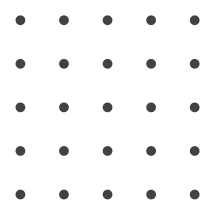




INSTITUTE OF ACTUARIAL
& QUANTITATIVE STUDIES



Probability



In simple terms, probability is a measure of how likely an event is to occur. It's a way to quantify the chance of something happening.

- ✓ Will it ever snow in Mumbai?
- ✓ What are the chances to get a face card on a random shuffle?
- ✓ Will Sundarlal ever return all the borrowed money to Jethalal?
- ✓ What are the chances that adulthood will give you anxiety?
- ✓ What are the chances to win on a roulette placed on an even number?

$$\text{Probability} = \frac{\text{Favorable outcomes}}{\text{Total outcomes}}$$





RISK

Risk refers to a situation where the possible outcomes are known as well as their probabilities



UNCERTAINTY

Uncertainty refers to a situation where the possible outcomes are unknown or their probabilities are not well-defined

➔ **Categorize the previous questions into risk and uncertainty**



RANDOM VARIABLE

A random variable is a numerical outcome of a random phenomenon or experiment. It's a variable whose value is a numerical result of a random event, and its value cannot be determined in advance. For example, rolling a die is a random experiment, and the number showing on the die is a random variable.

The expected value (also called the mean) of a random variable is a weighted average of all possible values that the variable can take, with each value weighted by its probability.

$$E[X] = \sum x_i p(x_i)$$

The variance of a random variable quantifies the spread or dispersion of its possible values around its expected value (mean).

$$\sigma^2 = E[(x - \mu)^2] = \sum (x - \mu)^2 p(x)$$

Where $E(X) = \mu$

INDEPENDENT EVENTS

Two events are independent if the outcome of one does not affect the outcome of the other.

✓ Formula for Independent Events (A and B):

$$P(A \text{ and } B) = P(A) \times P(B)$$

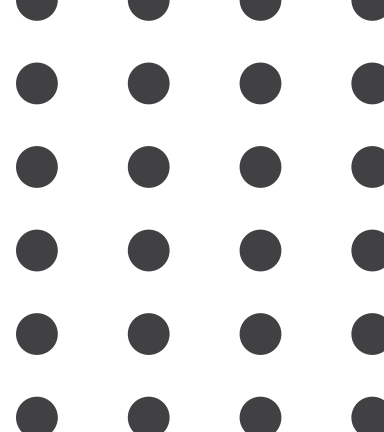
Example:

Tossing a coin: $P(\text{Heads}) = 1/2$

Rolling a 6 on a die: $P(6) = 1/6$

Since these are independent:

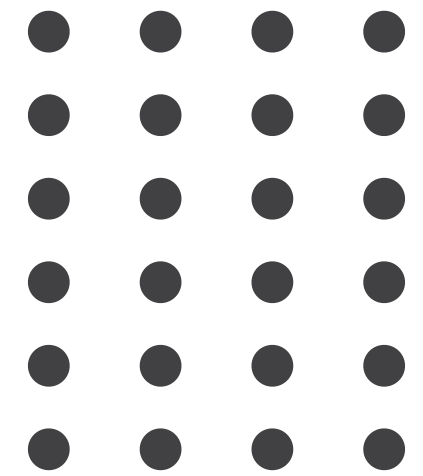
$$P(\text{Heads and } 6) = 1/2 \times 1/6 = 1/12$$



Mean

Mean is a measure of central tendency. Mean is the average of a given set of numbers. It generally gives the expected reward/ profit.

$$\bar{X} = \frac{\sum X}{N}$$



Variance

Variance is a measure of dispersion, meaning it is a measure of how far a set of numbers is spread out from their average value. It is a risk measure. Larger the variance, larger will be the risk.

$$\sigma^2 = \frac{\sum (xi - \bar{x})^2}{N}$$

MEAN-VARIANCE ANALYSIS IS THE PROCESS OF
WEIGHING RISK AGAINST EXPECTED RETURN.

Lets Play a Game

“ROLL UNTIL YOU DIE”
– LIFE EXPECTANCY SIMULATION

