7.4

C.I. and Sample Size for Proportions

Confidence Intervals and Sample Size for Proportion

(ex) I interview 100 century students, 73 of them own a car. So 73% of century students interviewed own a car.

- The 73% is a proportion.

Symbols Used In Proportion Notation

p = population proportion

$\hat{p}$ = sample proportion (read "p hat")

For a sample proportion,

$\hat{p} = \frac{X}{n}$ and $\hat{q} = \frac{n-X}{n}$ or $1-\hat{p}$

where X = # of sample that possess a characteristic

n = sample size

(ex) from above.

- $n=100 \quad X=73 \quad \hat{p}=.73 \quad \hat{q}=\frac{100-73}{100}$ or $1-.73=.27$

$\hat{p}$ will estimate p. The bigger n, the better the estimate

Just as before, with means, I can find a C.I. for the Proportion.

Formula for C.I. for a Proportion

$$\hat{p} - Z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}} < p < \hat{p} + Z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$$

when $np \geq 5$ & $nq \geq 5$

(ex) From above, $n=100$, $X=73$. Find 95% C.I. of true proportion of students w/ cars.

$\hat{p}=.73$ $\hat{q}=.27$ $n=100$ $\alpha=.05$ $z_{.025}=1.96$

$$.73-(1.96)\sqrt{\frac{(.73)(.27)}{100}} < p < .73+(1.96)\sqrt{\frac{(.73)(.27)}{100}}$$

$$\boxed{.643 < p < .817}$$

Sample Size for Proportions

to find sample size needed use

Formula for Minimum Sample Size Needed for p

$$n=\hat{p}\hat{q}\left(\frac{z_{\alpha/2}}{E}\right)^2$$ (round up if necessary.)

Two cases:

1. approximation of $\hat{p}$ is known: use this in formu
2. no approximation is known for $\hat{p}$: use $\hat{p}=.5$.

(ex) I want to be 90% confident that my estimate proportion of car-owners is w/in 2% of the true proportion.

I have a estimate for $\hat{p}=.73$, $\alpha=.1$ $z_{\alpha/2}=1.65$

$E=.02$ $\hat{q}=.27$

so

$$n=(.73)(.27)\left(\frac{1.65}{.02}\right)^2=1342$$

(ex) I want to know proportion of students w/ blue car. I want 90% C.I. that I'm w/in 2%.

$\hat{p}$=? so use .5 $\hat{q}$=.5 $z_{\alpha/2}$=1.65 E=.05

$$n=(.5)(.5)\left(\frac{1.65}{.02}\right)^2=1702$$

Using Your Calculator

1. STATS → TESTS
2. A-1-PropZInt
3. Enter Stuff
4. Calculate