to $\frac{1}{11}$

(1,1)	(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)	(3,6)
(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)

No. 15

PROBABILITY

Finding Probability : Sum based on 2 Dice

: Sum based on one die thrown twice

Q. **A die is thrown twice. What is the probability that**

(i) 5 will not come up either time?

(ii) 5 will come up at least once?

Sol. A die is thrown twice

$\therefore$ Possible outcomes are

$\therefore$ Total no of possible outcomes = 36

(i) Let A be the event that 5 will not come up either time

$\therefore$ Outcomes favourable to A 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) (6,6)

$\therefore$ No. of outcomes favourable to A = 25

Let us remove all the outcomes which have 5

(1,1), (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), (3,6),
(4,1), (4,2), (4,3), (4,4), (4,5), (4,6),
(5,1), (5,2), (5,3), (5,4), (5,5), (5,6),
(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)

$\therefore$ **P (A) =** $\frac{25}{36}$

Q. **A die is thrown twice. What is the probability that**

(i) 5 will not come up either time?

(ii) 5 will come up at least once?

Sol. (i) Let B be the event that 5 will come up at least once

$\therefore$ Outcomes favourable to B are

(1,5), (2,5), (3,5), (4,5), (5,5), (6,5)

(5,1), (5,2), (5,3), (5,4), (5,6)

$\therefore$ No. of outcomes favourable to B = 11

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

(1,5),
(2,5),
(3,5),
(4,5),
(5,1), (5,2), (5,3), (5,4), (5,5), (5,6),
(6,5)

No. 16

PROBABILITY

- **Finding Probability : Sum based on bulbs**

Q. (i) A lot of 20 bulbs contain 4 defective ones. One bulb is drawn at random from the lot. What is the probability that this bulb is defective ?

(ii) Suppose the bulb drawn in (i) is not defective and is not replaced. Now one bulb is drawn at random from the rest. What is the probability that this bulb is non defective ?

Sol.

How many defective bulbs are there ?

Total bulbs = 20

No. of all possible outcomes = 20

Defective bulbs = 4

$\therefore$ Non-defective bulbs = 20 – 4 = 16

(i) Let A be the event that the bulb taken out is defective

$\therefore$ No. of outcomes favourable to A = 4

$$\therefore \mathbf{P(A)} = \frac{4}{20} = \frac{1}{5}$$

Q. (i) A lot of 20 bulbs contain 4 defective ones. One bulb is drawn at random from the lot. What is the probability that this bulb is defective ?

(ii) Suppose the bulb drawn in (i) is not defective and is not replaced. Now one bulb is drawn at random from the rest. What is the probability that this bulb is non defective ?

Sol. (ii) Since the bulb drawn in (i) is not replaced

∴ Total no. of bul

∴ No. of all possi

No. of non defective bulbs = Total no. of bulbs – No. of defective bulbs

Let B be the event that the bulb is not defective

Total no. of non defective bulbs = 19 – 4 = 15

∴ No. of outcomes favourable to B = 15

$$\therefore P(B) = \frac{15}{19}$$

No. 17

PROBABILITY

- **Finding Probability : Sum based on Pens**

Q. **12 defective pens are accidentally mixed with 132 good ones. It is not possible to just look at the pen and tell whether or not it is defective. 1 pen is taken out at random from this slot. Determine the probability that a pen taken out is good one.**

Sol. No. of defective pens = 12

No. of good pens = 132

Total no. of pens = 12 + 132 = 144

Let A be the event that the pen drawn out is good pen.

No. of outcomes favourable for A = 132

How many good pens are there ?

$$P(A) = \frac{\text{No. of outcomes favourable to A}}{\text{No. of all possible outcomes}}$$

$$\therefore \quad P(A) = \frac{132}{144}$$

$$\therefore \quad \mathbf{P(A) = \frac{11}{12}}$$

Q. **A lot consists of 144 ball pens of which 20 are defective and the others are good. Nuri will buy a pen if it is good, but will not buy if it is defective. The shopkeeper draws one pen at random and gives it to her. What is the probability that**

(i) She will buy it?

(ii) She will not buy it?

Sol. Total no. of possible outcomes = 144

∴ No. of defective pens = 20

∴ No. of good pens = 144 - 20 = 124

All pens – Defective pens

Let A be the event that Nuri will buy a pen

∴ No. of outcomes favourable to A = 124

$$\therefore P(B) = \frac{\cancel{124}^{31}}{\cancel{144}_{36}}$$

$$\therefore \mathbf{P(B) = \frac{31}{36}}$$

Q. A lot consists of 144 ball pens of which 20 are defective and the others are good. Nuri will buy a pen if it is good, but will not buy if it is defective. The shopkeeper draws one pen at random and gives it to her. What is the probability that

(i) She will buy it?

(ii) She will not buy it?

Sol.

Let B be the event that Nuri will not buy a pen

No. of outcomes favourable to B = 20

$$\therefore \quad P(B) = \frac{\cancel{20}^{5}}{\cancel{144}_{36}}$$

$$\therefore \quad \mathbf{P(B) = \frac{5}{36}}$$

How many defective pens are there ?

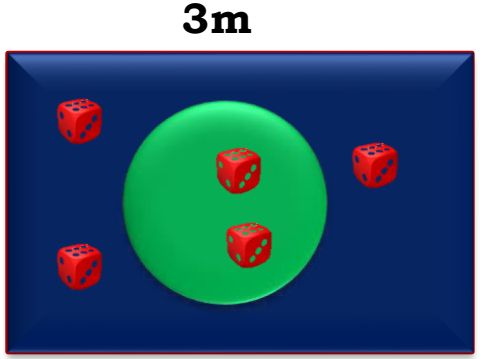
No. 18

PROBABILITY

- **Finding Probability : Sum based on Geometric Figures**
  : Theorey question based on arguements

Q. Suppose you drop a die at random on the rectangular region shown in fig.

What is the probability that it will land inside the circle with diameter 1m?



Sol.

Area of the rectangle $= l \times b = 3 \times 2 = 6\text{m}^2$

$\therefore$ Total area $= 6\text{m}^2$

For circle, $d = 1\text{m}$, $r = \frac{1}{2}\text{m}$

$\therefore$ Area of the circle $= \pi r^2 = \pi\left(\frac{1}{2}\right)^2 = \frac{\pi}{4}\text{m}^2$

Favourable Area $= \frac{\pi}{4}\text{m}^2$

$\therefore$ $P(A) = \dfrac{\text{Favourable Area}}{\text{Total area}}$

$$\therefore \mathbf{P(A)} = \frac{\pi/4}{6} = \frac{\pi}{24}$$

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

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

Sol.

