

Statistics

Lecture 40



Feb 19-8:47 AM

Estimating Parameters:

Samples \longleftrightarrow Statistic

Population \longleftrightarrow Parameter

To estimate Parameter \rightarrow We use similar statistic.

To estimate
Population Proportion
 P

Population Mean
 μ

We use
Sample Proportion
 \hat{P}
P-hat
Sample Mean
 \bar{x}

Point-
estimate

Point-estimate for

Pop. Prop. P is Sample Prop. \hat{P}

Pop. Mean μ is Sample Mean. \bar{x}

Nov 12-8:49 AM

when estimating a parameter, the answer is a range of values.

Confidence Interval

Every Confidence interval comes with Confidence level.

Middle Area

$$(1 - \alpha) \cdot 100\%$$

when C-level not given, we use 95%.

$$0 < \alpha < 1$$

α is the Significance level

when α not given, we use .05.

$\alpha/2$ is the area of each tail.

Nov 12-8:55 AM

Confidence Interval for population Proportion

$$\hat{P} - E < P < \hat{P} + E$$

Sample Proportion

$$\hat{P} = \frac{x}{n}$$

x ← # of favorable responses
 n ← Sample Size

$$\hat{q} = 1 - \hat{P}$$

Margin of error

$$E = Z_{\alpha/2} \cdot \sqrt{\frac{\hat{P}\hat{q}}{n}}$$

Critical Value
for $(1 - \alpha) \cdot 100\%$
C-level

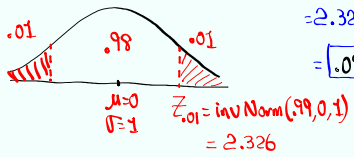
Nov 12-9:00 AM

I randomly surveyed 100 College students and 80 of them voted for presidential election.

$n = 100$
 $x = 80$
 $\hat{p} = \frac{x}{n} = \frac{80}{100} = .8$
 $\hat{q} = 1 - \hat{p} = .2$

Prop. of all College students that Voted
 $\hat{p} - E < P < \hat{p} + E$
 $.8 - .09 < P < .8 + .09$

Find $Z_{\alpha/2}$ for 98% C-level
 $E = Z_{\alpha/2} \cdot \sqrt{\frac{\hat{p}\hat{q}}{n}}$
 $= 2.326 \cdot \sqrt{\frac{(.8)(.2)}{100}}$
 $= .09$



$Z_{.01} = \text{invNorm}(.99, 0, 1) = 2.326$

$.71 < P < .89$

STAT TESTS
1-Prop ZInt
 $x = 80$
 $n = 100$
 C-level: .98
Calculate

We are 98% confident that between 71% & 89% of all College students voted for presidential election.

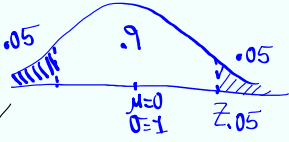
$.706 < P < .893 \dots$
 $.71 < P < .89$

Nov 12-9:05 AM

I surveyed 250 College students and 40 were smokers.

$n = 250$
 $x = 40$
 $\hat{p} = \frac{x}{n} = \frac{40}{250} = .16$
 $\hat{q} = 1 - \hat{p} = .84$

For 90% C-level.



$Z_{.05} = \text{invNorm}(.95, 0, 1) = 1.645$

Conf. Interval
 $\hat{p} - E < P < \hat{p} + E$
 $.16 - .04 < P < .16 + .04$
 $.12 < P < .20$

$E = Z_{\alpha/2} \cdot \sqrt{\frac{\hat{p}\hat{q}}{n}}$
 $= 1.645 \cdot \sqrt{\frac{(.16)(.84)}{250}} = .04$

STAT TESTS
1-Prop ZInt
 $x = 40$
 $n = 250$
 C-level: .90
Calculate

90% confident that between 12% & 20% of all students smoke.

$\hat{p} = \frac{.20 + .12}{2} = \frac{.32}{2} = .16$
 $E = \frac{.20 - .12}{2} = \frac{.08}{2} = .04$
 $.12 < P < .20$

Nov 12-9:19 AM

I surveyed 125 College students and 8% of them have been on diet to lose weight.

$$n=125 \quad \hat{p} = \frac{x}{n} \quad x = n\hat{p} = 125(.08) = 10$$

$$\hat{p} = .08$$

$$\hat{q} = 1 - \hat{p} = .92$$

if decimal Round-up

find 99% Conf. interval for the prop. of all students that have been on diet to lose weight.

C-level: .99 1-Prop Z Int

we are 99% confident that between 2% & 14% of all students have been on diet to lose weight.

$x = 10$

$n = 125$

C-level: .99

$.02 < p < .14$

$$E = \frac{.14 - .02}{2}$$

$$= .06$$

$$\hat{p} = \frac{.14 + .02}{2}$$

$$= .08$$

Nov 12-9:30 AM

I surveyed 240 registered voters and 72% of them trusted the outcome of election result.

$$n=240 \quad x = n\hat{p} = 240(.72) = 172.8 \quad x=173$$

$$\hat{p} = .72 \quad \text{if decimal} \rightarrow \text{Round-up}$$

find 99% Conf. interval for the prop. of all registered voters that trust the outcome of election result.

C-level: .99

$x=173, n=240$

1-Prop Z Int

$$\hat{p} = \frac{.80 + .65}{2} = .725 \approx 73\%$$

$$.65 < p < .80$$

$$E = \frac{.80 - .65}{2} = .075 \approx 8\%$$

we are 99% Conf. that 65% to 80% of all voters trust the result.

Nov 12-9:40 AM

Suppose $.125 < P < .275$, find

1) Point-estimate \hat{P} $\hat{P} = \frac{.275 + .125}{2} = \boxed{.2}$

2) Margin of error E $E = \frac{.275 - .125}{2} = \boxed{.075}$

Suppose $n = 184$ & $\hat{P} = .35$

1) $\hat{q} = 1 - \hat{P} = \boxed{.65}$

2) $X = n\hat{P} = 184(.35) = 64.4 \rightarrow \boxed{X = 65}$

Always
Round-up
if decimal.

Round-up

Nov 12-9:50 AM