Statistics

Lecture 11

Feb 19-8:47 AM

Clear all lists

Store 2, 4, 6 in L1.

Use [1-Var Stats] with L1 only To find

SG 20

$\mu = 4$

$\sigma = 1.633$

$\sigma^2 = \frac{8}{3}$

Take all Samples of Size 2 with replacement from this list.

2,2 2,4 2,6

4,2 4,4 4,6

6,2 6,4 6,6

Find $\bar{x}$ of each Sample

2	3	4
3	4	5
4	5	6

9 means

$\bar{x}$	$P(\bar{x})$
2	1/9
3	2/9
4	3/9
5	2/9
6	1/9

$\bar{x} \rightarrow$ L2

$P(\bar{x}) \rightarrow$ L3

Prob. Dist. Histogram

Normal Curve

2 3 4 5 6

use [1-Var Stats] with L2 & L3 to find

$\mu_{\bar{x}} = 4$

$\sigma_{\bar{x}} = 1.155$

$\sigma^2_{\bar{x}} = \frac{4}{3} = \frac{\frac{8}{3}}{2}$

Nov 8-11:37 AM

Central – Limit Theorem

$\mu_{\bar{x}} = \mu$ $\quad \sigma_{\bar{x}}^2 = \frac{\sigma^2}{n}$ $\quad \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

Ages of all College Students are normally dist. with mean of 30 Yrs and Standard dev. of 6 Yrs. $N(30, 6)$

If we take Samples of 4 Students,

$\mu_{\bar{x}} = \mu = 30$ $\quad \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{6}{\sqrt{4}} = \frac{6}{2} = 3$

CLT

Nov 8-11:51 AM

Clear all lists

Store 2, 4, 6, 8 in L1.

Use 1 – Var Stats with L1 only to find

$\mu = 5$

$\sigma = 2.236$

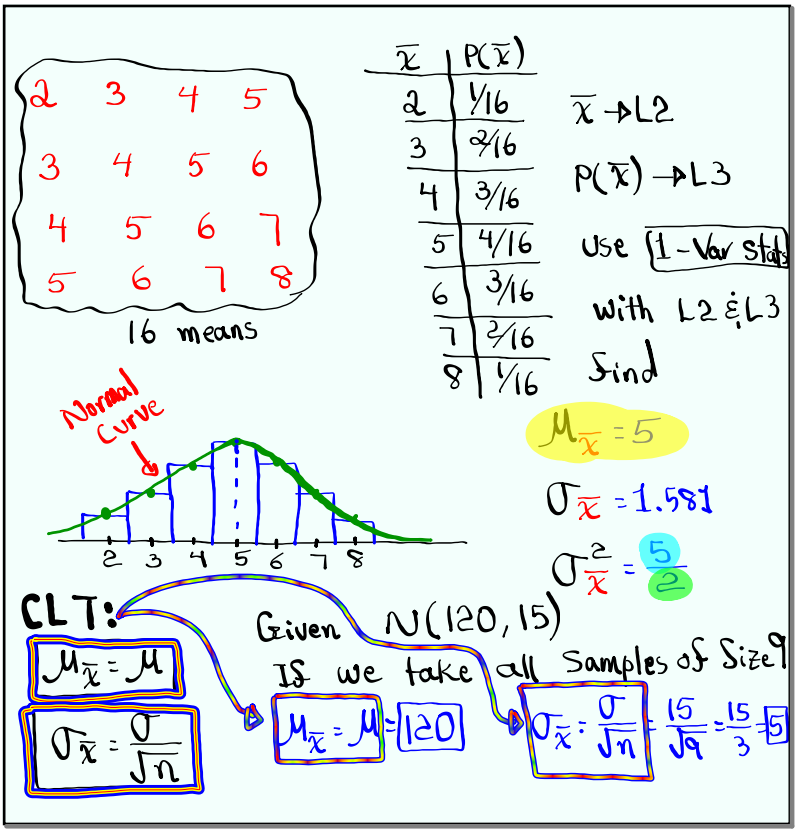
$\sigma^2 = 5$

Let's take all Samples of Size 2 with replacement from this list.

