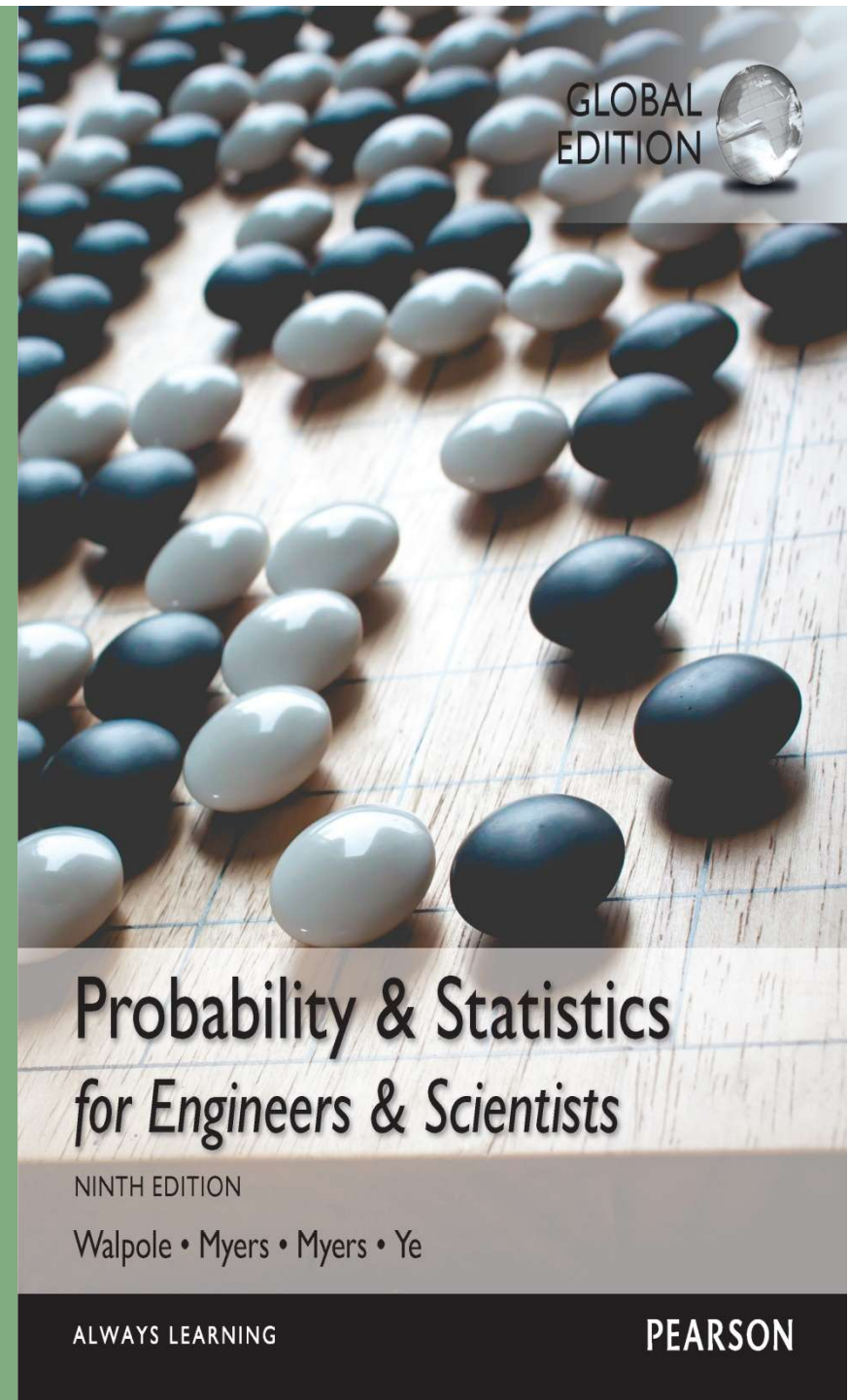


# Chapter 8

## Fundamental Sampling Distributions and Data Descriptions

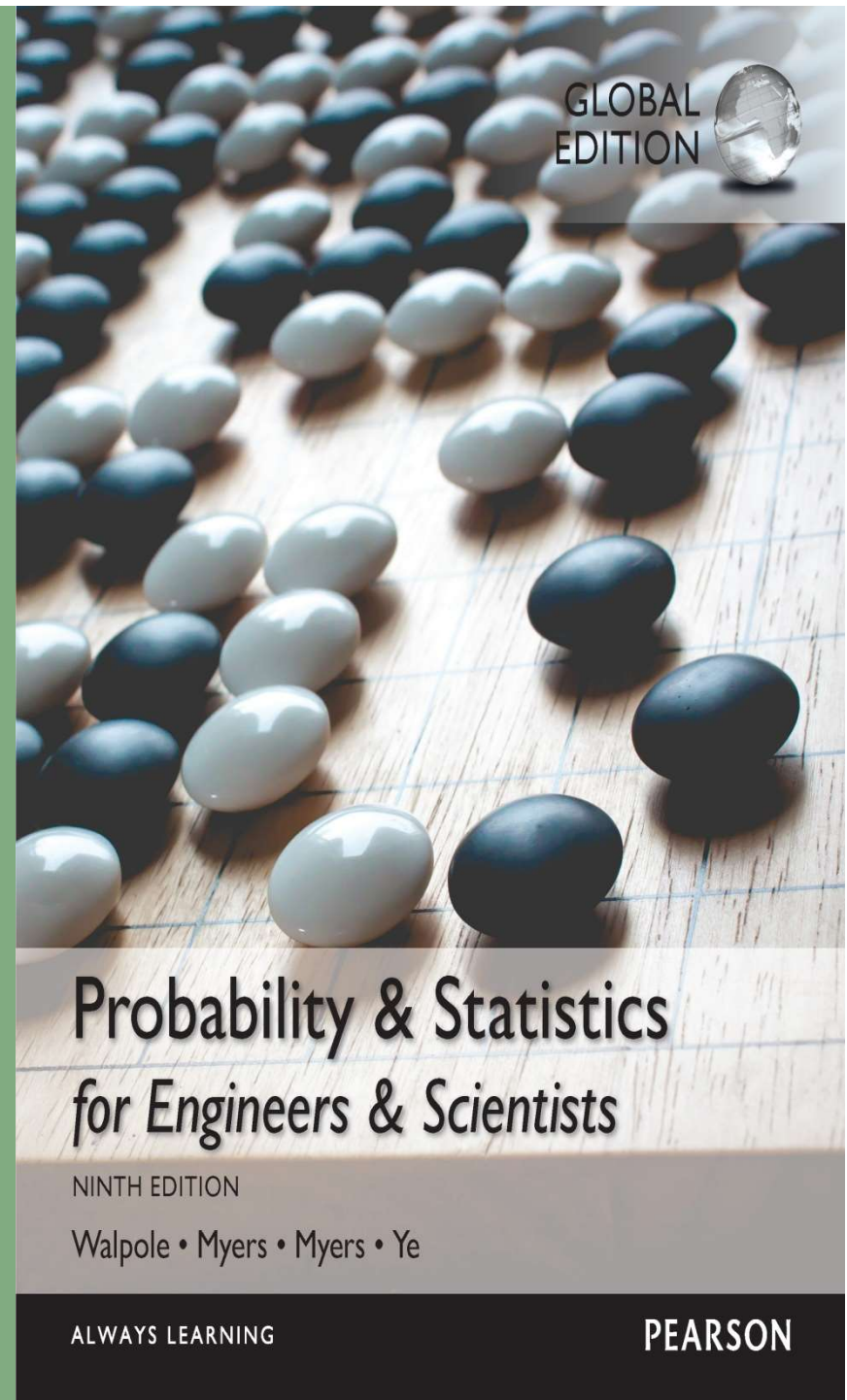
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# Section 8.3

## Sampling Distributions

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# Definition 8.1



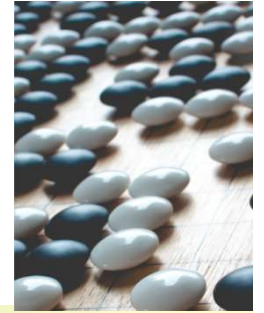
A **population** consists of the totality of the observations with which we are concerned.

# Definition 8.2



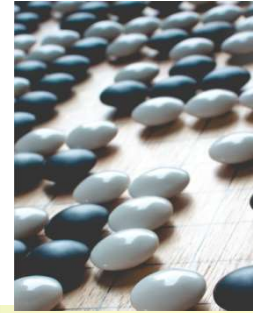
A **sample** is a subset of a population.

# Definition 8.4



Any function of the random variables constituting a random sample is called a **statistic**.

