

Probability

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Three Axioms of Probability

1. $0 \leq P(A) \leq 1$ for any event A .
2. $P(\Omega) = 1$ (Ω : sample space).
3. A_1, A_2, \dots are mutually exclusive events $\Rightarrow P(A_1 \cup A_2 \cup \dots) = P(A_1) + P(A_2) + \dots$.
> mutually exclusive: $A_i \cap A_j = \emptyset$ for $i \neq j$.

Derived from three axioms

- $P(\emptyset) = 0$ Empty set
- $P(A) + P(\bar{A}) = 1$: Complement
- $P(A) = P(A - B) + P(A \cap B)$: DeMorgan's Law
- $P(A \cup B) = P(A) + P(B) - P(A \cap B)$: Union and Intersection
- If $A \subseteq B \Rightarrow P(A) \leq P(B)$: Inclusion-Exclusion Principle
- Bool's Inequality: $P(A \cup B) \leq P(A) + P(B)$
- Bonferroni's Inequality: $P(A \cap B) \geq P(A) + P(B) - 1$ (not sure)