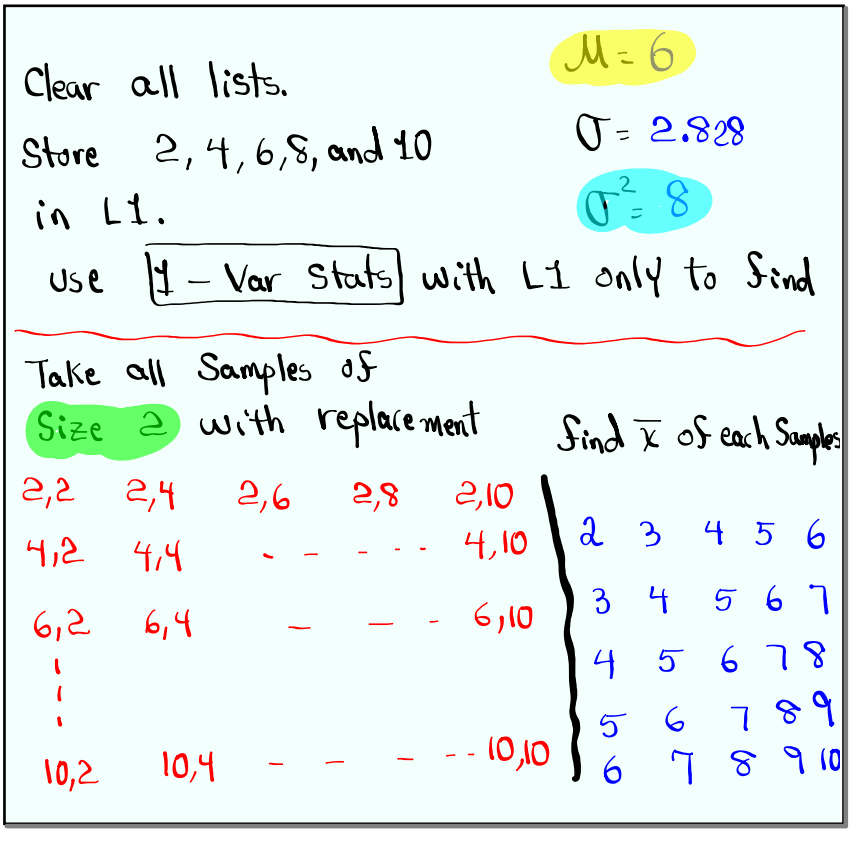
Find $\bar{x}$ of each Sample

2,2	2,4	2,6	2,8	2	3	4	5
4,2	4,4	4,6	4,8	3	4	5	6
6,2	6,4	6,6	6,8	4	5	6	7
8,2	8,4	8,6	8,8	5	6	7	8

Nov 8-11:57 AM



Nov 8-12:03 PM



Nov 8-12:13 PM

2	3	4	5	6
3	4	5	6	7
4	5	6	7	8
5	6	7	8	9
6	7	8	9	10

25 means

$\bar{x}$	$P(\bar{x})$
2	1/25
3	2/25
4	3/25
5	4/25
6	5/25
7	4/25
8	3/25
9	2/25
10	1/25

$\bar{x} \rightarrow$ L2

$P(\bar{x}) \rightarrow$ L3

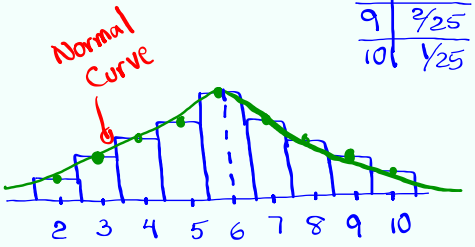
Use 1-Var Stats with L2 & L3

Find

$\mu_{\bar{x}} = 6$

$\sigma_{\bar{x}} = 2$

$\sigma^2_{\bar{x}} = 4 = \frac{8}{2}$



CLT $\quad \mu_{\bar{x}} = \mu$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

Nov 8-12:19 PM

Salaries of teachers in LAUSD has a normal dist. with mean of \$7800 and Standard dev. of \$400.

