Section 6.3

6.3 Estimating a Population Mean

In order to estimate the population mean the following <u>assumptions</u> must be true:

1) The sample is a simple random sample.

2) The value of the population std dev σ is known.

3) The population is normally distributed and/or n>30 (the sample size is greater than 30).

① SRS
② σ known
③ $n > 30$ and/or normal

p.327

**It doesn't make sense that we'd know the std dev but not the mean b/c you find the std dev based on the mean. But, we are going to find the mean to help us develop other skills.

The sample mean $\bar{x}$ is the best point estimate of the population mean.

Just as the population proportion p, has confidence intervals and a margin of error, so does the population mean .

$\bar{X}$: mean of sample

Definition

Margin of Error

based on known std dev σ

$$E = z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$$

Round E to nearest hundreth

$$\bar{x} - E < \mu < \bar{x} + E$$

Confidence Interval (or Interval Estimate) for Population Mean μ when σ is known

$$\boxed{\bar{x} - E < \mu < \bar{x} + E}$$

or

$$\bar{x} \pm E$$

or

$$\boxed{(\bar{x} - E, \bar{x} + E)}$$

confidence interval limits

For a simple random sample, $n = 210$, $\bar{x} = 35$ and $\sigma = 1.2$

Using a .95 confidence level, find

a) the margin of error E

b) the confidence interval for

a.) $E = Z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$

$= 1.96 \cdot \frac{1.2}{\sqrt{210}}$

$E = .16$

b.) $34.84 < \mu < 35.16$

heights of women $\bar{x} = 64.7$ $\sigma = 2.5$ $n = 142$

94% confidence

mean of sample

population st. dev.

$$E = z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$$

$$E = 1.88 \cdot \frac{2.5}{\sqrt{142}}$$

$$E = .39$$

$$\bar{x} - E < \mu < \bar{x} + E$$

$$64.31 < \mu < 65.09$$

I am 94% confident that the true mean of heights of women is between 64.31 and 65.09.

Determining the
Sample Size for Estimating Mean μ

$$n = \left[\frac{(z_{\alpha/2}) \cdot \sigma}{E}\right]^2$$ Formula 6-5

If n is not a whole number, round n up to the next larger whole number.

Use the given margin of error, confidence level, and population std dev to find the minimum sample size required to estimate an unknown population mean.

Margin of error: $2.50;

confidence level: 98%;

σ =$8.35

$$n = \left(\frac{Z_{\alpha/2} \cdot \sigma}{E}\right)^2$$

$$n = \left(\frac{2.33 \cdot 8.35}{2.50}\right)^2 = 61$$