

# Math 373 Hw 13 Worked examples and comments.

Hw 282: 8.3', 8.5', 8.7', 8.9', 8.12, 8.16. Rec 282: 8.3, 8.5, 8.7, 8.9, 8.11, 8.17.

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8.3 Find the margin of error in estimating a population mean  $\mu$ .

(a)  $n = 30, \sigma^2 = .2$  ME = .16

$$\sigma = \sqrt{.2}, SE = \frac{\sigma}{\sqrt{n}} = \frac{\sqrt{.2}}{\sqrt{30}},$$

$$ME = 1.96SE = 1.96\left(\frac{\sqrt{.2}}{\sqrt{30}}\right) = .1600$$

8.5 Find the margin of error.

(a)  $n = 50, s^2 = 4$  ME = .55

$$\sigma \approx s = \sqrt{4} = 2, SE = \frac{\sigma}{\sqrt{n}} = \frac{2}{\sqrt{50}}$$

$$ME = 1.96SE = 1.96\frac{2}{\sqrt{50}} = .5544$$

8.7 Find the margin of error for estimating a binomial proportion. Use  $p = .5$  to find the standard error of the estimator.

(a)  $n = 30$  ME = .18

$$SE = \sqrt{\frac{pq}{n}} = \sqrt{\frac{(.5)(.5)}{30}} = \frac{.5}{\sqrt{30}}$$

$$ME = 1.96SE = 1.96\frac{.5}{\sqrt{30}} = .1789$$

8.9 Find the margin of error for estimating a binomial proportion using samples of size  $n=100$  and the given estimated values of  $p$ .

(a)  $p = .1$  ME = .059

$$SE = \sqrt{\frac{(.1)(.9)}{100}} = \frac{\sqrt{.09}}{10},$$

$$ME = 1.96SE = 1.96\frac{\sqrt{.09}}{10} = .0588$$

8.11 A random sample of  $n=900$  observations from a binomial population produced  $x=655$  successes. Estimate the binomial proportion  $p$  and calculate the margin or error.

$$\hat{p} = .728$$

$$ME = .029$$

$$\hat{p} = \frac{655}{900} = .7277, SE = \sqrt{\frac{\hat{p}\hat{q}}{n}} = \sqrt{\frac{(.7277)(1-.7277)}{900}}$$

$$ME = 1.96SE = 1.96\sqrt{\frac{(.7277)(1-.7277)}{900}} = .02908$$

8.17 In a survey of 1000 adults, 78% felt sports had a positive effect on society.

(a) Estimate of the proportion of adults who feel sports have a positive effect.

$$\hat{p} = .78$$

(a') Find the margin of error.

$$ME = .026$$

(b) A magazine reports that in a separate poll of 1000 adults has a margin of error of 3.1%. What value of  $p$  produces this margin of error.

Hint: Set the formula for the margin of error equal to .031 and then use the quadratic formula to solve for  $p$ .

$$p = .5$$

$$SE = \sqrt{\frac{p(1-p)}{1000}}, ME = 1.96SE = 1.96\sqrt{\frac{p-p^2}{1000}}$$

Given:  $ME = .031$

$$\therefore 1.96\sqrt{\frac{p-p^2}{1000}} = .031$$

$$\therefore \frac{p-p^2}{1000} = \left(\frac{.031}{1.96}\right)^2$$

$$\therefore p-p^2 = .25$$

$$\therefore p^2 - p + .25 = 0$$

$$\therefore p = \frac{1 \pm \sqrt{1-4(.25)}}{2} = \frac{1}{2} = .5$$