Statistics
Spring 2023
Lecture 41

Estimating Population Mean

μ

Conf. Interval $\bar{x} - E < \mu < \bar{x} + E$

$\bar{x}$: Sample Mean "Point-estimate"

E: Margin of error

Case I: σ Known	Case II: σ unknown
$E = z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$ $(1-\alpha)\cdot 100\%$ C-level	$E = t_{\alpha/2} \cdot \frac{s}{\sqrt{n}}$ $(1-\alpha)\cdot 100\%$ C-level $df = n-1$
TI Command: ZInterval input: Stats	TI Command: TInterval input: Stats

Given: $n=10$, $\bar{x}=84$, $S=12$, C-level: 90%

Find Conf. interval for μ.

$\bar{x}-E<\mu<\bar{x}+E$

$84-E<\mu<84+E$

Since σ unknown,

$E=t_{\alpha/2}\cdot\frac{S}{\sqrt{n}}=1.833\cdot\frac{12}{\sqrt{10}}=6.956\approx 7$

$84-7<\mu<84+7$

$77<\mu<91$

σ unknown

$df=n-1=9$

$t_{.05}=\text{invT}(.95,9)=1.833$

we are 90% Confident that Population mean will be between 77 and 91.

STAT TESTS

TInterval

Inpt: Stats

$\bar{x}$: 84

S: 12

n: 10

C-level: .9

$E=\frac{91-77}{2}=7$

(77.044, 90.956)

$77.044<\mu<90.956$

$77<\mu<91$

$\bar{x}=\frac{91+77}{2}=84$

15 randomly selected students had a mean age of 31.4 yrs with standard deviation of 9.5 yrs.

$n=15$ $\bar{x}=31.4$ $S=9.5$

Find 98% Conf. interval for the mean age of all students, C-level: .98

$\bar{x}-E<\mu<\bar{x}+E$

$31.4-E<\mu<31.4+E$

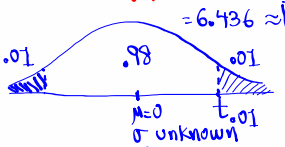
Since σ is unknown

$E=t_{\alpha/2}\cdot\frac{S}{\sqrt{n}}=2.624\cdot\frac{9.5}{\sqrt{15}}=6.436\approx 6.4$

$31.4-6.4<\mu<31.4+6.4$

$25.0<\mu<37.8$

Rounded to 1-decimal since $\bar{x}$ was 1-decimal.



σ unknown

$df=n-1=14$

$t_{.01}=\text{invT}(.99,14)=2.624$

TInterval

Inpt: Stats

$\bar{x}=31.4$

S=9.5

n=15

C-level: .98

Calculate

(24.962, 37.838)

$E=\frac{37.8-25.0}{2}=6.4$

$\bar{x}=\frac{37.8+25.0}{2}=31.4$

$25.0<\mu<37.8$

Salaries of randomly Selected 12 nurses are given below:

$n=12$

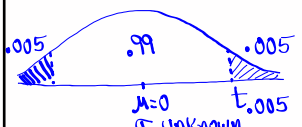
6800	5400	4800	7000
7200	6580	5620	7500
5050	5950	4950	6000

1) Find $\bar{x}$ & s. Round to whole #

$\bar{x}=6071$

$s=932$

2) Find $t_{\alpha/2}$ for 99% Conf. level.



σ unknown

$df = n-1 = 11$

$t_{.005} = \text{invT}(.995, 11) = 3.106$

$E = \frac{6907-5235}{2} = 836$

$\bar{x} = \frac{6907+5235}{2} = 6071$

(5235.4, 6906.6)

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

$5235 < \mu < 6907$

3) Find 99% Conf. interval for mean Salary of all nurses.

Since σ is unknown ⇒ use TInterval

Inpt: Stats

$\bar{x}=6071$

$s=932$

$n=12$

C-level: .99

Calculate

---

20 randomly selected exams had a mean of 86.5 and Standard deviation of 12.8.

$n=20$ $\bar{x}=86.5$ $s=12.8$

Find Conf. interval for the mean of all exams.

C-level Not given use .95

ZInterval (σ Known)

TInterval (σ Unknown)

(80.509, 92.491)

Inpt: Stats

Since $\bar{x}$ is in 1-decimal, we round to 1-decimal

$\bar{x}$: 86.5

s: 12.8

n: 20

$df = n-1 = 19$

$80.5 < \mu < 92.5$

C-level: .95

Calculate

$E = \frac{92.5-80.5}{2} = 6$

$\bar{x} = \frac{92.5+80.5}{2} = 86.5$

You can work on SG 22 & SG 23.

we need to talk about minimum Sample Size.

You can learn about by watching the video on the right-hand side of SG 22 & SG 23.

Exam II: Tuesday

SG 11 to SG 21 + Exam 1

You can start as early as 6:00 AM.

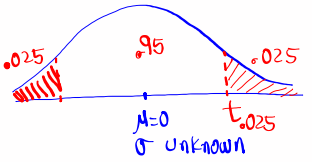
Find $t_{\alpha/2}$ for $\alpha = .05$ with $df = 8$.

$\alpha/2 = .05/2 = .025$

$t_{.025}$

$(1-\alpha)\cdot 100\% = 95\%$

Middle Area: .95



Left Area df $df = 8$

$t_{.025} = \text{INVT}(.975, 8) = 2.306$

What is df?

You take 10 donuts to work.

10 people All Together

$df = 10 - 1 = 9$

	choices
First person →	10
Second " →	9
Third " →	8
⋮	
Last " →	0 "I donot left"

You have 7 clean shirts.

You only wear clean shirt.

Monday → 7 choices

Tuesday → 6 "

Wednesday → 5 "

⋮

Sunday → 0 choices (1 clean shirt)

$df = 7 - 1 = 6$