Statistics

Fall 2022

Lecture 23

Feb 19-8:47 AM

I surveyed 175 students and 12% of them were taking bus to get to campus.

$n = 175$
$\hat{p} = .12$

1) How many of them in the survey were taking bus to get to campus?

$x = n\hat{p}$
$= 175(.12) = \boxed{21}$

$\boxed{21}$

2) Find 90% Confidence Interval for the prop of all students that use bus to get to campus.

C-level: .9

1-PropZInt
$x = 21$, $n = 175$, C-level: .9

$.076 < p < .160$

$\boxed{.08 < p < .16}$

3) Find the margin of error

$\hat{p} = \frac{.16 + .08}{2} = \frac{.24}{2} = .12$

Point-estimate

$E = \frac{.16 - .08}{2} = \frac{.08}{2} = \boxed{.04}$

We are 90% confident that between 8% to 16% of all students use bus to get to campus.

Dec 5-6:02 AM

I Surveyed 40 teachers, and their mean age was 48.5 Years.

$n=40$

$\bar{x}=48.5$

It is Known that standard deviation of ages of all teachers is 12.5 Yrs.

$\sigma = 12.5$

Sigma

Find 98% Conf. interval for the mean age of all teachers.

$43.902 < \mu < 53.098$

C-level: .98

inpt: $\boxed{\text{Stats}}$

If σ Known ⇒ $\boxed{\text{Z Interval}}$

If σ Unknown ⇒ T Interval

$\sigma = 12.5$

$\bar{x} = 48.5$

$n = 40$

C-level: .98

Now since $\bar{x}$ is in 1-decimal, Round to 1-decimal

$\boxed{43.9 < \mu < 53.1}$

$\bar{x} = \frac{53.1 + 43.9}{2} = \boxed{48.5}$

$E = \frac{53.1 - 43.9}{2} = \boxed{4.6}$

we are 98% confident that the mean age of all teachers is between 43.9 & 53.1 Yrs.

Dec 5-6:20 AM

I randomly selected 12 exams, the mean Score was 82 with standard deviation of 10.

$n=12$, $\bar{x}=82$, $S=10$

Find Confidence interval for the mean Score of all exams.

$75.646 < \mu < 88.354$

Since $\bar{x}$ is a whole #, we round to whole #

C-level: .95

If σ Known ⇒ Z Interval

If σ Unknown ⇒ $\boxed{\text{T Interval}}$

inpt: $\boxed{\text{Stats}}$

$\bar{x}: 82$

$S: 10$

$n = 12$

C-level: .95

$\boxed{76 < \mu < 88}$

$\bar{x} = \frac{88 + 76}{2} = \boxed{82}$

$E = \frac{88 - 76}{2} = \boxed{6}$

Dec 5-6:34 AM

How to determine minimum Sample Size needed to construct Confidence Interval:

1) one population proportion

$$E = Z_{\alpha/2} \cdot \sqrt{\frac{\hat{p}\hat{q}}{n}} \Rightarrow n = \hat{p}\hat{q}\left(\frac{Z_{\alpha/2}}{E}\right)^2$$

If decimal $\Rightarrow$ Always round-up

If $\hat{p}$ & $\hat{q}$ are both unknown $\Rightarrow$ use .5 for each

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

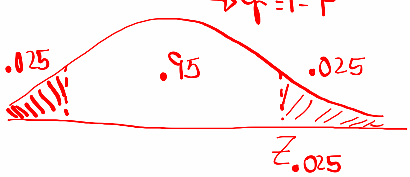
Dec 5-6:48 AM

Find minimum Sample Size needed to construct 95% conf. interval for pop. proporation with $\hat{p} = .4$ and margin of error not to exceed 5%

$$n = \hat{p}\hat{q}\left(\frac{Z_{\alpha/2}}{E}\right)^2 = (.4)(.6)\left(\frac{1.960}{.05}\right)^2 = 368.7936$$

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

$\boxed{n = 369}$



$Z_{.025} = \text{invNorm}(.975, 0, 1) = \boxed{1.960}$

Redo for $E = 4\%$

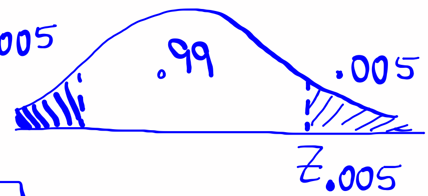
$$n = \hat{p}\hat{q}\left(\frac{Z_{\alpha/2}}{E}\right)^2 = (.4)(.6)\left(\frac{1.960}{.04}\right)^2 = 576.24$$

$\boxed{n = 577}$

Dec 5-6:54 AM

find minimum sample size needed to construct 99% conf. interval for population proportion with margin of error not to exceed 6%.

a) Assume $\hat{p} = .25$



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

$= (.25)(.75)\left(\frac{2.576}{.06}\right)^2 \Rightarrow \boxed{n = 346}$

$Z_{.005} = \text{invNorm}(.995, 0, 1)$
$= \boxed{2.576}$

b) Assume $\hat{p}$ & $\hat{q}$ both unknown.

