Statistics

Lecture 22

Feb 19-8:47 AM

SG 21

Estimating Parameters:

Describe Population

Estimation is a range of values called

Confidence Interval

Every Conf. interval comes with Conf. level.

$1-\alpha$ is the middle Area.

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

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

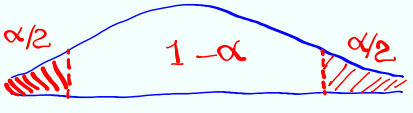
$0 < \alpha < 1$

Alpha

Significance level

α not given → .05

C-level not given → .95



May 18-9:56 AM

Estimating Population Proportion

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

$\hat{p}$: Sample Proportion

E: Margin of error

Point-estimate (Best guess)

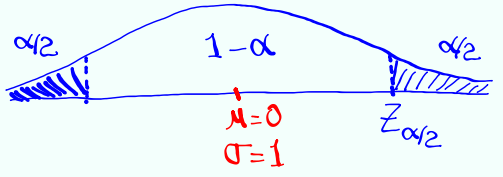
$\hat{p} = \frac{x}{n}$ ← # favorable replies.

n ← Sample Size

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

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

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



May 18-10:03 AM

I surveyed 100 students and 80 of them had iPhone. $n=100$, $x=80$

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

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

Find 90% Conf. interval for the proportion of all students that have iPhone.

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

$.8 - .07 < p < .8 + .07$

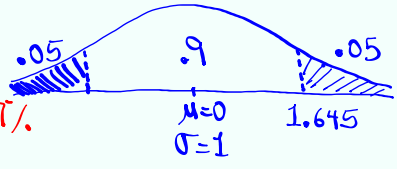
$.73 < p < .87$

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

$= 1.645\sqrt{\frac{(.8)(.2)}{100}}$

$= .0658 \approx .07$

I am 90% Confident that between 73% & 87% of all students have iPhone.



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

May 18-10:10 AM

Using TI:

STAT → TESTS ↓ 1-PropZInt

$x = 80$

$n = 100$

C-level: .9

Calculate

$.73 < p < .87$

$E = \frac{.87 - .73}{2} = \frac{.14}{2} = .07$

$\hat{p} = \frac{.87 + .73}{2} = \frac{1.6}{2} = .8$

May 18-10:22 AM

I surveyed 250 students, and 100 of them were STEM majors. $n = 250$, $x = 100$

No C-level → .95

find Conf. interval for the prop. of all students that are STEM majors.

1-PropZInt

$.34 < p < .46$

$E = \frac{.46 - .34}{2} = .06$

$\hat{p} = \frac{.46 + .34}{2} = .4$

we are 95% confident that between 34% & 46% of all students are STEM majors.

May 18-10:27 AM

In a Survey of 180 Students, 10% of them were Smokers. $n=180$, $\hat{p}=.1$ → $x=n\hat{p}=180(.1)=18$ if decimal → Round-up

Find 99% Conf. Interval for the prop. of all Students that are smokers. C-level: .99

1-Prop ZInt

$E=\frac{.16-.04}{2}=.06$

$\hat{p}=\frac{.16+.04}{2}=.1$

$.04<p<.16$

We are 99% Confident that between 4% & 16% of all Students are Smokers.

May 18-10:34 AM

How to determine min. Sample Size:

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

We Solve for n → $n=\hat{p}\hat{q}\left(\frac{z_{\alpha/2}}{E}\right)^2$

When decimal → Always round-up

If $\hat{p}$ & $\hat{q}$ are both unknown use .5 for each → $n=.25\left(\frac{z_{\alpha/2}}{E}\right)^2$

May 18-10:43 AM

How many students should we survey to construct 95% Conf. Interval for the prop. of all students that are STEM majors and margin of errors not to exceed 5% with

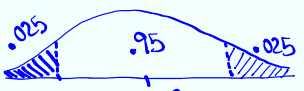
1) $\hat{p} = .4$

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

$$= (.4)(.6)\left(\frac{1.960}{.05}\right)^2$$

$$= 368.7936$$

$$n \approx 369$$



$z_{.025} = \text{InvNorm}(.975, 0, 1) =$

2) Assume $\hat{p}$ & $\hat{q}$ are unknown.

$$n = .25\left(\frac{z_{\alpha/2}}{E}\right)^2 = .25\left(\frac{1.960}{.05}\right)^2$$

$$= 384.16$$

$$n = 385$$

May 18-10:48 AM

Given $\hat{p} = .25$, C-level: .99, $E = .04$

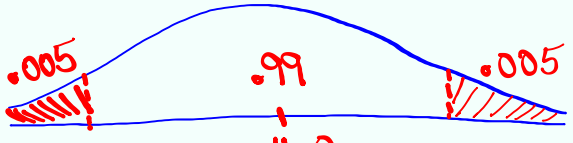
Find n.

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

$$= (.25)(.75)\left(\frac{2.576}{.04}\right)^2$$

$$= 777.63$$

$$n \approx 778$$



$z_{.005} = \text{InvNorm}(.995, 0, 1)$

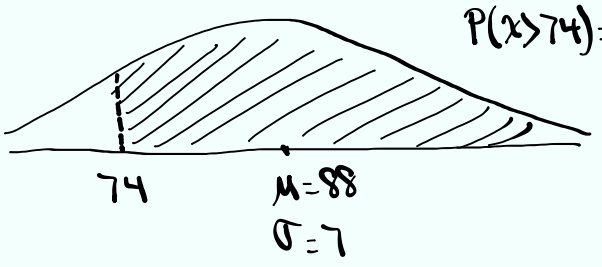
May 18-10:58 AM

Class Qz 1

Given $N(88, 7)$

Find $P(x > 74)$

Drawing, labeling, shading, and TI Command required.



$P(x>74) = \text{normalcdf}(74, E99, 88, 7)$

$= \boxed{.977}$

May 18-11:03 AM