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What is Probability?

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Probability is the measure of the likelihood that an event will occur. It's quantified as a number between 0 and 1:

- **0 means the event will not happen.**
- **1 means the event will certainly happen.**

Key Probability Terms:

1. **Experiment: An action or process that leads to a result (e.g., rolling a die).**
2. **Outcome: The result of an experiment (e.g., getting a 3 when you roll a die).**
3. **Event: A set of one or more outcomes (e.g., rolling an odd number).**
4. **Sample Space (S): The set of all possible outcomes (e.g., for a die: S={1,2,3,4,5,6}S = \{1, 2, 3, 4, 5, 6\}S={1,2,3,4,5,6}).**

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Probability Formula:

The probability of an event AAA is calculated by:

$$P(A) = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes in the sample space}}$$

For example:

If you roll a fair die, what's the probability of getting a 4? $P(4) = \frac{1}{6}$

There's 1 favorable outcome (getting a 4) and 6 possible outcomes in total.

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Basic Probability Rules

Addition Rule: The probability of either of two mutually exclusive events happening is the sum of their individual probabilities.

$$P(A \cup B) = P(A) + P(B)$$

Example:

$$P(2 \cup 5) = P(2) + P(5) = \frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$$

If you roll a die, what is the probability of getting a 2 or a 5?

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Multiplication Rule: The probability of two independent events both happening is the product of their probabilities.

$$P(A \cap B) = P(A) \times P(B)$$

Example:
If you roll a die and flip a coin, what's the probability of getting a 3 on the die and heads on the coin?

$$P(3 \cap \text{heads}) = \frac{1}{6} \times \frac{1}{2} = \frac{1}{12}$$

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Complementary Rule: The probability that an event does not happen is:

$$P(\text{not } A) = 1 - P(A)$$

Example: If the probability of it raining tomorrow is 0.3, the probability of it not raining is:

$$P(\text{not rain}) = 1 - 0.3 = 0.7$$