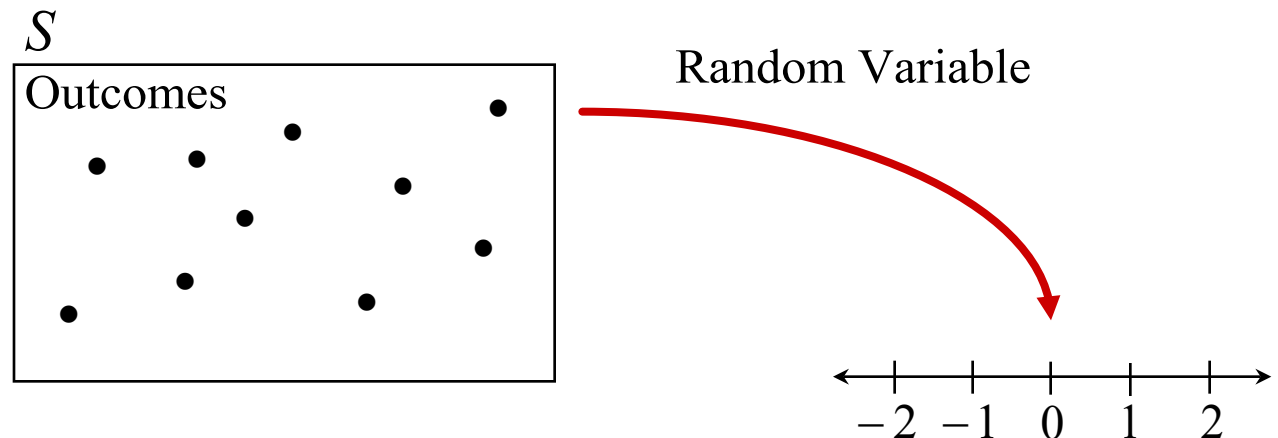


Random Variable

Random Variable: A variable that assumes a unique numerical value for each of the outcomes in the sample space of a random phenomenon.

Notes:

- Used to denote the outcomes of a random phenomenon
- Each outcome in the sample space is assigned to a unique value
- Illustration:



Discrete & Continuous Random Variables

Discrete Random Variable: A random variable that can assume only a countable number of values

- Intuitively, a discrete random variable can assume values corresponding to isolated points along a line interval. That is, there is a “gap” between any two values.

Continuous Random Variable: A random variable that can assume any real value over an interval.

- Intuitively, a continuous random variable can assume any value along a line interval, including every possible value between any two values

Examples of Random Variables

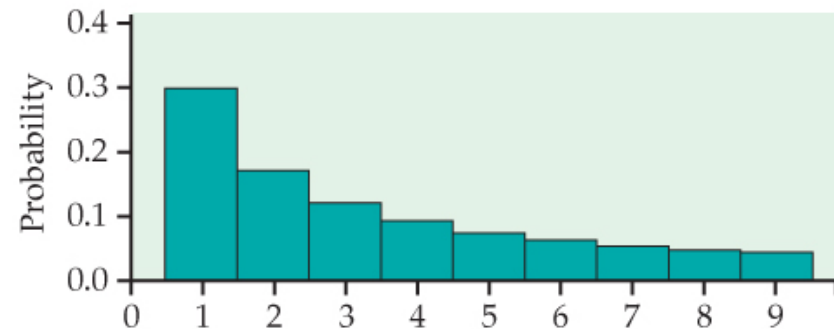
1. Let the number of computers sold per day by a local merchant be a random variable. Integer values ranging from zero to about 50 are possible values.
2. Let the number of pages in a mystery novel at a bookstore be a random variable. The smallest number of pages is 125 while the largest number of pages is 547.
3. Let the time it takes an employee to get to work be a random variable. Possible values are 15 minutes to over 2 hours.
4. Let the volume of water used by a household during a month be a random variable. Amounts range up to several thousand gallons.
5. Let the number of defective components in a shipment of 1000 be a random variable. Values range from 0 to 1000.

Probability Distribution

Discrete Random Variable

- The distribution of a discrete random variable X identifies all possible values x_1, x_2, \dots and its associated probabilities p_1, p_2, \dots
- A distribution can be described as either a table, graph or formula.

Value of X	x_1	x_2	x_3	\dots
Probability	p_1	p_2	p_3	\dots



$$P(X = x_i) = \frac{1}{n} \quad i=1 \dots n$$

Probability Distribution

Discrete Random Variable

- The probabilities p_i , must satisfy two requirements:
 1. Every probability p_i is a number between 0 and 1.
 2. $p_1 + p_2 + \dots = 1$
- Probability distributions can be used to find probabilities of events such as:

$$P(X = x_2) = p_2$$
$$P(X \leq x_3) = p_1 + p_2 + p_3$$

- Commonly used probability distributions have names such as binomial, geometric, Poisson etc.