When two coins are tossed simultaneously,

All possible outcomes are HH, HT, TH, TT

No. of all possible outcomes = 4

P (HH) = P (Two heads) = $\frac{1}{4}$

P (TT) = P (Two tails) = $\frac{1}{4}$

$\therefore$ P (HT or TH) = P (one head or one tail) = $\frac{2}{4} = \frac{1}{2}$

$\therefore$ (i) argument is incorrect.

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

Sol.

When a die is thrown,

All possible outcomes are 1, 2, 3, 4, 5, 6

No. of all possible outcomes = 6

$$P(\text{odd number}) = P(1, 3, 5) = \frac{3}{6} = \frac{1}{2}$$

$$\therefore \quad P(\text{Even number}) = P(2, 4, 6) = \frac{3}{6} = \frac{1}{2}$$

$\therefore$ (ii) argument is correct.

Thank You

Lecture_04

No. 19

PROBABILITY

- **Finding Probability : Sum based on Fish**
  : Sum based on tossing 3 coins

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

Sol. Number of all possible outcomes of the experiment = Total number of fish

= 5 male fish + 8 female fish

= 13 fish

Let ' E ' be the event that a male fish is picked up.

Number of outcomes favourable to E = 5

How many male fishes are there ?

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

$$\therefore \mathbf{P(E) = \frac{5}{13}}$$

Q. A game consists of tossing a one rupee coin 3 times and nothing its outcome each time. Hanif wins if all the tosses give the same result i.e., three heads or tails, and loses otherwise. Calculate the probability that Hanif will lose the game.

Sol. When a coin is tossed 3 times
Possible outcomes are HHH, HTH, THH, TTH, HHT, HTT, THT, TTT

∴

1st coin/ 1st time	2nd coin/ 2nd time	3rd coin/ 3rd time
		
		
		
		

1st coin/ 1st time	2nd coin/ 2nd time	3rd coin/ 3rd time
		
		
		
		

anif will lose game if ll tosses do not give same result

No. 20

PROBABILITY

- **Finding Probability : Sum based on Tossing 1 coin**
  : Sum based on Playing cards

Q. Why is tossing a coin considered to be a fair way of deciding which team should get the ball at the beginning of a football game?

Sol.

When we toss a coin, the outcomes head and tail are equally likely.

So, the result of an individual coin toss is completely unpredictable.

Outcomes are head and tail. These two outcomes are equally likely to occur

Q. Five cards — the ten, jack, queen, king and ace of diamonds, are well - shuffled with their face downwards. One card is then picked up at the random?

(i) What is the probability that the ca… queen?

(ii) If the queen is drawn and put asi… is the probability that the second card picked up is (a… (b) a queen?

Sol. Total number of possible out…

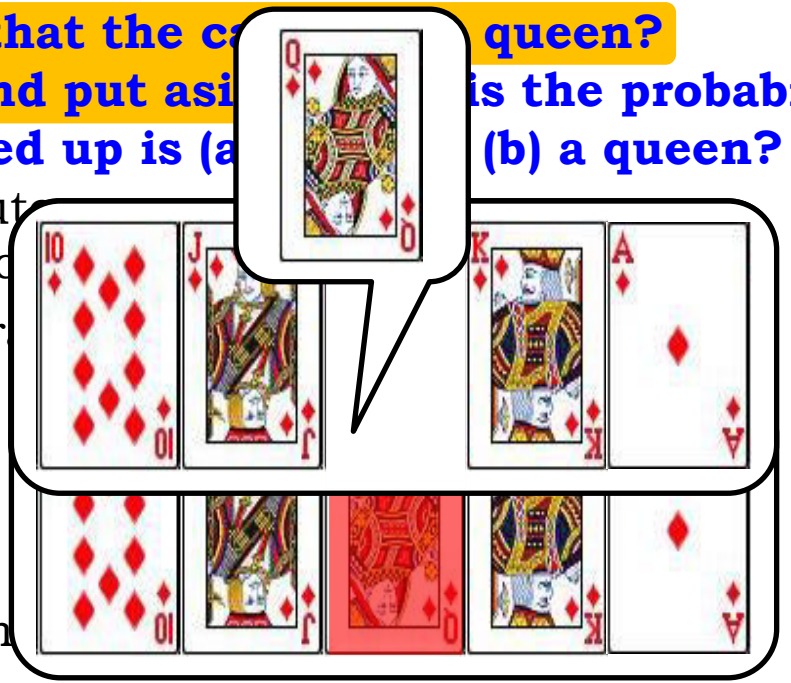
Let A be the event that the c…

Number of outcomes favour…

$$\therefore \quad P(A) = \frac{1}{5}$$

If Queen is drawn and kept …

Total no. of possible outcom…



Q. Five cards — the ten, jack, queen, king and ace of diamonds, are well - shuffled with their face downwards. One card is then picked up at the random?

(i) What is the probability that the card is the qu

(ii) If the queen is drawn and put aside, what is t ility that the second card picked up is (a) an ace? (b)

