# Chapter 11 Sampling Distributions
# Key Ideas

- **Parameter:** numerical fact about the population
- **Statistics:** numerical fact about the sample
- **Sampling variability**: the fact that a statistic will vary from sample to sample
- **Sampling distribution**: the distribution of values taken by a statistic (e.g., sample mean $\overline{x}$) in all possible samples of the same size from the same population.

## THE BIG FOUR!

### 1. LAW OF LARGE NUMBERS

Draw observations at random from any population with finite mean $\mu$. As the number of observations drawn increases, the mean $\bar{x}$ of the observed values gets closer and closer to the mean $\mu$ of the population.

Note: The following result holds **whether or not the population distribution is Normal.**

**2. MEAN AND STANDARD DEVIATION OF $\bar{x}$**

Let $\bar{x}$ represent the mean of an SRS of size *n* drawn from a *large* population with mean $\mu$ and standard deviation $\sigma$. Then:

- The **mean** of $\bar{x}$ is $\mu$
- The **standard deviation** of $\bar{x}$ is $\frac{\sigma}{\sqrt{n}}$.

Note: The following result holds **if the population distribution is Normal.**

**3. SAMPLING DISTRIBUTION OF $\bar{x}$**

Suppose a population has the $N(\mu,\sigma)$ distribution. Let $\bar{x}$ represent the sample mean of *n* independent observations. Then:

- **The mean** of $\bar{x}$ is $\mu$
- **The standard deviation** of $\bar{x}$ is $\frac{\sigma}{\sqrt{n}}$
- The sampling distribution of $\bar{x}$ is Normal.

Note: The following result holds **<u>whether or not</u> the population distribution is Normal.**

**4. CENTRAL LIMIT THEOREM**

Suppose a population has mean $\mu$ and finite standard deviation $\sigma$. Let $\bar{x}$ represent the sample mean of an SRS of size *n* from this population. *If n is large*, then:

- **The mean** of $\bar{x}$ is $\mu$
- **The standard deviation** of $\bar{x}$ is $\frac{\sigma}{\sqrt{n}}$
- The sampling distribution of $\bar{x}$ is **approximately** normal.