$N(7800, 400)$

If we randomly select groups of 16 teachers,

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{400}{\sqrt{16}} = 100$$

$\mu_{\bar{x}} = \mu = 7800$ ← CLT

SG20

Nov 8-12:26 PM

Suppose ages of all College students are normally dist. with mean of 32 yrs and standard dev. of 6 years.

$N(32, 6)$

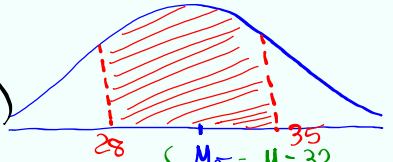
$n=4$

If we randomly Select 4 students, what is the prob. that their mean age $\bar{x}$ is between 28 and 35 yrs.

$P(28 < \bar{x} < 35)$

=normalcdf(28,35,32,3)

=.750



CLT $\begin{cases} \mu_{\bar{x}} = \mu = 32 \\ \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{6}{\sqrt{4}} = 3 \end{cases}$

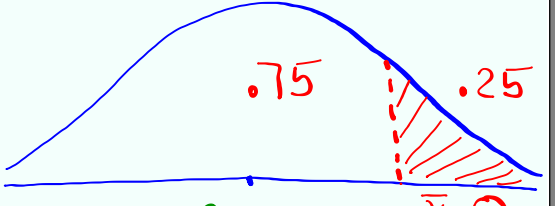
Nov 8-12:45 PM

For randomly selected group of 5 students,

Find $\bar{x} = Q_3$ Round to whole #.

75% below

25% above



$\bar{x}$ = invNorm(.75, 32, 6/√5)

≈ 34 Yrs

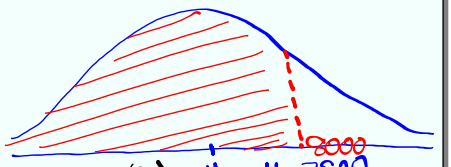
CLT $\begin{cases} \mu_{\bar{x}} = \mu = 32 \\ \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{6}{\sqrt{5}} \end{cases}$ $\bar{x} = Q_3$

Nov 8-12:51 PM

Salaries of teachers in LAUSD has a normal dist with mean of \$7800 and standard dev. of \$400. $N(7800, 400)$

If we randomly select $n=6$ 6 teachers, find the prob. that their mean salary $\bar{x}$ is below \$8000.

$P(\bar{x} < 8000)$



$= \text{normalcdf}(-E99, 8000, 7800, 400/\sqrt{6})$

$= .890$

CLT $\mu_{\bar{x}} = \mu = 7800$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{400}{\sqrt{6}}$

Nov 8-12:55 PM

For randomly selected 10 teachers, find $\bar{x} = Q_1$. Round to whole #.

25% below

75% above

CLT $\mu_{\bar{x}} = \mu = 7800$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{400}{\sqrt{10}}$

$\bar{x} = \text{invNorm}(.25, 7800, 400/\sqrt{10})$

$= \$7715$

Nov 8-1:02 PM

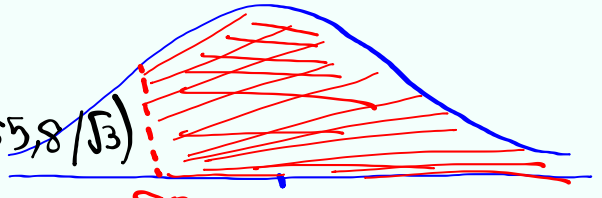
Exam Scores are N.D. with $\mu=85$ & $\sigma=8$.

If we randomly select $n=3$ exams find the Prob. that their mean Score $\bar{x}$ is above 80.

