PROBABILITY

Probability = Number of favorable outcomes/Total number of outcomes

1) Tossing a coin
   Head = ½
   Tail = 1/2
1) Rolling a die
   1/6……1/6
1) Rolling dice
   1/36, 2/36……6/36,5/36…..1/36
1) Pick a ball from the bag

Probability is always in between 0 and 1
We can take it as likelihood of an event and not guaranteed

Probability of an event A is P(A).
Probability of an event A not being is P(A’)
P(A)+P(A’) = 1

Types of Events

1) Mutually Exclusive:
2) Non-Mutually Exclusive
3) Independent
4) Dependent

Mutually Exclusive:

Two events can not happen at the same time in a **single** test.

When you toss a coin Head and Tail can not happen. Either head or tail can happen.

So both head and tail are mutually exclusive

Probability of head when you toss a coin is P(A) = ½.

Probability of tail when you toss a coin is P(B) = ½.

Probability of head and tail when you toss a coin is P(A and B) i.e. $P(A \cap B) = 0$.

Probability of head or tail is P(A or B) = P(A)+P(B) = 1

Probability of 2 when you roll a die = 1/6

Probability of 2 and 5 when you roll a die i.e $P(A \cap B) = 0$

Probability of 2 or 5 when you roll a die P(A or B) i.e. $P(A \cup B) = 1/6+1/6 = 2/6$

This is also called **Additional Rule 1** in Probability

Non - Mutually Exclusive:

Two events can happen at the same time in a **single** test.

Example : When you pick a student from a college, student can be both Maths student and girl

Consider a class of 50 students with 33 boys and 13 girls. Out of 50 students, 7 Girls and 11 Boys are from Bangalore.

What is the probability that a randomly selected student is both from Bangalore a girl?

Ans : ?

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Consider a class of 50 students with 33 boys and 13 girls. Out of 50 students, 7 Girls and 11 Boys are from Bangalore.

What is the probability that a randomly selected student is both from Bangalore a girl?

Ans : 7/50

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Consider a class of 50 students with 33 boys and 13 girls. Out of 50 students, 7 Girls and 11 Boys are from Bangalore.

What is the probability that a randomly selected student is from Bangalore or a girl?

Ans : ?

Non - Mutually Exclusive:

Two events can happen at the same time.

Example : When you pick a student from a college, student can be both Maths student and girl

Consider a class of 50 students with 33 boys and 13 girls. Out of 50 students, 7 Girls and 11 Boys are from Bangalore.

What is the probability that a randomly selected student is from Bangalore or a girl?

Ans : From Bangalore we have 18 students from the class

We have 13 girls from the class

So it should be 18/50 + 13/50

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Correct?

Non - Mutually Exclusive:

Two events can happen at the same time.

Example : When you pick a student from a college, student can be both Maths student and girl

Consider a class of 50 students with 33 boys and 17 girls. Out of 50 students, 7 Girls and 11 Boys are from Bangalore.

What is the probability that a randomly selected student is from Bangalore or a girl?

Ans : From Bangalore we have 18 students from the class

We have 17 girls from the class

So it should be 18/50 + 17/50

Remember that out of 18 students from Bangalore we also have Girls included. But we are already considering girls in 17/50. So we should exclude the girls from the Bangalore list 18/50 i.e. remove the girls from Bangalore group.

How many girls from Bangalore group? 7/50

So Probability of student being from Bangalore or Girls is : 18/50+17/50 – 7/50 = 28/50

So Probability of **P(A or B) i.e. P(A ∪ B) = P(A)+P(B) - P(A ∩ B)**

This is also called **Additional Rule 2**

Independent Events

Two events when happened in sequence are not dependent on each other i.e. Result of event 1 is not influencing the result of event 2

Definition: Two events, A and B, are independent if that A occurring does not affect the probability of B occurring.

Examples:

1) Tossing a coin and the tossing the coin
2) Rolling a die and then rolling the die again
3) Selecting a ball from the bag, putting the ball back in the bag and again picking up a ball

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Definition: Two events, A and B, are independent if that A occurring does not affect the probability of B occurring.

Examples:

1) Tossing a coin and the tossing the coin

   ½ * ½

1) Rolling a die and then rolling the die again

   1/6 * 1/6

1) Selecting a red ball from the bag of 5 red balls and 4 blue balls, putting the ball back in the bag and again picking up a red ball

   5/9 * 5/9

This is also called **Multiplication Rule 1**

Dependent Events

Two events when happened in **sequence** are dependent on each other i.e. Result of event 1 is influencing the result of event 2

Definition: Two events, A and B, are Dependent if that A occurring affecting the probability of B occurring.

Examples:

1) Selecting a red ball from the bag of 5 red balls and 4 blue balls, not putting the ball back in the bag and then picking up a red ball from the bag

?

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Definition: Two events, A and B, are Dependent if that A occurring affecting the probability of B occurring.

Examples:

1) Selecting a red ball from the bag of 5 red balls and 4 blue balls, not putting the ball back in the bag and then picking up a red ball from the bag

   5/9 * 4/8

This is also called **Multiplication Rule 2**

PERMUTATIONS & COMBINATIONS

Combinations:

A class consists of 33 Boys and 17 Girls. *Order doesn't matter here*

Permutations

My lottery ticket number is : 365096528749 . *Order matters here*

Combinations:

A class consists of 33 Boys and 17 Girls. *Order doesn't matter here*

Repetition is Allowed: Above example Boys and girls are repeating 33 and 17 times respectively.

No Repetition: for example the ICC rankings. Virat can not be first and second

Permutations

My lottery ticket number is : 365096528749 . *Order matters here*

Repetition is Allowed: such as the lottery number above. It has 5, 6 and 9 repeating.

No Repetition: for example the ICC rankings. Virat can not be first and second

Combinations:

Probability of selecting two cricket players from 6 players.

$$ {}^{n}_{r}C = \frac{n!}{r!\,(n-r)!} $$

$ {}^{6}_{2}C = \frac{6!}{2!(6-2)!} = 15 $

Permutations

Probability of two players being holding rank 1 and rank 2 among 6 players. Here order matters as one player has to be number one another player has to be number 2.

$$ {}^{n}_{r}p = \frac{n!}{(n-r)!} $$

$ {}^{6}_{2}c = \frac{6!}{(6-2)!} = 30 $