# **What is a Random Experiment**

* An Experiment is called random experiment if it satisfies the following conditions :-

1. It has more than one possible outcome.

* Example: When you roll the die, there are six possible outcomes—landing on any one of the six faces, numbered 1 through 6.

1. It is not possible to predict the outcome in advance.

* Example: Before rolling the die, it's not possible to accurately predict which specific number will be face up after the roll. The outcome is influenced by various factors like the initial conditions of the roll, air resistance, and the surface it lands on, making it unpredictable.

# **What is Outcome**

* A possible result of a random experiment is called Outcome.
* Example: In rolling a six-sided die, a possible outcome could be getting a 3.

# **What is Sample Space**

* The set of all possible outcomes of a random experiment is called sample space.
* Example: In rolling a six-sided die, the sample space is the set of all possible outcomes:
* {1, 2, 3, 4, 5, 6}.

# **What is Impossible Event**

* If the probability of occurrence of an event is 0, such an event is called an impossible event.
* Example: The empty set ϕ is an impossible event

# **What is Sure Event**

* If the probability of occurrence of an event is 1, it is called a sure event.
* Example: Sample space S is a sure event.

# **What is Simple Event**

* Any event consisting of a single point of the sample space is known as a simple event in probability.
* Example: If A = {56 , 78 , 96 , 54 , 89} and B = {78} then B is a simple event.

# **What is Compound Event**

* A compound event is a combination of two or more simple events.
* Example: If S = {56 ,78 ,96 ,54 ,89}, E1 = {56 ,54 }, E2 = {78 ,56 ,89 } then, E1 and E2 represent two compound events.

# **What is Compound Event**

* A complementary event, often denoted as A’ is the event that an outcome is not in a specified event A.
* In other words, it represents all outcomes that are not in event A.

# **Find Total Outcomes when 1-rupee coin and 2-rupee coin is tossed**

**Outcomes**

S.S = {(H,H),(H,T),(T,T),(T,H)}

**Total Outcome = 4**

**Each Probability = ¼**

1. **Number of tails is exactly 2**

* (T,T)
* ¼

1. **Number of tails at least 1**

* (H,T),(T,T),(T,H)
* ¾

1. **Number of head at most 1**

* (H,T),(T,T),(T,H)
* ¾

1. **Second toss is not head**

* (T,H) (T,T)
* 2/4 = ½

1. **Number of tails is at most 2**

* (H,T),(T,T),(T,H),(H,H)

1. **Number of tails is more than 2**

* Null

# **A coin is tossed. If it shows head, we draw a ball from a bag consisting of 3 blue and 4 white balls; if it shows tail, we throw a die.**

* If a coin is tossed ten possible outcomes are
* (H,T)
* If a dice is thrown then possible outcomes are (1,2,3,4,5,6,)
* If it shows head then we draw a ball from a bag consist of 3 blue ball (B1,B2,B3) and 4 while ball (W1,W2,W3,W4)
* **S.S = {HB1, HB2, HB3, HW1, HW2, HW3, HW4, T1, T2, T3, T4, T5, T6}**

# **Find Total outcomes when two dices are there, one is red and another is blue and give answers to the given question**

**Outcomes**

* S.S = { (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) }

**Total Outcomes = 36**

**Each Probability = 1/36**

1. **Sum of the addition is exactly 4**

* (1,3), (2,2), (3,1)
* 3/36
* **1/12**

1. **Addition of both the dices is more than 7**

* (2,6),(3,5),(3,6),(4,4),(4,5),(4,6),(5,3),(5,4),(5,5),(5,6),(6,2),(6,3),(6,4),(6,5),(6,6)
* 15/36
* **5/12**

1. **Multiplication of both the dice is less than 12**

* (1,1),(1,2),(1,3),(1,4),(1,5),(1,6),(2,1),(2,2),(2,3),(2,4),(2,5),(3,1),(3,2),(3,3),(4,1),(4,2),(5,1),(5,2),(6,1)
* **19/36**

1. **Subtraction of both the dice is less than 6 and more than 1**

* (3,1),(4,1),(4,2),(5,1),(5,2),(5,3),(6,1),(6,2),(6,3),(6,4)
* 10/36
* **5/18**

# **Find the probability of getting a numbered card when a card is drawn from the pack of 52 cards**

* Total Cards = 52
* Numbered Cards = (2,3,4,5,6,7,8,9,10) x Four Suits
* = 9 x 4
* = 36
* **P(A) = 36/52 = 9/13**

# **There are 5 green 7 red balls. Two balls are selected one by one without replacement. Find the probability that first is green and second is red.**

* 5 green + 7 red = 12 balls
* The probability of selecting a green ball on the first draw: **P(G) = 5/12**
* The probability of selecting a red ball on the second draw: **P(R) = 7/11**
* The probability of selecting the first ball green and then second ball red without replacement:
* P(Probability of selecting green and red) = P(G) \* P(R)
* P(Probability of selecting green and red) = 5/12 \* 7/11
* **P(Probability of selecting green and red) = 35/132**

# **1 card is drawn at random from the pack of 53 cards.**

1. **Find the probability that it is an honor card.**

* Total Cards = 52
* Honor Cards = (Ace, King, Queen, Jacks) x Four Suits
* = 4 x 4
* = 16
* P(A) = 16/52 = 4/13

1. **It is a face card.**

* Total Cards = 52
* Honor Cards = (King, Queen, Jacks) x Four Suits
* = 3 x 4
* = 12
* P(B) = 12/52 = 3/13

# **10% of the bulbs produced in a factory are of red colour and 2% are red and defective. If one bulb is picked up at random, determine the probability of its being defective if it is red.**