Sol. Let B be the event that the card pi

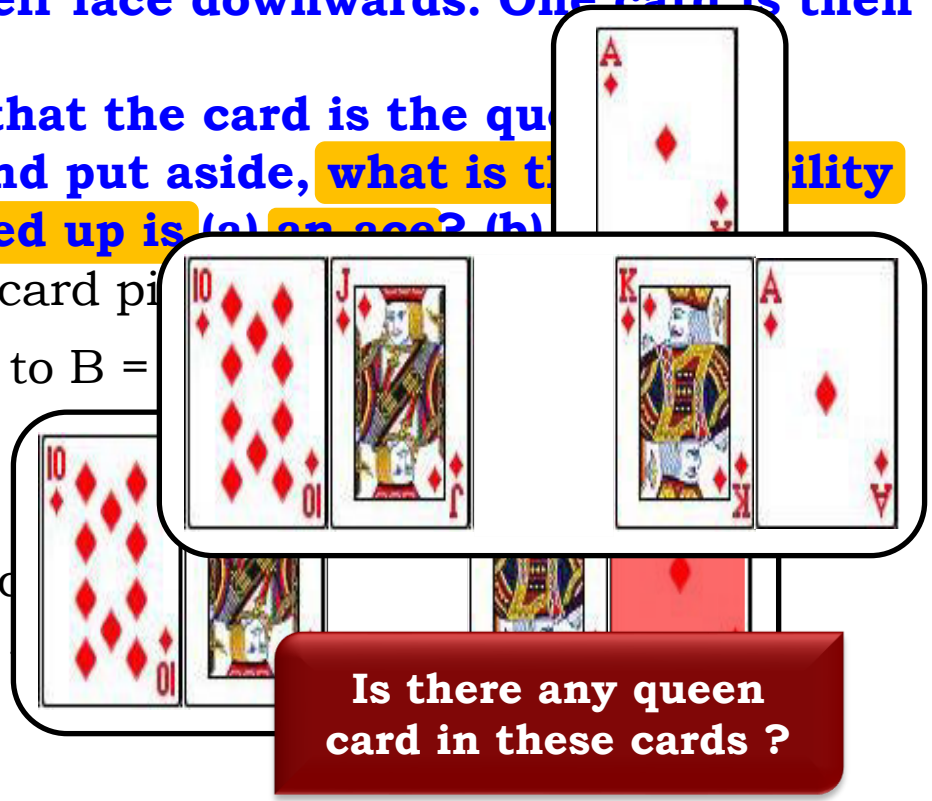
No. of outcomes favourable to B =

$$\therefore \text{ P (B)} = \frac{1}{4}$$

Let C be the event that the c

No. of outcomes favourable

$$\therefore \text{ P (C)} = \frac{0}{4} = 0$$



No. 21

PROBABILITY

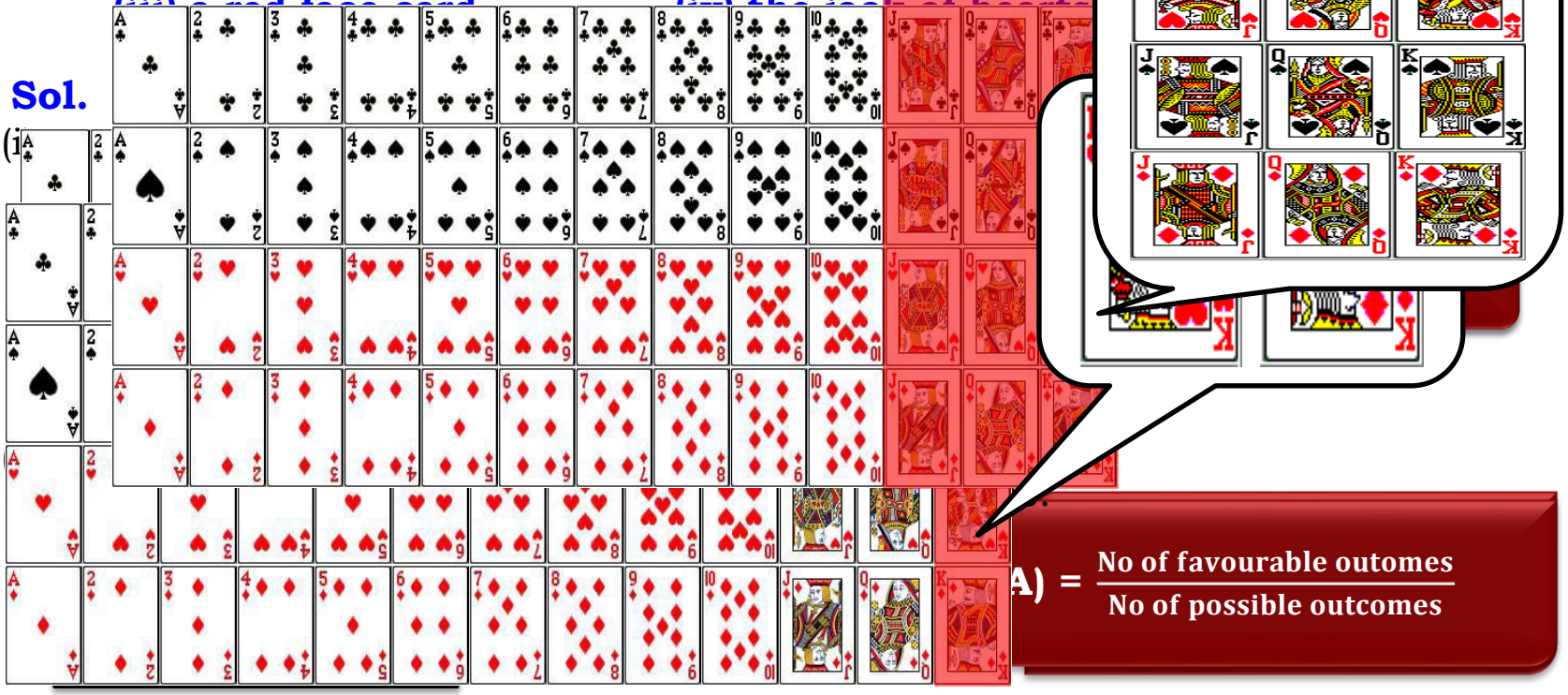
- **Finding Probability : Sum based on Playing cards**

Q. One card is drawn from a well-shuffled deck of 52

Find the probability of getting

(i) a king of red colour (ii) a face card

Sol.

