

7.3 Sample Means

- ✓ FIND the mean and standard deviation of the sampling distribution of a sample mean. CHECK the 10% condition before calculating the standard deviation of a sample mean.
- ✓ EXPLAIN how the shape of the sampling distribution of a sample mean is affected by the shape of the population distribution and the sample size.
- ✓ If appropriate, use a Normal distribution to CALCULATE probabilities involving sample means.

The Sampling Distribution of \bar{x}

Suppose that \bar{x} is the mean of an SRS of size n drawn from a large population with mean μ and standard deviation σ . Then:

The mean of the sampling distribution of \bar{x} is $\mu_{\bar{x}} = \mu$ $\mu_{\bar{x}} = \mu$

The standard deviation of the sampling distribution of \bar{x} is

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} \quad \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

as long as the 10% condition is satisfied: $n \leq (1/10)N$. Independent

50. $\mu = 40.125$ $\mu = .002$
 $4 \leq \frac{1}{10}(\text{All kids})$
 Find $\mu_{\bar{x}} = 40.125$ $\sigma_{\bar{x}} = \frac{.002}{\sqrt{9}} = .001$

The Central Limit Theorem

Most population distributions are not Normal.

It is a remarkable fact that as the sample size increases, the distribution of sample means changes its shape: it looks less like that of the population and more like a Normal distribution!

When the sample is large enough, the distribution of sample means is very close to Normal, no matter what shape the population distribution has, as long as the population has a finite standard deviation.

The Central Limit Theorem

If the population distribution is Normal, then so is the sampling distribution of \bar{x} . This is true no matter what the sample size n is.

If the population distribution is not Normal, the central limit theorem tells us that the sampling distribution of \bar{x} will be approximately Normal in most cases if $n \geq 30$.

64. $\mu = 1.6$ $\sigma = 1.2$

$n = 200$

Conditions: SRS - stated
 Independent - 10% condition $200 \leq \frac{1}{10}(\text{All Carpet})$ yes
 Normal - CLT $n \geq 30$ yes

Find $P(x \geq 1.8)$

$\text{Normalcdf}(1.8, 99, 1.6, 1.2/\sqrt{200}) = .009$