* P(A) = 10/100 = 1/10
* P(A n B) = 2/100 = 1/50
* P(B/A) = P(A n B) / P(A)
* P(B/A) = (1/50)/(1/10)
* P(B/A) = 10/50
* P(B/A) = 1/5

# **Two dice are thrown together. Let A be the event ‘getting six on the first dice’ and B be the event ‘getting 2 on the second dice’. Are the events A and B independent.**

* A = {(6,1), (6,2), (6,3), (6,4), (6,5), (6,6)}
* B = {(1,2), (2,2), (3,2), (4,2), (5,2), (6,2)}
* A n B = {(6,2)}
* P(A) = 6/36 = 1/6
* P(B) = 6/36 = 1/6
* P (A n B) = 1/36
* P(A).P(B) = 1/6 \* 1/3 = 1/36
* P(A).P(B) = P(A n B)
* Therefore, A and B are independent events.

# **A committee of 4 students is selected at random from a group consisting 8 boys and 4 girls. Given that there is at least one girl on the committee, calculate the probability that there are exactly 2 girls on the committee.**

* let event of getting at least one girl in committee be A
* A = 1girl + 2girl + 3girl + 4girl
* A =
* A = 12\*11\*10\*9/4\*3\*2 – 8\*7\*6\*5/4\*3\*2
* A = 495-70
* A = 425
* let B be the event of exactly 2 girls in the committee
* B = 4
* B = (4\*3/2) \* (8\*7/2)
* B = 6 \* 28
* B = 168
* P(B/A) = P(B n A)/P(A)
* P(B/A) = 168/425

# **Three machines E1. E2,E3 in a certain factory produce 50% . 25% and 25% respectively of the total daily output of electric tubes. It is known that 4% of the tube produced on each of machines E1. and E2,are defective and that 5% those produced on E3 are defective. If one is picked up at random from a day production, calculate the probability that it is defective.**

* Let A be the event that the tube picked is defective.
* P(E1) = 50% = 50/100 = ½
* P(E2) = 25% = 25/100 = ¼
* P(E3) = 25% = 25/100 = ¼
* P(A|E1) = 4% = 4/100 = 1/25
* P(A|E2) = 4% = 4/100 = 1/25
* P(A|E3) = 5% = 5/100 = 1/20
* P(A) = P(E1)\* P(A|E1) + P(E2)\* P(A|E2) + P(E3) \* P(A|E3)
* P(A) = (1/2 \* 1/25) + (1/4 \* 1/25) +(1/4 \* 1/20)
* P(A) = 1/50 + 1/100 + 1/80
* P(A) = 8+4+5/400 = 17/400

# **Types of Probability**

1. **Classical Probability**

* This is based on the assumption of equally likely outcomes. It is applicable when each outcome in a sample space is equally likely to occur.
* Formula:
* P(A) = Number of favourable outcomes for event A / Total number of possible outcomes

1. **Subjective or Judgement Probability**

* This is based on an individual's judgment, opinions, and beliefs. It is often used in situations where it is difficult or impossible to assign precise probabilities based on data or reasoning.
* Example: Predicting the probability of a sports team winning a game based on personal opinions about the team's performance.

# **Rules of Probability**

1. **Addition Rule of Probability:**

* **For Mutually Exclusive Events:**
* If events A and B are mutually exclusive (meaning they cannot both occur at the same time), then the probability of either event A or event B occurring is the sum of their individual probabilities.
* P(A or B)=P(A)+P(B)
* **For Non-Mutually Exclusive Events:**
* If events A and B are not mutually exclusive, the addition rule is modified to account for the possibility of both events occurring.
* P(A or B)=P(A)+P(B)−P(A and B)

1. **Multiplication Rule of Probability:**

* **For Independent Events:**
* If events A and B are independent (the occurrence of one does not affect the occurrence of the other), the probability of both events A and B occurring is the product of their individual probabilities.
* P(A and B) = P(A n B) = P(A)⋅P(B)
* **For Dependent Events:**
* If events A and B are dependent (the occurrence of one event affects the occurrence of the other), the probability of both events A and B occurring is the product of the probability of A and the probability of B given that A has occurred.
* P(A and B)=P(A)⋅P(B∣A)

# **P(I) = 0.4, the probability of the monetary authority increasing interest rate (I) is 40% P(R/I) = 0.7, probability of recession (R) given an increase rate is 70%. What is the probability of [P(R n I)] join probability of recession and on increasing interest rate.**

* Given P(I) = 0.4, P(R|I) = 0.7
* You can use the conditional probability formula to calculate this:
* P(R∩I) = P(R∣I)⋅P(I)
* P(R∩I) = 0.7 \* 0.4
* P(R∩I) = 0.28 (28%)
* **So, the probability of both a recession and an increase in interest rates is 0.28, or 28%.**

# **Expected Value**

* E[X] = Σpixi
* σi2 = Σpi(x-ΣRx)2
* σi = √ σi2
* *pi*​ is the probability of the ith outcome.
* *xi*​ is the value of the ith outcome.
* Σx = Expected Value (Mean Return)
* σi2 = Varianceof security
* σi = Risk of a security
* Σ*Rx* is the expected valuefrom x
* **Fifteen management graduates cross all hurdles and reach the final phase of a selection process for the recruitment of management trainees by a company. The final phase is an interview and we can gather from past data that, on an average, only 12% of the candidates qualifying for the interview get the job. Determine the following probabilities. (Assume that there is no restriction on the number of management trainees to be recruited).**

1. **What is the Probability that exactly 5 candidates get the job?**
2. **What is the Probability that fewer than four candidates get the job?**