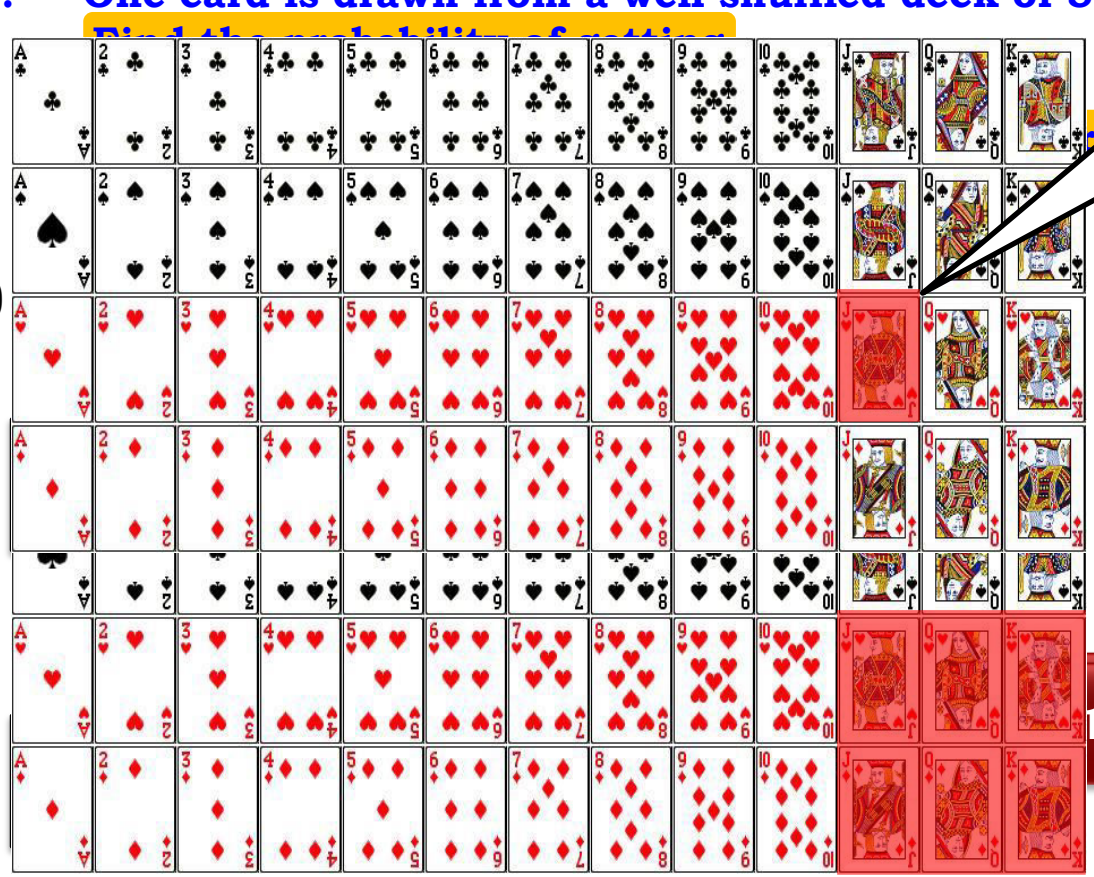


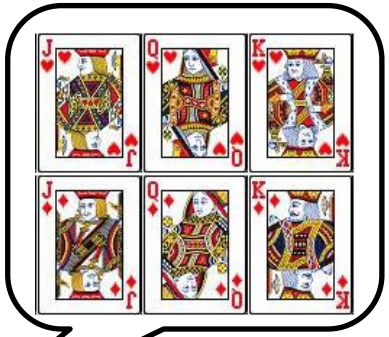
$$P(A) = \frac{\text{No of favourable outomes}}{\text{No of possible outcomes}}$$

Q. **One card is drawn from a well-shuffled deck of 52 cards.**

(iii)

(iv)





bility of event C is ....?

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

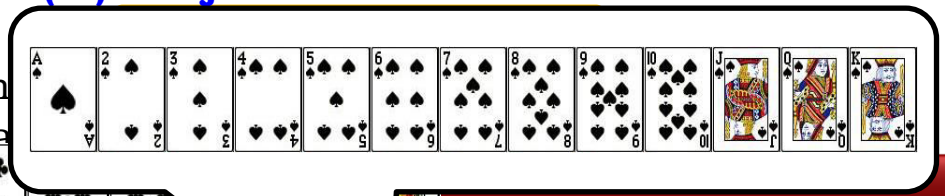
(i) a king of red colour **(ii) a face card**

(iii) a red face card **(iv) the jack of hearts**

(v) a spade

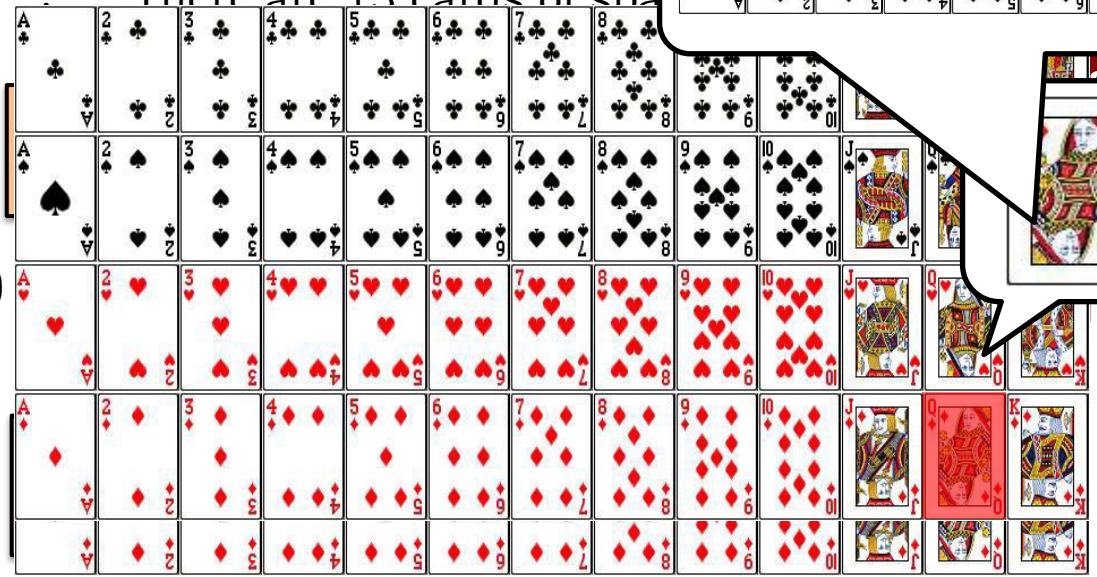
(v) Let E be the event of gettin

∴ There are 13 cards of spa



ability of event F is ...?

(vi)



No. 22

PROBABILITY

- **Finding Probability : Sum based on Year**
  : Sum based on Leap Year

Q. What is the probability that an ordinary year has 53 Sundays ?

Sol. An ordinary year has 365 days

52 weeks and 1 extra day

52 weeks will have 52 Sundays

The possible c… are

Mon, Tue, We… the… ?