$P(\bar{x}>80)$

$=\text{normalcdf}(80, E99, 85, 8/\sqrt{3})$

$\approx \boxed{.860} \approx 86\%$



CLT $\begin{cases} \mu_{\bar{x}} = \mu = 85 \\ \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{8}{\sqrt{3}} \end{cases}$

Nov 8-1:07 PM

Find K such that $P(\bar{x}>K)=.025$

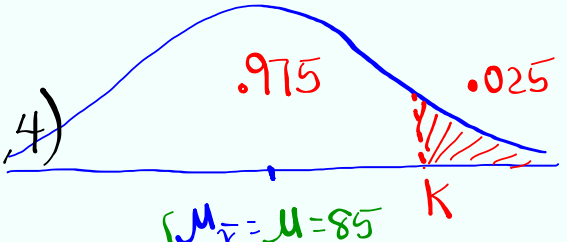
Right Area

for randomly selected 4 exams.

Round to whole #

$K=\text{invNorm}(.975, 85, 4)$

$\approx \boxed{93}$



CLT $\begin{cases} \mu_{\bar{x}} = \mu = 85 \\ \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{8}{\sqrt{4}} = 4 \end{cases}$

Nov 8-1:12 PM

Find two means, round to whole #, for randomly selected $n=3$ exams that separate the middle 98% from the rest.

$1 - .98 = .02$

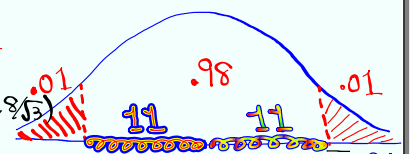
$.02 \div 2 = .01$

$\bar{x}_1 = \text{invNorm}(.01, 85, 8/\sqrt{3})$

≈ 74

$\bar{x}_2 = \text{invNorm}(.99, 85, 8/\sqrt{3})$

≈ 96



CLT $\mu_{\bar{x}} = \mu = 85$, $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{8}{\sqrt{3}}$

SG 21

Exam 3
Nov. 22, 2024

SG 1 – SG 23
Make Sure to Review exams 1 & 2.

Nov 8-1:16 PM

α Alpha

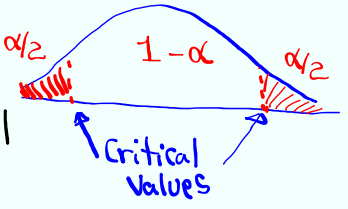
$0 < \alpha < 1$

α Significance level

$1 - \alpha$ Middle Area

$(1-\alpha) \cdot 100\%$ Conf. level

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

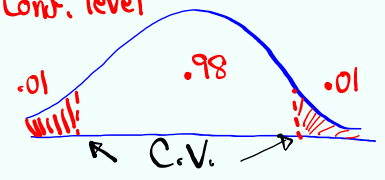


ex: $\alpha = .02$ ← Significance level

$\alpha/2 = .01$ ← Area of each tail

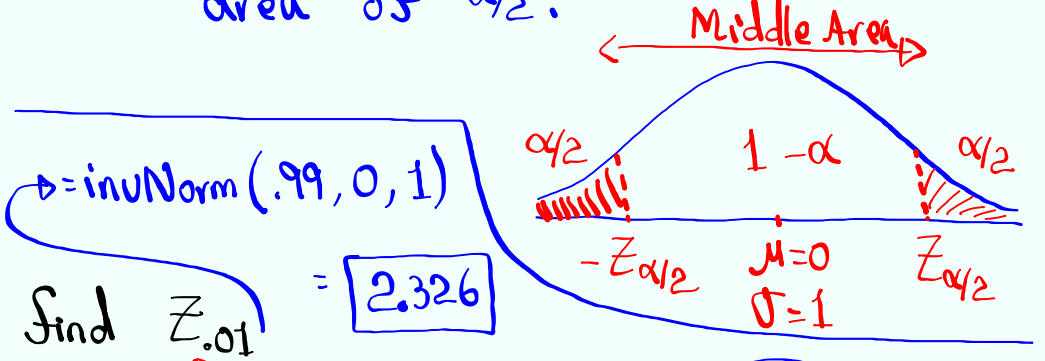
$1 - \alpha = .98$ ← Middle Area

$(1-\alpha) \cdot 100\% = 98\%$ ← Conf. level



Nov 8-1:40 PM

$z_{\alpha/2}$ is a Critical Value with right-Tail area of $\alpha/2$.



