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1. Introduction

- Probability is a branch of mathematics that deals with calculating the likelihood of events occurring.
- Probability helps us measure and predict the chances of events happening in the real world like-



Weather forecasting



Medical Diagnosis



Sports and Games



Airplane Safety

2. What is a Probability?

- Probability is a measure of how likely an event is to occur.
- Probability Rules:
 - Range of Probability $0 \le P(E) \le 1$
 - Sum of Probabilities For all outcomes in S, $\Sigma P(E) = 1$.
 - **Complement Rule** P(not E) = 1 P(E).

For an event E, probability P(E) is calculated as:

P(E) = Total number of possible outcomes
Number of favorable outcomes

Example: A bag contains 3 red marbles, 4 green marbles and 3 blue marbles. If you pick one marble at random, what is the probability that it will be blue?



Solution: Total number of marbles:

```
5 (red) + 3 (blue) + 2 (green) = 10 marbles
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Probability of picking a blue marble:

$$P(E) = \frac{\text{Number of blue marbles}}{\text{Total Number}} = \frac{3}{10}$$

The probability of picking a blue marble is $\frac{3}{10}$

3. What is an Experimental Probability?

- Experimental probability is the probability of an event based on actual experiments or observations.
- It is calculated by dividing the number of times the event occurs by the total number of trials performed.
- Mathematically,

Experimental Probability = Number of times the event occurs Total Number of Trials

Note: Theoretical Probability is calculated without doing an Experiment.

Example: If we flip a coin 10 times and get these results:

- Heads: 6 times
- Tails: 4 times

What is the experimental probability of getting Heads?

Solution:

- Successful outcomes (Heads): 6
- Total flips: 10

P(Heads) = Number of Heads Total Flips

$$P(\text{Heads}) = \frac{6}{10}$$

The experimental probability of getting Heads is $\frac{6}{10}$

4. Key Points

• Experiment: An experiment is any process that produces a well-defined outcome. Examples-



Rolling a die





Tossing a coin

Drawing a card

• Outcome: An outcome is a possible result of an experiment. Example- In a coin toss,

Possible outcomes are Heads (H) or Tails (T).



 Sample Space (S): The sample space is the set of all possible outcomes of an experiment. Example- For a die roll,

S= {1,2,3,4,5,6}



- Events: An event is any subset of the sample space. It can include,
 - **Simple Event:** A single outcome (e.g., **rolling a 3**).
 - Compound Event: Multiple outcomes (e.g., rolling an even number {2,4,6}).

5. Solved Examples

Problem1: A coin is flipped 4 times. It lands on heads 3 times. What is the experimental probability of getting heads?

Solution:

The event is getting heads, where

- Heads occurred 3 times.
- Total number of coin flips = 4.

Using the Experimental Formula,

Experimental Probability = Number of times the event occurs Total Number of Trials

> P(Heads) = Number of Heads Total Flips

$$P(\text{Heads}) = \frac{3}{4}$$

So, the Experimental probability of getting heads is 0.75

Problem2: A bag has 5 red and 3 blue balls. One ball is picked. Find the probability that the ball is not blue.

Solution:

Total Balls = 5 + 3 = 8 Blue balls = 3

Use the complement rule,

P(Not Blue) = 1 – P(Blue)

P(Not Blue) = $1 - \frac{3}{8} = \frac{5}{8}$

$$P(Not Blue) = \frac{5}{8}$$

The probability that the ball is not blue is $\frac{5}{8}$

Problem3: A coin is tossed once. What is the probability of getting a head? **Solution:**

Total possible outcomes = 2 (Head, Tail)

Probability of getting a head:

P(E) = Favorable outcomes Total outcomes

$$P(E) = \frac{1}{2}$$

The probability of getting a head $\frac{1}{2}$