Total no. of poss…

Let A be the event that the extra day is a Sunday

∴ Outcome favoura…

No. of outcomes … to A

$$P(A) = \frac{\text{Number}}{\text{Total}}$$

$$\therefore \quad P(A) = \frac{1}{7}$$

How many days are

Lets find number of weeks in 365 days

52 weeks will have How many sundays?

Extra day may give us an extra Sunday i.e. 53rd Sunday

Probability of event A is

$$7 \overline{)\,365} \quad 52$$
$$-\,35$$
$$15$$
$$-\,14$$
$$1$$

1 extra day

∴ **The probability that an ordinary year selected at random will have 53 Sundays is $\frac{1}{7}$.**

Q. What is the probability that a leap year has 53 Sundays ?

Sol. A leap year has 366 days

52 weeks and 2 extra days

52 weeks will have 52 Sundays

The sample space for 2 extra days

All possible outcomes are Sun - Mon, Mon - Tue,

Tue - Wed, Wed - Thu, Thu - Fri, Fri - Sat, Sat - Sun

$\therefore$ Total no. of possible outcom... = 7

Let A be the event of ge... L...

remaining 2 days

$\therefore$ Outcomes favourable to A is S...

No of outcomes favourable to...

$$P(A) = \frac{\text{Number of outcomes}}{\text{Total no.of possib...}}$$

$$\therefore \quad P(A) = \frac{2}{7}$$

Two extra days will be two consecutive days.

52 weeks will have

2 extra days may give us an extra Sunday i.e. 53rd Sunday

$\therefore$ **The probability that a leap year selected at random will have 53 Sundays is $\frac{2}{7}$.**

No. 23

PROBABILITY

- **Finding Probability : Sum based on 3 Horses**

Q. Three horses A, B and C are in a race, A is twice as like to win as B and B is twice as like to win as C, what are their probabilities of winning ?

Sol. Let probabilities of horses A, B and C be P (A), P (B), and P (C).

P (A) = 2P (B) .....(i)

P (B) = 2 P(C) .....(ii)

Substituting (ii) in (i),

P (A) = 2 × 2P(C)

∴ P (A) = 4 P(C) .....(iii)

Assuming only one of them is going to win the race

∴ P (A) + P (B) + P (C) = 1

∴ + + P (C) = 1

∴ 7P (C) = 1

∴ **P (C) = $\frac{1}{7}$**

Substituting the value of P (C) in (iii),

P (A) = $4\left(\frac{1}{7}\right)$

∴ **P (A) = $\frac{4}{7}$**

Substituting the value of P (C) in (ii),

P (B) = $2\left(\frac{1}{7}\right)$

∴ **P (B) = $\frac{2}{7}$**

Probabiltv of Horse A

We know sum of probabilities of all elementary events = 1

likely to occur

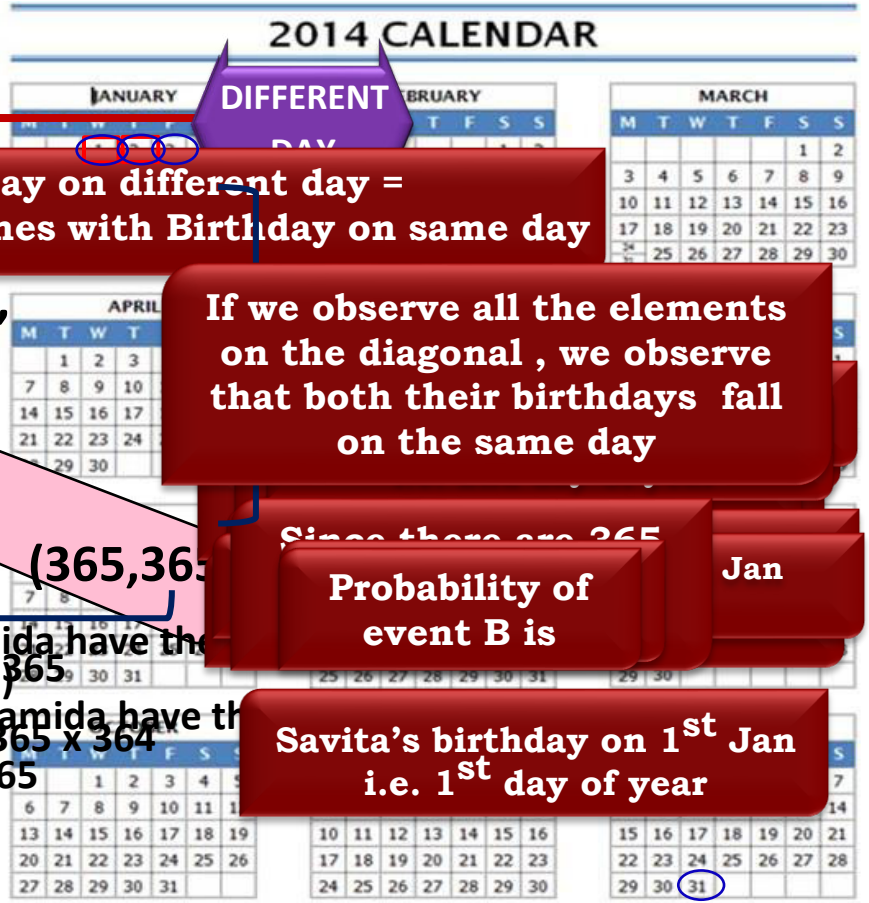
No. 24

PROBABILITY

- **Finding Probability : Sum based on Birthday**

Q. Savita and Hamida are friends, w
have (i) the same birthday (ii) dif

Sol All possible outcomes are



No. of outcomes with birthday on different day =
Total No. of outcomes – No. of outcomes with Birthday on same day

(2,1), (2,2), (2,3), ……., 2,365),
(3,1), (3,2), (3,3), ……, (3,365),
⋮ ⋮ ⋮ ⋮ ⋮ ⋮ ⋮ ⋮
(365,1),(365,2),(365,3) ,……, (365,365)

365 columns

If we observe all the elements on the diagonal , we observe that both their birthdays fall on the same day

Since there are 365 Jan

Probability of event B is

Let B be the event that both Savita and Hamida have the

∴ n (B) = 365 x 365 Total no. of possible outcomes = (365 x 365)