Coin Tosses

- Toss a coin four times
- Define the random variable:

X = Number of heads observed

- In a previous example we looked at an event:

A = Two heads are observed

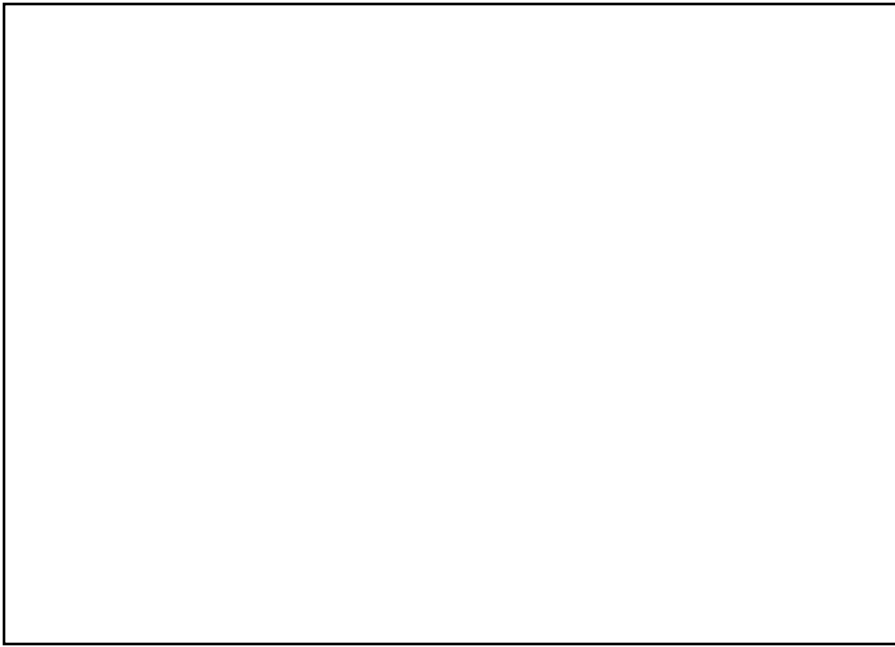
$$P(A) = P(X=2)$$

- Note the difference between the event (A) and the random variable X .



Coin Tosses

Sample Space



Probability Distribution

[illegible]

