

Lecture Slides



Essentials of Statistics 5th Edition

and the Triola Statistics Series

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Chapter 4

Probability

4-1 Review and Preview

4-2 Basic Concepts of Probability

4-3 Addition Rule

4-4 Multiplication Rule: Basics

4-5 Multiplication Rule: Complements and Conditional Probability

4-6 Counting

4-7 Probabilities Through Simulations

4-8 Bayes' Theorem

Key Concept

This section presents the **addition rule** as a device for finding probabilities that can be expressed as $P(A \text{ or } B)$, the probability that either event A occurs or event B occurs (or they both occur) as the single outcome of the procedure.

The key word in this section is “or.” It is the *inclusive or*, which means either one or the other or both.

Compound Event

Compound Event

any event combining 2 or more simple events

Notation

$P(A \text{ or } B) = P(\text{in a single trial, event } A \text{ occurs or event } B \text{ occurs or they both occur})$

General Rule for a Compound Event

When finding the probability that event A occurs or event B occurs, find the total number of ways A can occur and the number of ways B can occur, but **find that total in such a way that no outcome is counted more than once.**

Compound Event

Formal Addition Rule

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

where $P(A \text{ and } B)$ denotes the probability that A and B both occur at the same time as an outcome in a trial of a procedure.

Compound Event

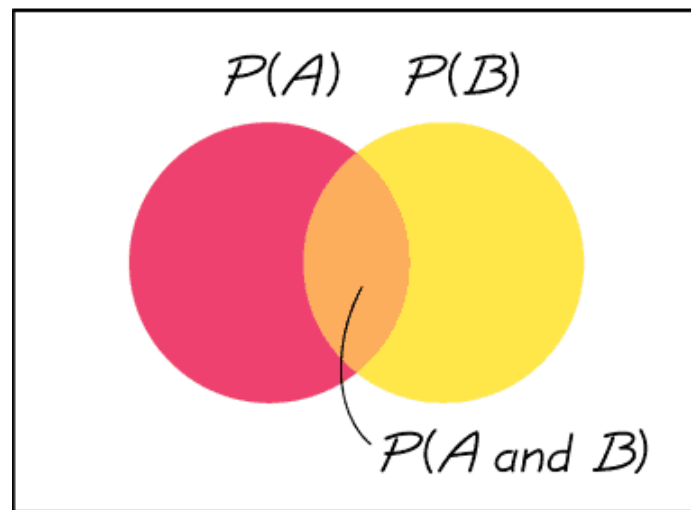
Intuitive Addition Rule

To find $P(A \text{ or } B)$, find the sum of the number of ways event A can occur and the number of ways event B can occur, adding in such a way that every outcome is counted only once. $P(A \text{ or } B)$ is equal to that sum, divided by the total number of outcomes in the sample space.

Disjoint or Mutually Exclusive

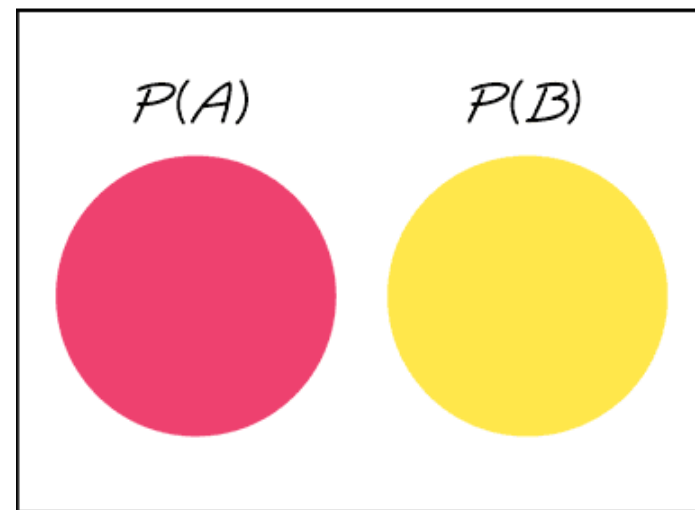
Events A and B are **disjoint** (or **mutually exclusive**) if they cannot occur at the same time. (That is, disjoint events do not overlap.)

Total Area = 1



Venn Diagram for Events That Are Not Disjoint

Total Area = 1



Venn Diagram for Disjoint Events

Complementary Events

A and \bar{A} must be disjoint.

It is impossible for an event and its complement to occur at the same time.

Rule of Complementary Events

$$P(A) + P(\bar{A}) = 1$$

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

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

Venn Diagram for the Complement of Event A

Total Area = 1