Let A be the event that both Savita and Hamida have th

∴ Number of outcomes favourable to B is 365 x 364

∴ Number of outcomes favourable to A = 365

$$P(B) = \frac{n(B)}{n(S)} = \frac{365 \times 364}{365 \times 365} = \frac{364}{365}$$

$$P(A) = \frac{n(A)}{n(S)} = \frac{365}{365 \times 365} = \frac{1}{365}$$

Savita's birthday on 1st Jan i.e. 1st day of year

Thank You

Lecture_05

No. 25

PROBABILITY

- **Finding Probability : Sum based on Playing cards**

Q. A card is drawn at random from a well shuffl

Find the probability that the card drawn i

(i) bears a number between 4 and 7 both inc

(ii) bears a number between 3 and 8 both inc

Sol. There are 52 cards in a pack of cards

$\therefore$ Total no. of all possible outcomes = 52

(i) Let A be the event that card drawn bears a
between 4 and 7

There are 4 n

and there are

$\therefore$ Total no. of ca

inclusive in t

Number of ou

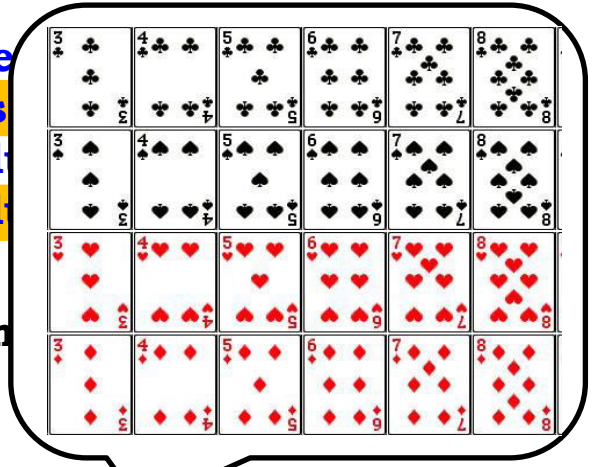
$$\therefore \quad P(A) = \frac{16}{52} = \frac{4}{13}$$

Q. A card is drawn at random from a well shuffle

Find the probability that the card drawn is

(i) bears a number between 4 and 7 both incl

(ii) bears a number between 3 and 8 both incl



Sol.

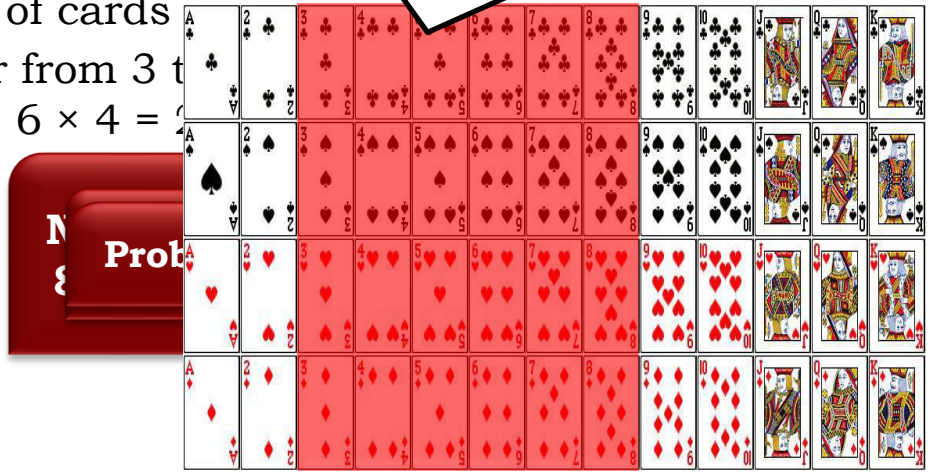
(ii) Let B be the event that card drawn bears a n between 3 and 8 both inclusive.

There are 6 numbers from 3 to 8 both inclusive and there are 4 types of cards

∴ Total no. of card bearing number from 3 t inclusive in the pack of cards is 6 × 4 = 2

n (B) = 24

$$\therefore \quad P(B) = \frac{24}{52} = \frac{6}{13}$$



No. 26

15. PROBABILITY

- **Finding the probability sum based on playing cards.**

Q.] If a card is drawn from a pack of 52 cards. Find the Probability of getting :