$\blacktriangleright$ = invNorm(.99, 0, 1)

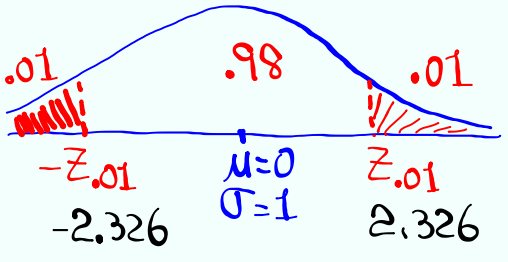
= 2.326

Find $z_{.01}$

Right Area

$\frac{\alpha}{2} = .01$ $\alpha = .02$

$1 - \alpha = .98$, 98% C-level

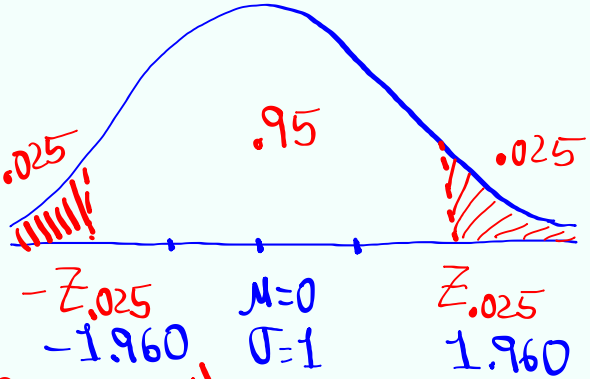


Nov 8-1:45 PM

Find $\pm z_{\alpha/2}$ for $\alpha = .05$.

$\alpha/2 = .025$

$1 - \alpha = .95$

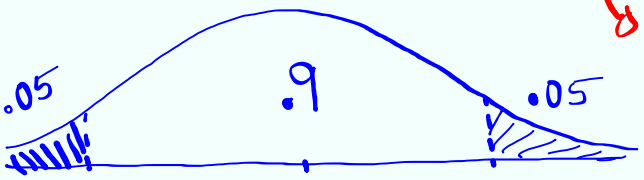


$z_{.025}$ = invNorm(.975, 0, 1) = 1.960

Nov 8-1:52 PM

Find $\pm z_{\alpha/2}$ for 90% Conf. level.

Middle Area
.9
$1-\alpha = .9$
$\alpha = .1$
$\alpha/2 = .05$



$-z_{.05}$ $\quad \mu=0$ $\quad z_{.05}$
-1.645 $\quad \sigma=1$ $\quad 1.645$

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

Nov 8-1:56 PM

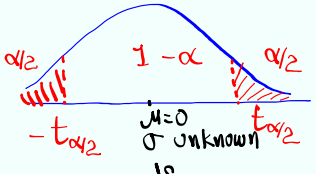
t- Dist.

1) Symmetric, bell-shape, Total Area = 1

2) $\mu = 0$, σ unknown

3) It comes with degrees of freedom.

How to find it
use [invT]



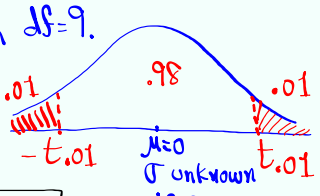
$-t_{\alpha/2}$ $\quad t_{\alpha/2}$

G. Calculator

invT(Left Area, df)

ex: Find $t_{.01}$ with df = 9.