# Definition 8.5



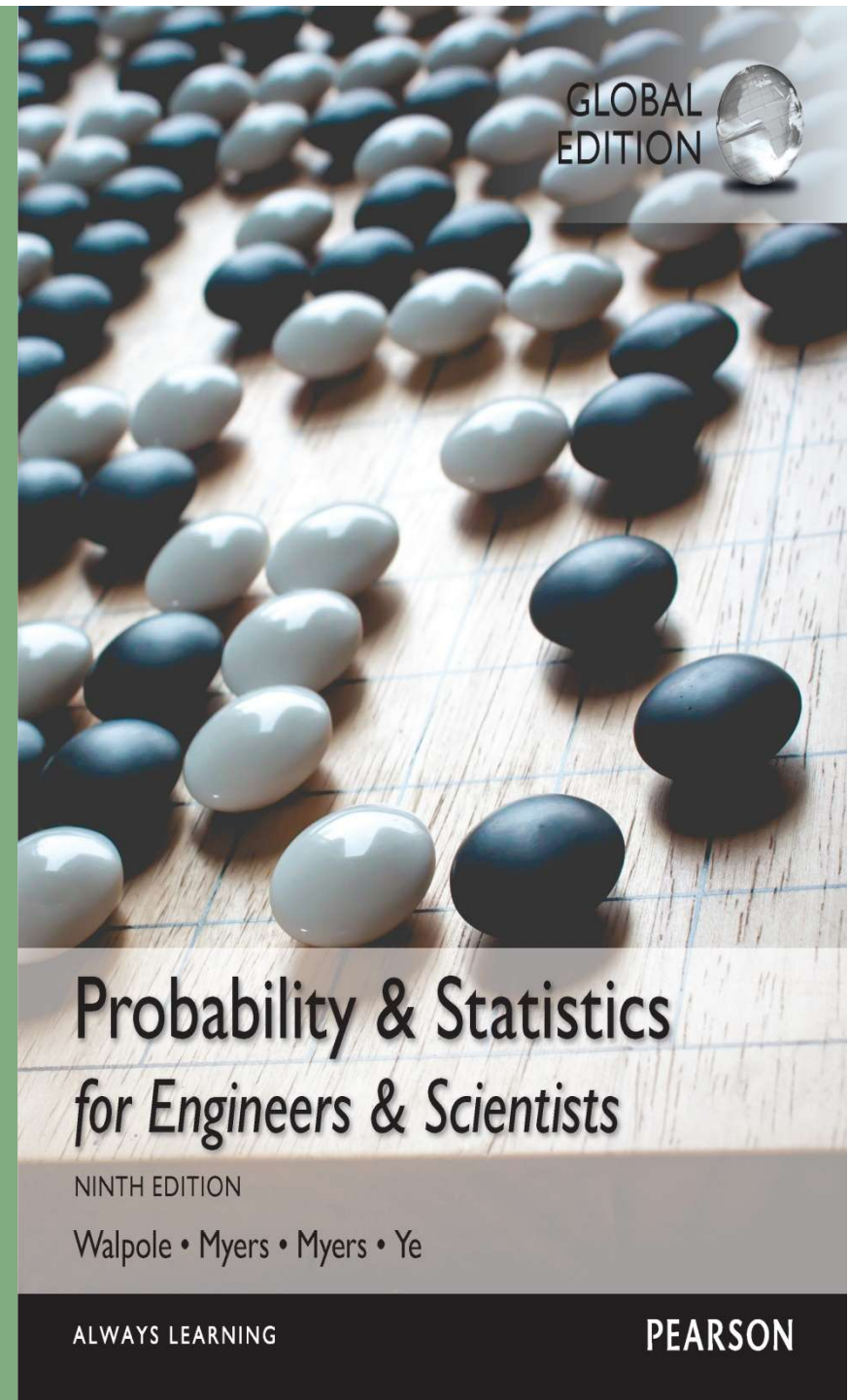
The probability distribution of a statistic is called a **sampling distribution**.



# Section 8.4

## Sampling Distribution of Means and the Central Limit Theorem

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# Theorem 8.2



**Central Limit Theorem:** If  $\bar{X}$  is the mean of a random sample of size  $n$  taken from a population with mean  $\mu$  and finite variance  $\sigma^2$ , then the limiting form of the distribution of

$$Z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}},$$

as  $n \rightarrow \infty$ , is the standard normal distribution  $n(z; 0, 1)$ .





**Example 8.4:** An electrical firm manufactures light bulbs that have a length of life that is approximately normally distributed, with mean equal to 800 hours and a standard deviation of 40 hours. Find the probability that a random sample of 16 bulbs will have an average life of less than 775 hours.



**Example 8.5:** Traveling between two campuses of a university in a city via shuttle bus takes, on average, 28 minutes with a standard deviation of 5 minutes. In a given week, a bus transported passengers 40 times. What is the probability that the average transport time was more than 30 minutes? Assume the mean time is measured to the nearest minute.