(i) Event A : black card (ii) Event B : not a black

(iii) Event C : a card bearin

Sol. There are 52 cards in

$\therefore$ Total no. of card

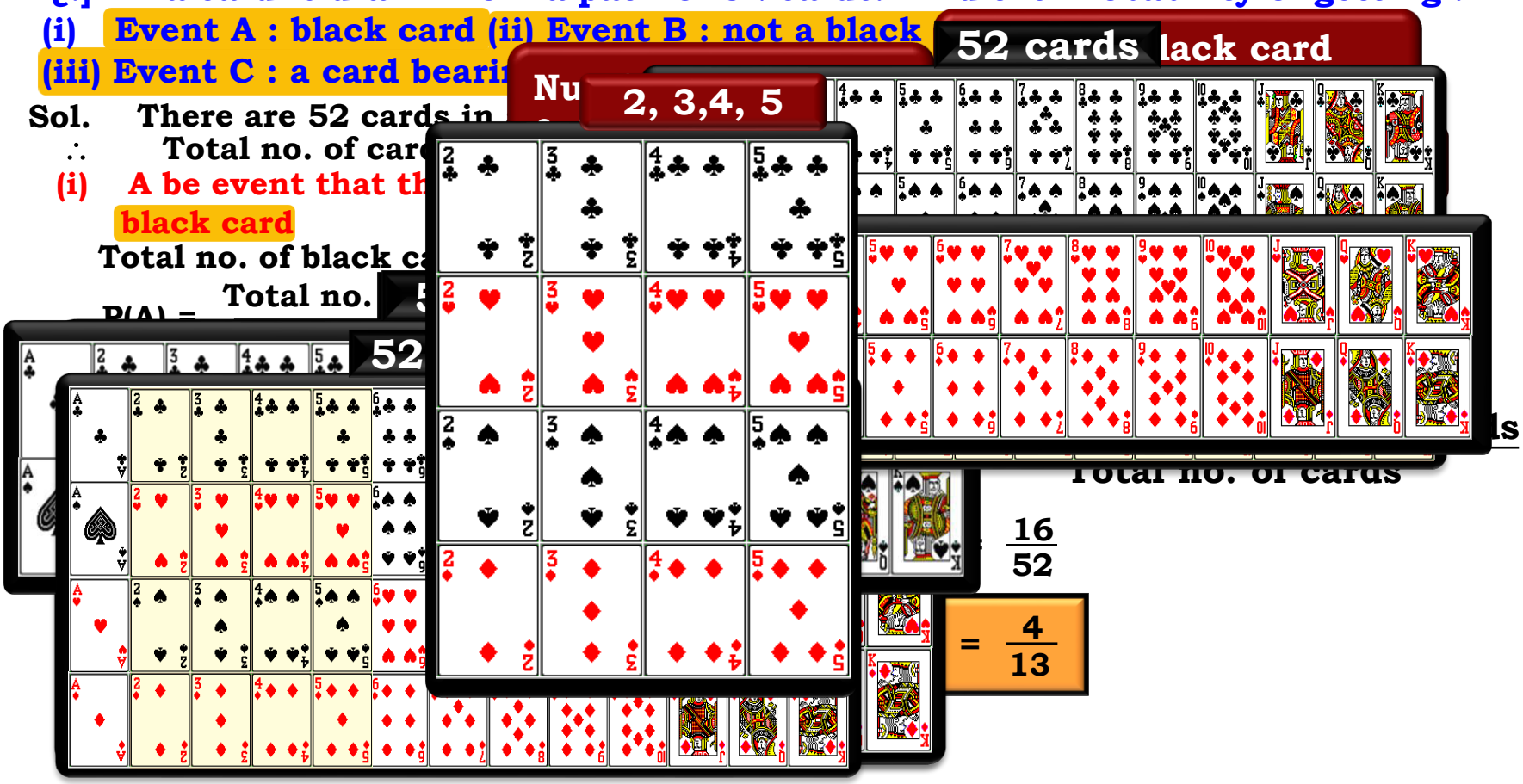
(i) A be event that th

black card

Total no. of black c

Total no.

$P(A) =$



Total no. of cards

$= \frac{16}{52}$

$= \frac{4}{13}$

Q.] A card is drawn at random from well shuffled pack of 52 cards. Find the probability that the card drawn is :

(i) a spade

(ii) not of diamond

There are 52 cards in a pack

Sol: There are 52 cards in a pack

Total no. of cards = 52

(i) Let A be event that the card drawn is a spade card

(ii) Let B be event that the card drawn is not a diamond

52 cards

rds which are not a diamond

al no. of favorable cards

Total no. of cards

No. 27

15. PROBABILITY

- **Finding the probability sum based on playing cards.**

Q.] One card is drawn from a well- shuffled pack of 52 cards.
Find the probability of getting :
(i) a king of red colour. (ii) a face card. (iii) a red face card.

Probability of event A is

Sol. There are 52 cards in a pack

Total no. of c

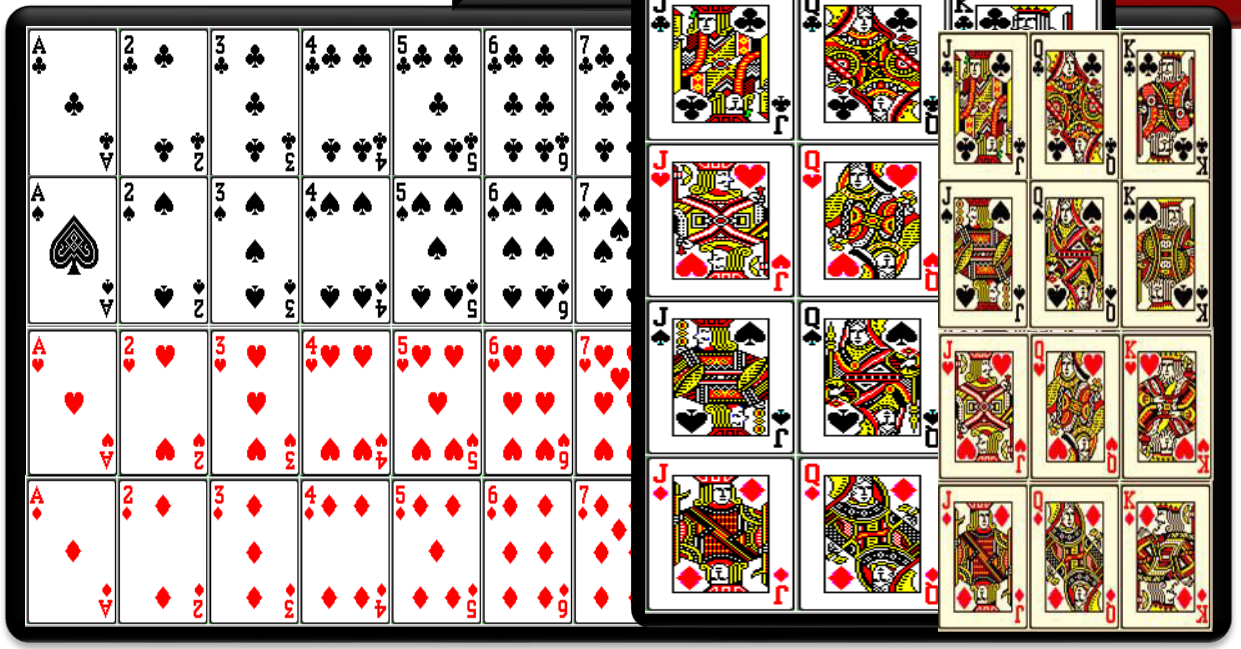
Q.] One card is drawn from a well- shuffled pack of 52 cards.
Find the probability of getting :
(i) a king of red colour. (ii) a face card. (iii) a red face card.