$\frac{\alpha}{2} = .01$ $\quad \alpha = .02$
$1-\alpha = .98$



$-t_{.01}$ $\quad t_{.01}$

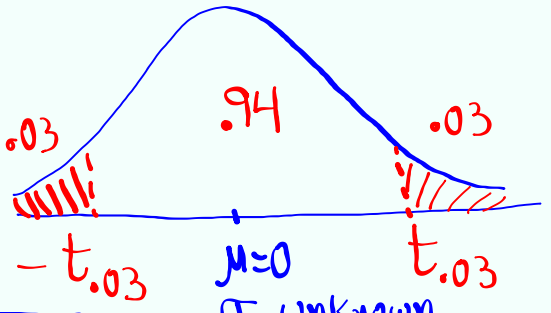
$t_{.01} = \text{invT}(.99, 9) = \boxed{2.821}$

Nov 8-2:00 PM

Find $\pm t_{\alpha/2}$ for $\alpha = .06$ with $df = 12$.

$\alpha/2 = .03$

$1 - \alpha = .94$



σ unknown

$df = 12$

$\text{invT}(.97, 12) \approx \boxed{2.076}$

Nov 8-2:07 PM

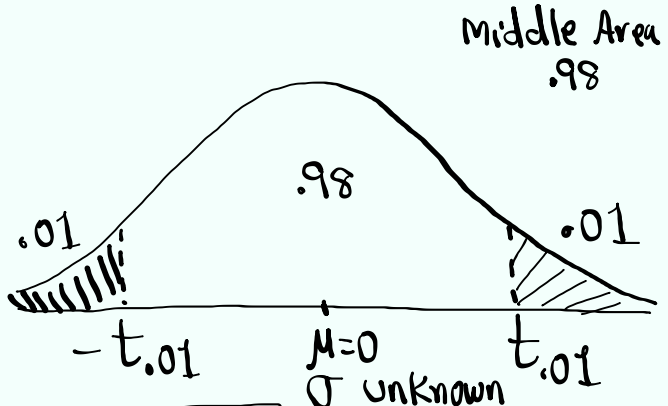
Find $\pm t_{\alpha/2}$ with $df = 19$ and C-level 98%.

Middle Area .98

$1 - \alpha = .98$

$\alpha = .02$

$\alpha/2 = .01$



σ unknown

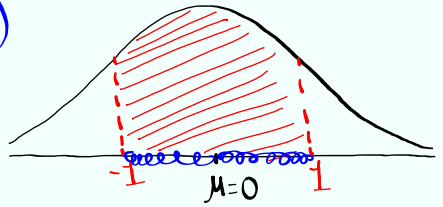
$t_{.01} = \text{invT}(.99, 19) \approx \boxed{2.539}$ $df = 19$

Nov 8-2:10 PM

Find $P(-1<t<1)$ with $df=999$.

tcdf(L, U, df)

tcdf(-1, 1, 999)



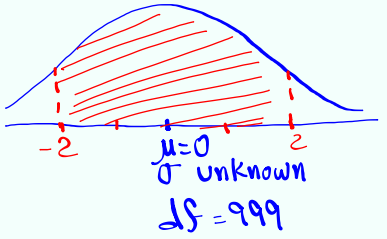
$\approx .682$

$\approx 68\%$

$P(-2<t<2)$ with $df=999$

=tcdf(-2, 2, 999)

$\approx .954 \approx 95\%$



Nov 8-2:14 PM

What is degrees of freedom?

The way to find it depends on topic.

21 students

I bring 21 donuts.

First student → 21 donuts → 21 choices

Second " → 20 " → 20 "

⋮ ⋮ ⋮

Last student → 1 donut → No choice

df = 20

7 clean shirts

You wear only clean shirt daily.

Monday → 7 choices

Tuesday → 6 "

Wed. → 5 "

⋮

Sunday → No choice (1 clean shirt)

df = 6

Nov 8-2:20 PM