

Chapter 3

Probability

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- 3-1 Overview
- 3-2 Fundamentals
- 3-3 Addition Rule
- 3-4 Multiplication Rule: Basics

Overview

Objectives

- ❖ develop sound understanding of probability values used in subsequent chapters
- ❖ develop basic skills necessary to solve probability values in a variety of circumstances

Overview

Rare Event Rule for Inferential Statistics:

If, under a given assumption, the probability of a particular observed event is extremely small, we conclude that the assumption is probably not correct.

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If, under a given assumption (the lottery is fair), the probability of a particular observed event is extremely small (winning lottery five times in a row), we conclude that the assumption is probably not correct.

3-2 Fundamentals Definitions

- ❖ Event - any collection of results or outcomes from some procedure
- ❖ Simple event - any outcome or event that cannot be broken down into simpler components
- ❖ Sample space - all possible *simple* events

Notation

P - denotes a probability

A, B, ... - denote specific events

P (A) - denotes the probability of event A occurring

Basic Rules for Computing Probability

Rule 1: Relative Frequency Approximation

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$$P(A) \approx \frac{\text{number of times A occurred}}{\text{number of times trial was repeated}}$$

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Rule 2: Classical approach

(requires equally likely outcomes)

If a procedure has n different simple events, each with an equal chance of occurring, and event A can occur in s of these ways, then

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$$P(A) = \frac{s}{n} = \frac{\text{number of ways A can occur}}{\text{number of different simple events}}$$

Basic Rules for Computing Probability

Rule 3: Subjective Probabilities

$P(A)$, the probability of A, is found by simply guessing or estimating its value based on knowledge of the relevant circumstances.

Rule 1

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Rule 2

The classical approach is the actual probability.

Law of Large Numbers

As a procedure is repeated again and again, the relative frequency probability (from Rule 1) of an event tends to approach the actual probability.

Possible Values for Probabilities

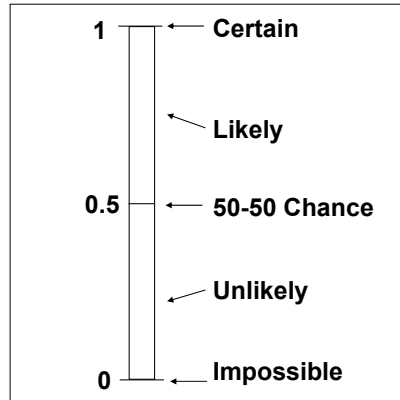


Figure 3-2

Possible Values for Probabilities

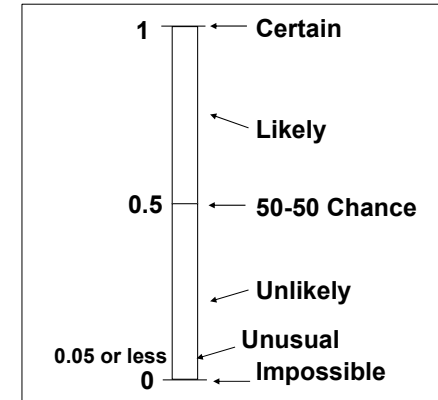


Figure 3-2

Complementary Events

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$P(A)$

$P(\bar{A})$
(read "not A")

Example: Testing Corvettes

The General Motors Corporation wants to conduct a test of a new model of Corvette. A pool of 50 drivers has been recruited, 20 of whom are men. When the first person is selected from this pool, what is the probability of *not* getting a male driver?

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Because 20 of the 50 subjects are men, it follows that 30 of the 50 subjects are women so,

$$\begin{aligned} P(\text{not selecting a man}) &= P(\overline{\text{man}}) \\ &= P(\text{woman}) \\ &= \frac{30}{50} = 0.6 \end{aligned}$$