

Stat 140: Rules for Probabilities

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Probability (Chapters 13 and 14)

General Terminology

1. Trial: a single attempt or realization of a random phenomenon
2. Outcome: an observed value in a trial
3. Event: A set of possible outcomes. Use letters like A , B , C
4. Sample Space: The set of all possible outcomes. Use S .
5. Complement: The complement of the event A is the set of all possible outcomes *not* in A . Use A^C .
6. Disjoint Events: have no outcomes in common

Law of Large Numbers

As we increase the number of trials, the relative frequency of an event's occurrence *approaches* the true relative frequency.

Probability Definitions and Rules

Let A and B be events, and let S be the sample space.

1. $0 \leq P(A) \leq 1$
2. $P(S) = 1$
3. $P(A^c) = 1 - P(A)$
4. $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
5. If A and B are disjoint events, then $P(A \text{ or } B) = P(A) + P(B)$.
6. Conditional Probability of B given A : $P(B|A) = \frac{P(B \text{ and } A)}{P(A)}$
7. A and B are **independent** if (and only if) $P(B|A) = P(B)$, or turning that around, $P(A|B) = P(A)$.
8. $P(A \text{ and } B) = P(A) \times P(B|A) = P(B) \times P(A|B)$
9. If A and B are **independent** events, then $P(A \text{ and } B) = P(A) \times P(B)$.
10. Bayes' Rule: $P(A|B) = \frac{P(B|A)P(A)}{P(B|A)P(A) + P(B|A^c)P(A^c)}$