

Probability & Risk Analysis

ਸੰਭਾਵਨਾ (Probability), ਖਤਰੇ ਦਾ ਅੰਦਾਜ਼ਾ (Risk Assessment) ਅਤੇ ਰੋਜ਼ਾਨਾ ਫੈਸਲੇ

1. Understanding Probability & Risk (ਸੰਭਾਵਨਾ ਕੀ ਹੈ?)

Probability measures the likelihood of an event occurring, expressed as a number between **0 (Impossible)** and **1 (Certain)**, or as a percentage (0% to 100%).

CORE PROBABILITY FORMULA

Probability $P(E)$ = Number of Favorable Outcomes / Total Possible Outcomes

Probability of Event NOT Happening = $1 - P(E)$

2. Real-Life Practical Scenarios

Scenario A: Weather Forecast & Carrying an Umbrella (ਮੀਂਹ ਪੈਣ ਦੀ ਸੰਭਾਵਨਾ)

Example: The weather app shows a **70% chance of rain** today. What is the probability that it will NOT rain?

1. Step 1: Convert Percentage to Probability Scale

$$P(\text{Rain}) = 70\% = 0.70$$

2. Step 2: Calculate Probability of No Rain

$$P(\text{No Rain}) = 1 - 0.70 = 0.30 \text{ (or 30\%)}$$



Decision Rule: When $P(\text{Rain}) > 50\%$, the risk of getting wet is high enough to justify carrying an umbrella!

Scenario B: Insurance & Risk Evaluation (ਬੀਮਾ ਅਤੇ ਜੋਖਮ)

Example: A health insurance plan costs **₹10,000/year**. It covers medical costs up to **₹5,000,000**. If the probability of major hospitalization in a year is **2% (0.02)**, what is the expected monetary benefit?

1. Calculate Expected Payout value:

$$\text{Expected Payout} = \text{Probability} \times \text{Coverage} = 0.02 \times ₹5,000,000 = ₹10,000$$

2. Risk Analysis Conclusion:

While the expected payout equals the premium, insurance protects against catastrophic single events that could otherwise cause financial ruin.

3. Everyday Probability Scale Cheatsheet

Probability / Odds	Percentage	Everyday Example	Recommended Action
0.00	0%	Winning a lottery without buying a ticket	Impossible event
0.25 (1 in 4)	25%	Drawing a Spade card from a deck	Low risk / Low chance
0.50 (1 in 2)	50%	Flipping a coin (Heads or Tails)	Equal chance / Unpredictable
0.90 (9 in 10)	90%	Passing an exam after thorough preparation	Highly probable / Safe bet

4. Practical Practice Exercises (ਅਭਿਆਸ ਲਈ ਪ੍ਰਸ਼ਨ)

Q1 Raffle Ticket Odds: A community raffle sells 500 total tickets. If you purchase 10 tickets, what is your probability of winning the grand prize?

Answer: $P(\text{Win}) = 10 / 500 = 1 / 50 = 0.02$ (or 2% chance).

Q2 Quality Control / Product Defect: A factory produces 1,000 bulbs per batch. On average, 25 bulbs are found defective. What is the probability of selecting a non-defective bulb?

Answer: $\text{Non-defective Bulbs} = 1,000 - 25 = 975$. $P(\text{Good}) = 975 / 1,000 = 0.975$ (or 97.5%).

Q3 Traffic Light Signal Risk: A traffic signal stays Red for 45 seconds and Green for 15 seconds in a 60-second total cycle. What is the probability that you will hit a Green light when arriving randomly?

Answer: $P(\text{Green}) = 15 / 60 = 1 / 4 = 0.25$ (or 25% chance).