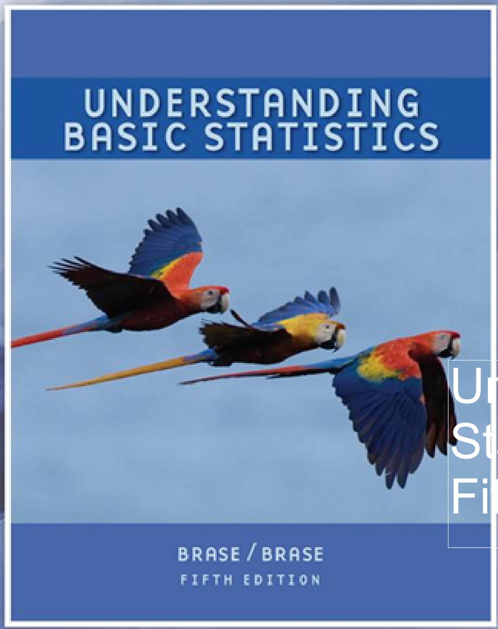

Chapter 6

The Binomial Probability Distribution and Related Topics

Understanding Basic Statistics
Fifth Edition

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Statistical Experiments and Random Variables

- Statistical Experiments – any process by which measurements are obtained.
- A quantitative variable, *x*, is a random variable if its value is determined by the outcome of a random experiment.
- Random variables can be discrete or continuous.

Discrete 12

continuous $8.47

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Random Variables and Their Probability Distributions

- Discrete random variables – can take on only a countable or finite number of values.
- Ex: Whole Numbers
- Continuous random variables – can take on countless values in an interval on the real line
- Ex: Decimals, fractions.
- Probability distributions of random variables – An assignment of probabilities to the specific values or a range of values for a random variable.

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Random Variables and Their Probability Distributions

Which measurement involves a discrete random variable?

1 Answer?

a). Determine the mass of a randomly-selected penny

b). Assess customer satisfaction rated from 1 (completely satisfied) to 5 (completely dissatisfied).

c). Find the rate of occurrence of a genetic disorder in a given sample of persons.

d). Measure the percentage of light bulbs with lifetimes less than 400 hours.

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Discrete Probability Distributions

- Each value of the random variable has an assigned probability.
- The sum of all the assigned probabilities must equal 1.

	x	$P(x)$
1	14	$\frac{14}{23}$
2	7	$\frac{7}{23}$
3	2	$\frac{2}{23}$

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Probability Distribution Features

- Since a probability distribution can be thought of as a relative-frequency distribution for a very large *n*, we can find the mean and the standard deviation.
- Ex: $\bar{x}$ = Mean s = standard deviation
- When viewing the distribution in terms of the population, use *μ* for the mean and *σ* for the standard deviation.

μ = mean σ = standard deviation

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Means and Standard Deviations for Discrete Probability Distributions

The **mean** and the **standard deviation of a discrete population probability distribution** are found by using these formulas:

$\mu = \Sigma x P(x)$; μ is called the **expected value** of x

$\sigma = \sqrt{\Sigma(x - \mu)^2 P(x)}$ is called the standard deviation of x

where x is the value of a random variable,
$P(x)$ is the probability of that variable, and
the sum Σ is taken for all the values of the random variable.

Note: μ is the *population mean* and σ is the underlying *population standard deviation* because the sum Σ is taken over *all* values of the random variable (i.e., the entire sample space).

x	$P(x)$	$x \cdot P(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 \cdot P(x)$
		Σ = mean			$\Sigma = \sqrt{\text{Variance}}$

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