Sol. There are 52 cards in a pack

Total no. of cards = 52 cards

Probability of event B is

(ii)



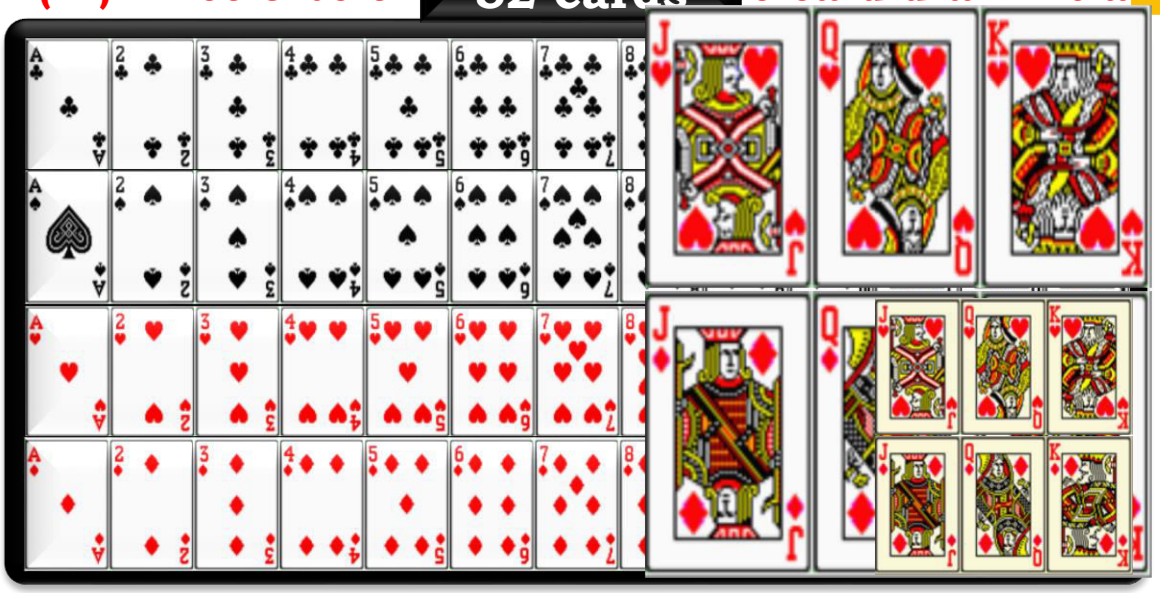
Q.] One card is drawn from a well- shuffled pack of 52 cards.
Find the probability of getting :
(i) a king of red colour. (ii) a face card. (iii) a red face card.

Probability of event C is

Sol. There are 52 cards in a pack

Total no. of cards = 52

(iii) Let C be th **52 cards** **e card drawn is a red face card**



No. 28

15. PROBABILITY

- **Finding the probability of a four turning up at least once in two tosses of a fair die**

Q.] Find the probability of a four turning up at least once in two tosses of a fair die.

Sol. The sample space when a fair die

Total outcomes = (1, 1), (1, 2), (1, 3), (1

(2, 1), (2, 2), (2, 3), (2

(3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6),

(4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6),

(5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6),

(6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6).

Total possibl

Let A be the event of getting 4 at least once in two tosses of a fair die.

(1, 4), (2, 4), (3, 4), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 4), (6, 4)

No. of favorable outcomes = 11

$\therefore$ $P(A) = \dfrac{\text{No. of favorable outcomes}}{\text{Total possible outcomes}}$ $\therefore$ $P(A) = \dfrac{11}{36}$

Favourable elements of A are

The given event is

Probability of event A is

The number 4 should appear at least once

Either on 1st die or on 2nd die or on both the dice

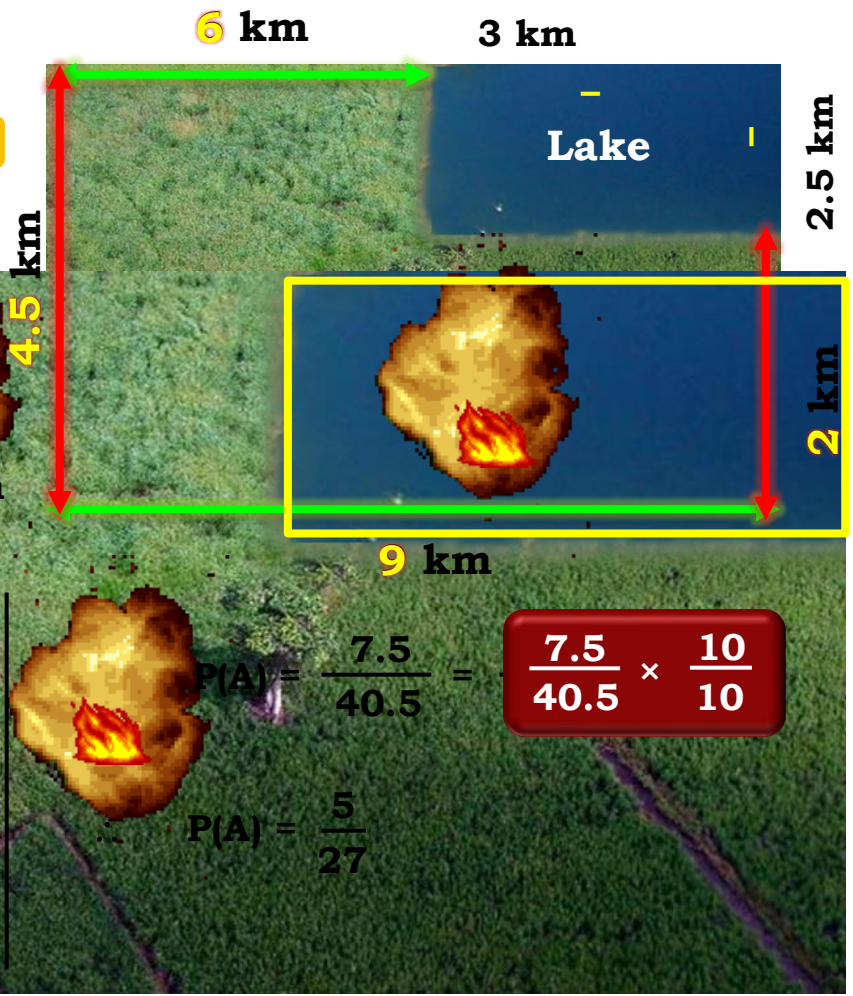
Total possible outcomes are

No. 29

15. PROBABILITY

- **Finding the probability that the helicopter is crashed inside the lake**

Q.) A missing helicopter is reported to have crashed somewhere in the rectangular region shown in fig .What is the probability that



Area of the rectangular lake = ar lake ×
lar lake

What do we need to

Total no. of possible outcomes

i.e. Area of a rectangular region

r region =
ar region ×
Breadth of the rectangular region

= 40.5 sq km

Let A be the event that the helicopter would crashed inside the lake

$$\therefore \quad P(A) = \frac{\text{Area of rectangular lake}}{\text{Area of rectangular region}}$$

$$P(A) = \frac{7.5}{40.5} = \frac{7.5}{40.5} \times \frac{10}{10}$$

$$\therefore \quad P(A) = \frac{5}{27}$$

Thank You