Statistics

Lecture 40

Feb 19-8:47 AM

Estimating Parameters:

Samples ⟷ Statistic

Population ⟷ Parameter

To estimate Parameter → 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

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

When α not given, we use .05.

Nov 12-8:55 AM

Confidence Interval for population Proportion p

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

$\hat{P}$: Sample Proportion

E: Margin of error

$\hat{P} = \frac{x}{n}$ ← # of favorable responses; ← Sample Size

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

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

$Z_{\alpha/2}$: 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.

$n = 100$

$x = 80$

$\hat{p} = \frac{x}{n} = \frac{80}{100} = .8$

$\hat{q} = 1 - \hat{p} = .2$

Find $Z_{\alpha/2}$ for 98% C-level

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

Prop. of all College Students that Voted

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

$.8 - .09 < p < .8 + .09$

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

$= 2.326 \cdot \sqrt{\frac{(.8)(.2)}{100}}$

$= .09$

$.71 < p < .89$

STAT → TESTS → 1-PropZInt

$x = 80$

$n = 100$

C-level: .98

Calculate

$.706... < p < .893...$

$.71 < p < .89$

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

Nov 12-9:05 AM

I Surveyed 250 College Students and 40 were Smokers.

$n = 250$

$x = 40$

$\hat{p} = \frac{x}{n} = \frac{40}{250} = .16$ ✓

$\hat{q} = 1 - \hat{p} = .84$

Conf. Interval

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

$.16 - .04 < p < .16 + .04$

$.12 < p < .20$

90% Confident that between 12% & 20% of all Students Smoke.

$\hat{p} = \frac{.20 + .12}{2} = \frac{.32}{2} = .16$

$E = \frac{.20 - .12}{2} = \frac{.08}{2} = .04$

For 90% C-level.

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

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

$= 1.645 \cdot \sqrt{\frac{(.16)(.84)}{250}} = .04$ ✓

STAT → TESTS

1-PropZInt

$x = 40$

$n = 250$

C-level: .90

Calculate

$.12 < p < .20$

Nov 12-9:19 AM

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

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

$\hat{p}=.08$ (if decimal → Round-up)

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

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

C-level: .99 $\quad$ 1-Prop ZInt

$x=10$

$n=125$

C-level: .99

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

$.02<p<.14$

$E=\frac{.14-.02}{2}=.06$

$\hat{p}=\frac{.14+.02}{2}=.08$

Nov 12-9:30 AM

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

$n=240$

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

(if decimal ⇒ 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 ZInt

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

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

$.65<p<.80$

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 $\hat{p}$ $\quad \hat{p} = \frac{.275 + .125}{2} = \boxed{.2}$

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

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

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

2) $x = n\hat{p} = 184\,(.35) = 64.4 \rightarrow \boxed{x = 65}$

Round-up

Always Round-up if decimal.

Nov 12-9:50 AM