

3th Week Summary (09/11/25)

- **Probability**

An **experiment** is a process by which a measurement is taken or observations is made

An **outcome** is the result of an experiment

Sample space is a listing of possible outcomes

An **event** A is an outcome or a combination of outcomes.

- **Different type of Probability**

Subjective, Empirical (experimental) and Theoretical

- **Tree Diagram**

- **Properties of Probability**

A probability is always a numerical value between zero and one: $0 \leq P(A) \leq 1$

The sum of probabilities for all *outcomes* of an experiment is equal to exactly one: $\sum_{\text{all}} P(A) = 1$

- **Law of large numbers:** As the number of times an experiment is repeated increases, the ratio of the number of successful occurrences to the number of trials will tend to approach the theoretical probability of the outcome for an individual trial.

- **Odds:** If the odds in favor of an event A are $(a : b)$, then $P(A) = \frac{a}{a + b}$

- **Conditional probability:** $P(A|B)$ is “probability of A happening, knowing B has already occurred”

- **Rules of probability**

Complement Rule: $P(\bar{A}) = 1 - P(A)$

General Addition Rule: $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

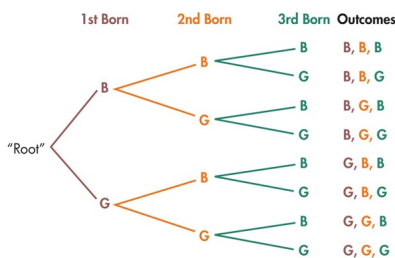
General Multiplication Rule: $P(A \text{ and } B) = P(A) \cdot P(B|A) = P(B) \cdot P(A|B)$

- **Mutually exclusive events:** $P(A \text{ and } B) = 0$

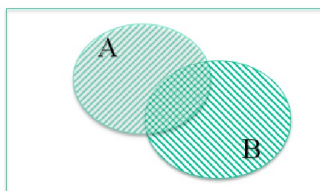
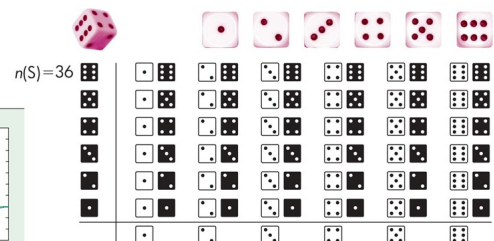
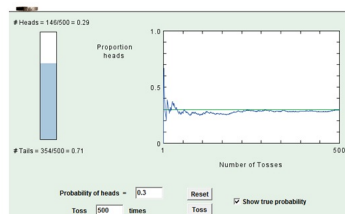
Special Addition Rule: $P(A \text{ or } B \text{ or } C \text{ or } \dots \text{ or } E) = P(A) + P(B) + P(C) + \dots + P(E)$

- **Independent events:** $P(A) = P(A|B)$, or equivalently: $P(A \text{ and } B) = P(A) \cdot P(B)$

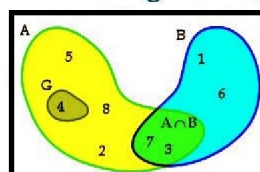
Special Multiplication Rule: $P(A \text{ and } B \text{ and } C \text{ and } \dots \text{ and } E) = P(A) \cdot P(B) \cdot P(C) \cdot \dots \cdot P(E)$



$S = \{(B, B, B), (B, B, G), (B, G, B), (B, G, G), (G, B, B), (G, B, G), (G, G, B), (G, G, G)\}$
 $n(S) = 8$, the 8 branches



Venn Diagram set operations



$A = \{5, 8, 2, 4, 7, 3\}$
 $B = \{1, 6, 7, 3\}$
 $G = \{4\}$
 $A \cap B = \{7, 3\}$
 $A \cup B = \{1, 2, 3, 4, 5, 6, 7, 8\}$
 $G \cap B = \emptyset$

