Statistics

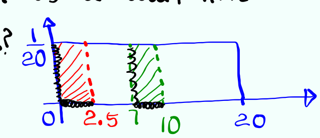
Lecture 20

Feb 19-8:47 AM

The city bus comes every 20 minutes.

It follows a uniform Prob. dist.

1) What is the prob. of a wait time less than 2.5 minutes?



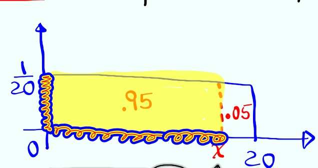
$P(x<2.5) = (2.5-0)\cdot\frac{1}{20}$

$= \frac{2.5}{20} = \boxed{\frac{1}{8}}$

2) What is the prob. that wait time is between 7 and 10 minutes?

$P(7<x<10) = (10-7)\cdot\frac{1}{20} = \boxed{\frac{3}{20}} = \boxed{.15}$

3) Find the $\overset{x}{\boxed{\text{wait time}}}$ that separates the top 5% from the rest.



$(x-0)\cdot\frac{1}{20} = .95$

$x - 0 = 20(.95)$

$\boxed{x = 19}$

Nov 6-12:17 PM

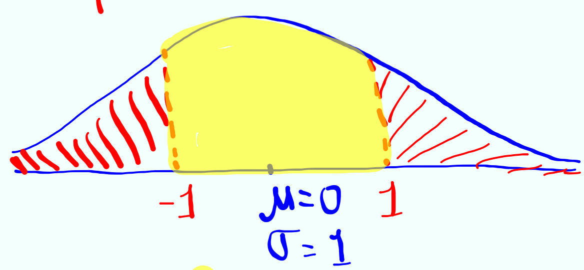
Find $P(Z < -1 \text{ or } Z > 1)$

Standard Normal Prob. dist.

Bell-shape $\mu = 0$ $\sigma = 1$

$= 1 - P(-1 < Z < 1)$

Total Prob.



$= 1 - \text{normalcdf}(-1, 1, 0, 1)$

$= \boxed{.317}$

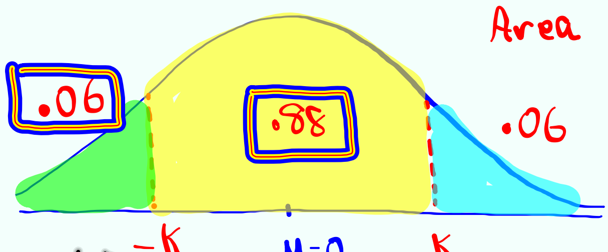
Nov 6-12:27 PM

Find K such that $P(-K < Z < K) = .88$

middle Area

$1 - .88 = .12$

$.12 \div 2 = .06$



−1.555

σ=1

1.555

$K = \text{invNorm}(\underset{\text{left Area}}{.94}, \underset{\mu}{0}, \underset{\sigma}{1})$

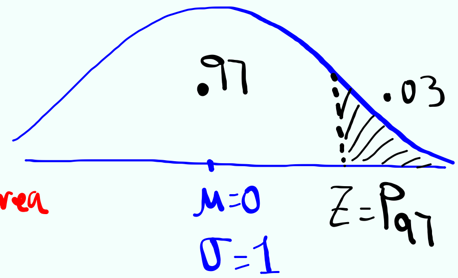
$= \boxed{1.555}$

Nov 6-12:31 PM

Find $Z = P_{97}$

97% below → Left Area .97

3% above → Right Area .03



$Z = P_{97} = \text{invNorm}(.97, 0, 1)$

$= \boxed{1.881}$

Nov 6-12:36 PM

Given $N(320, 8)$

Normal Dist.

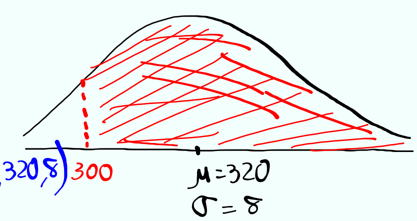
$\mu=320$

$\sigma=8$

$P(x > 300)$

$= \text{normalcdf}(300, E99, 320, 8)$

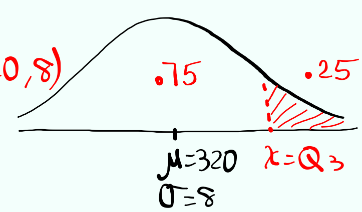
$= \boxed{.994}$



Find $x = Q_3$, Round to whole #.

$x = Q_3 = \text{invNorm}(.75, 320, 8)$

$\approx \boxed{325}$

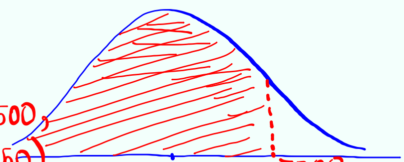


Nov 6-12:39 PM

Salaries of teachers in LAUSD are normally dist. with mean of \$7500/mo. and standard dev. of \$500. $N(7500, 500)$

If we randomly select $\boxed{\text{4 teachers}}$ ($n=4$), find the prob. that $\boxed{\text{their mean salary}}$ ($\bar{x}$) is below \$7700/mo.