$n = .25\left(\frac{Z_{\alpha/2}}{E}\right)^2 = .25\left(\frac{2.576}{.06}\right)^2 \Rightarrow \boxed{n = 461}$

Dec 5-7:17 AM

How to determine minimum sample size needed to construct Confidence Interval:

1) One population Mean

$E = Z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}} \Rightarrow n = \left(\frac{Z_{\alpha/2} \cdot \sigma}{E}\right)^2$

If decimal ⇒ Always round-up

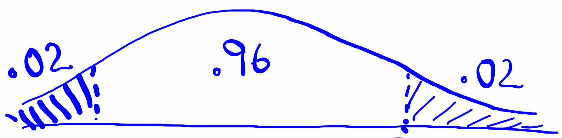
If σ is unknown, we use S instead.

$n = \left(\frac{Z_{\alpha/2} \cdot S}{E}\right)^2$

Dec 5-6:48 AM

Find minimum Sample Size needed to construct 96% Conf. interval for pop. mean with margin of error 10 and standard deviation of 15 for all.

$$n = \left(\frac{z_{\alpha/2} \cdot \sigma}{E}\right)^2 = \left(\frac{2.054 \cdot 15}{10}\right)^2 \Rightarrow \boxed{n = 10}$$



$z_{.02} = \text{invNorm}(.98, 0, 1) = \boxed{2.054}$

Dec 5-7:31 AM

Find minimum Sample Size needed for Constructing 95% Conf. interval for pop. mean given $\boxed{S = 20}$ and $\boxed{\text{error not to exceed } 8}$

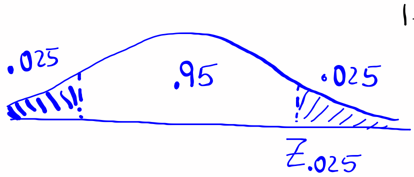
$$n = \left(\frac{z_{\alpha/2} \cdot \sigma}{E}\right)^2$$

when σ not given we use S instead.

$$n = \left(\frac{z_{\alpha/2} \cdot S}{E}\right)^2 = \left(\frac{1.960 \cdot 20}{8}\right)^2 \Rightarrow \boxed{n = 25} \checkmark$$

$1 - .95 = .05$

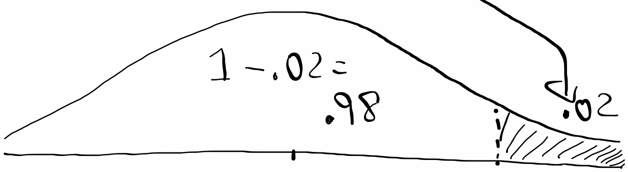
$.05 \div 2 = .025$



$z_{.025} = \text{invNorm}(.975, 0, 1) = \boxed{1.960}$

Dec 5-7:37 AM

find $t_{.02}$ with df = 19.

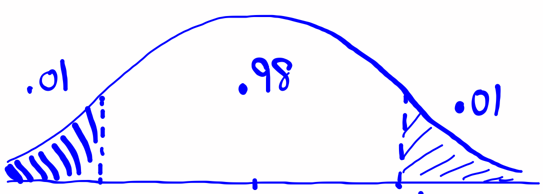


$\mu = 0$
σ unknown
df = 19

$t_{.02} = \text{invT}(.98, 19)$
$= \boxed{2.205}$

Dec 5-7:45 AM

find $t_{\alpha/2}$ for 98% Conf. level with df = 12.



$\mu = 0$
σ unknown
df = 12

$t_{.01} = \text{invT}(\underset{\uparrow \text{ Left Area}}{.99}, \underset{\uparrow \text{ df}}{12}) = \boxed{2.681}$

SG 22 & SG 23

Make sure to print Testing Chart on the left side of SG 24-27.

Dec 5-7:51 AM