

Discrete probability distributions

Chapter 5

- Section 5-1: Introduction
- Section 5-2: Probability Distributions
- Section 5-3: Mean, Variance, Standard Deviation and Expectation
- Section 5-4: The Binomial Distribution
- Section 5-6: Summary

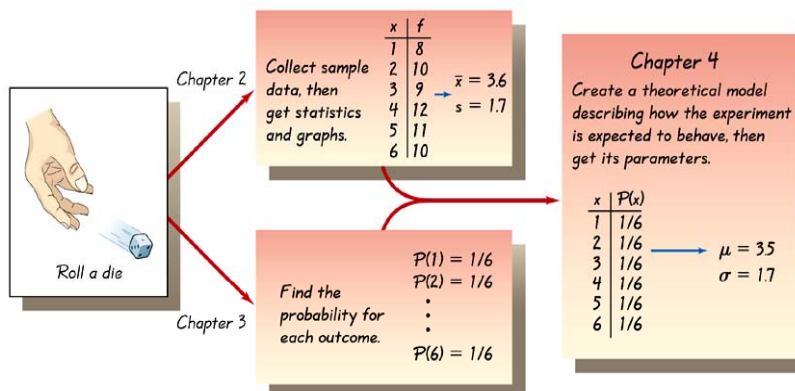
Outline

- This chapter will deal with the construction of discrete probability distributions by combining methods of descriptive statistics from Chapters 2 and 3 and those of probability presented in Chapter 4.
- A probability distribution, in general, will describe what will probably happen instead of what actually did happen

Overview

Combining Descriptive Methods and Probabilities

In this chapter we will construct probability distributions by presenting possible outcomes along with the relative frequencies we *expect*.



- Many decisions in business, insurance, and other real-life situations are made by assigning probabilities to all possible outcomes pertaining to the situation and then evaluating the results
 - Saleswoman can compute probability that she will make 0, 1, 2, or 3 or more sales in a single day. Then, she would be able to compute the average number of sales she makes per week, and if she is working on commission, she will be able to approximate her weekly income over a period of time.

Why do we need probability distributions?

Section 5-2 Probability Distributions

Objective: Construct a probability distribution for a random variable

- A **random variable** is a variable whose values are determined by chance
 - Typically assumes values of $0, 1, 2, \dots, n$
- 4 step process
 - Chance Experiment which leads to
 - Sample Space which leads to
 - Definition of a Random Variable which leads to
 - A Probability Distribution

Random Variable and Probability Distributions

Discrete Variables (Data)— Chapter 5

- Can be assigned values such as 0, 1, 2, 3
- "Countable"
- Examples:
 - Number of children
 - Number of credit cards
 - Number of calls received by switchboard
 - Number of students

Continuous Variables (Data)---Chapter 6

- Can assume an infinite number of values between any two specific values
- Obtained by measuring
- Often include fractions and decimals
- Examples:
 - Temperature
 - Height
 - Weight
 - Time

Remember

- Consists of the values a random variable can assume and the corresponding probabilities of the values.
- The probabilities are determined theoretically or by observation
- Can be shown by using a graph (probability histogram), table, or formula
- **Two requirements:**
 - The sum of the probabilities of all the events in the sample space must equal 1; that is, $\sum P(x) = 1$
 - The probability of each event in the sample space must be between or equal to 0 and 1. That is, $0 \leq P(x) \leq 1$

Discrete Probability Distribution

Example: Determine whether the distribution represents a probability distribution. If it does not, state why.

| | | | | | |
|----------|----------|----------|----------|----------|----------|
| x | 1 | 2 | 3 | 4 | 5 |
| P(x) | 0.3 | 0.1 | 0.1 | 0.2 | 0.3 |

| | | | | |
|----------|----------|----------|----------|-----------|
| x | 3 | 6 | 8 | 12 |
| P(x) | 0.3 | 0.5 | 0.7 | -0.8 |

- Based on past results found in the Information Please Almanac, there is a 0.1818 probability that a baseball World Series contest will last four games, a 0.2121 probability it will last five games, a 0.2323 probability that it will last six games, and a 0.3737 probability that it will last seven games.
- In a study of brand recognition of Sony, groups of four consumers are interviewed. If x is the number of people in the group who recognize the Sony brand name, then x can be 0, 1, 2, 3, or 4 and the corresponding probabilities are 0.0016, 0.0564, 0.1432, 0.3892, and 0.4096

Example: Construct a probability distribution for the data