Discrete Random Variable

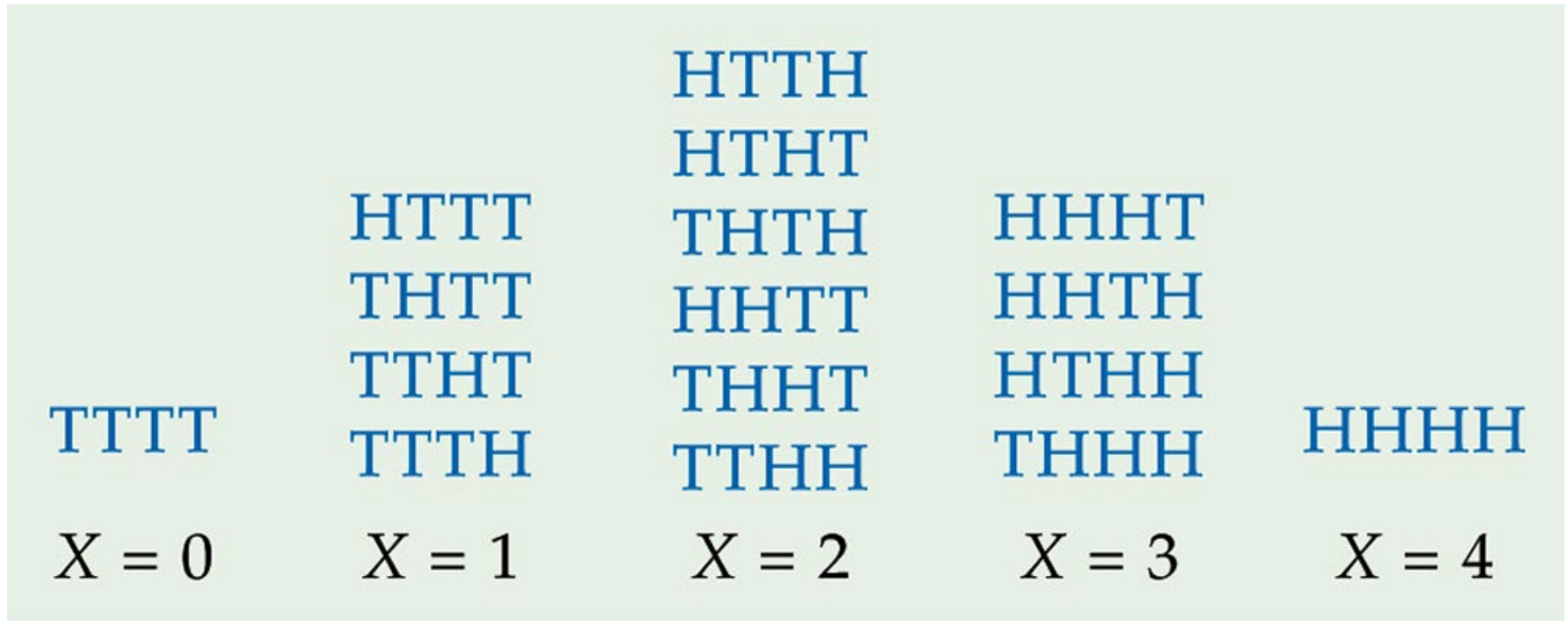


Figure 4.6

Introduction to the Practice of Statistics, Sixth Edition

© 2009 W.H. Freeman and Company

Discrete Random Variable

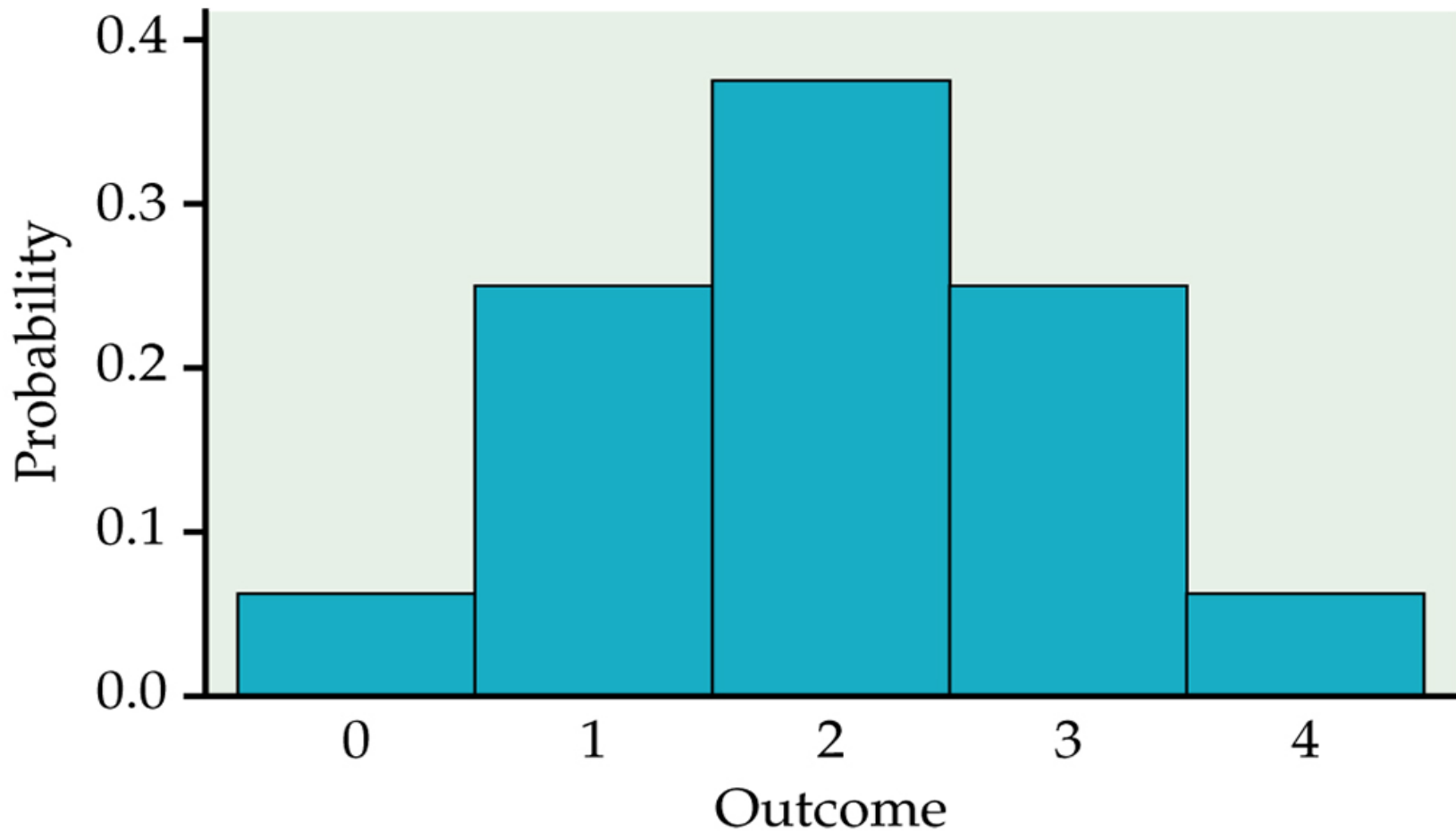


Figure 4.7

Introduction to the Practice of Statistics, Sixth Edition

© 2009 W.H. Freeman and Company