Outline

1. Fix a population, a sample size \( n \), and a quantitative variable \( x \). The quantitative variable has a mean \( \mu \) and a standard deviation \( \sigma \).

2. The sampling distribution of \( \bar{x} \) has the following properties:
   (a) mean \( \mu \) \( (\mu_{\bar{x}} = \mu_x) \)
   (b) standard deviation \( \sigma / \sqrt{n} \) \( (\sigma_{\bar{x}} = \sigma_x / \sqrt{n}) \)
   (c) approximately normal (if \( n \) is large or the distribution of the population variable \( x \) is approximately normal).

3. Some examples:
   (a) IQ Test: \( \mu = 100 \quad \sigma = 15 \)

   (b) SAT Math: \( \mu = 500 \quad \sigma = 110 \)

   (c) Raisin Bran boxes: \( \mu = 11 \quad \sigma = .2 \)

   (d) US Counties: \( \mu = 89,596 \quad \sigma = 292,462 \)

   (e) GPA of Calvin seniors: \( \mu = 3.3 \quad \sigma = .45 \)

4. Two important notes:
   (a) 2(b) above is only true if the population is large relative to the sample size.
   (b) If the population variable is exactly normal, then the sampling distribution of \( \bar{x} \) is exactly normal.