$P(\bar{x} < 7700)$



$= \text{normalcdf}(-E99, 7700, 7500, 250)$

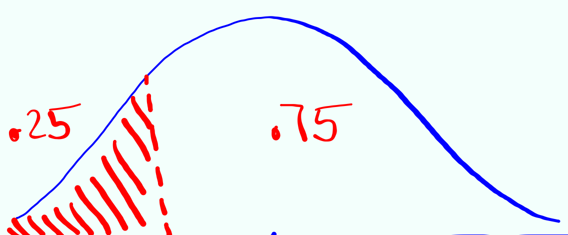
$= \boxed{.788}$

CLT $\begin{cases} \mu_{\bar{x}} = \mu = 7500 \\ \sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}} = \dfrac{500}{\sqrt{4}} = 250 \end{cases}$

Nov 6-12:46 PM

Find $\bar{x} = Q_1$ for randomly selected groups of 5 teachers.

$n=5$



$\bar{x} = Q_1$

CLT $\begin{cases} \mu_{\bar{x}} = \mu = 7500 \\ \sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}} = \dfrac{500}{\sqrt{5}} \end{cases}$

$\bar{x} = Q_1 = \text{invNorm}\left(.25, 7500, \dfrac{500}{\sqrt{5}}\right)$

$\approx \boxed{7349}$

Nov 6-12:53 PM

Store 1 5 9 in L1, use $\boxed{\text{1-Var Stats}}$ with L1 only to find

$\mu = \bar{x} = 5$

$\sigma = \sigma_x = 3.266$

$\sigma^2 = \sigma_x^2 = \frac{32}{3}$

Take all Samples of Size 2 with replacement

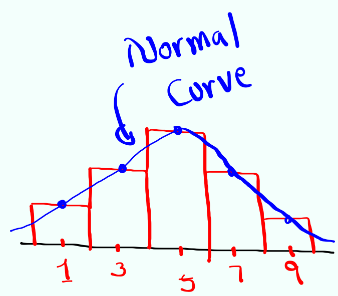
1,1	1,5	1,9		1	3	5
5,1	5,5	5,9		3	5	7
9,1	9,5	9,9		5	7	9

Find $\bar{x}$ of each Sample

Nov 6-12:57 PM

1	3	5
3	5	7
5	7	9

$\bar{x}$	$P(\bar{x})$
1	1/9
3	2/9
5	3/9
7	2/9
9	1/9



$\mu = 5$

$\sigma = 2.309$

$\sigma^2 = \frac{16}{3}$

$\sigma^2 = \frac{\sigma^2}{n} = \frac{\frac{32}{3}}{2}$

$\bar{x} \to L2$, $P(\bar{x}) \to L3$

use $\boxed{\text{1-Var Stats}}$ with L2 & L3

CLT

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

$\sigma_{\bar{x}}^2 = \frac{\sigma^2}{n}$

Nov 6-1:02 PM

Ages of College students are N.D. with $\mu = 28.5$, $\sigma = 6.2$. $N(28.5, 6.2)$

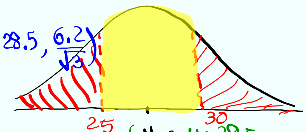
$n = 3$

If we randomly Select $\boxed{3 \text{ students}}$ find the Prob. that $\boxed{\text{their mean age}}$ ($\bar{x}$) is below 25 or above 30.

$P(\bar{x} < 25 \text{ OR } \bar{x} > 30)$

$= 1 - \text{normalcdf}(25, 30, 28.5, \frac{6.2}{\sqrt{3}})$

$= \boxed{.502} \approx 50\%$

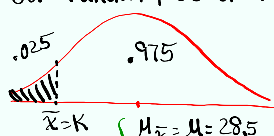


CLT $\begin{cases} \mu_{\bar{x}} = \mu = 28.5 \\ \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{6.2}{\sqrt{3}} \end{cases}$

Find K Such that $P(\bar{x} < K) = .025$

Left Area

For randomly Selected groups of 4 Students.



$\bar{x} = K = \text{invNorm}(.025, 28.5, 3.1)$

$= \boxed{22.4}$ Yrs.

CLT $\begin{cases} \mu_{\bar{x}} = \mu = 28.5 \\ \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{6.2}{\sqrt{4}} = \frac{6.2}{2} = 3.1 \end{cases}$

Nov 6-1:09 PM

Find $Z_{.02}$

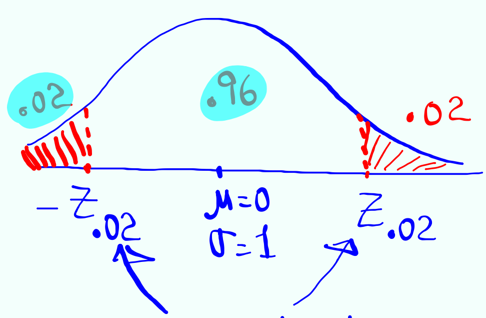
$\frac{\alpha}{2} = .02$ Area of each tail

$\alpha = .04$

Significance lvel

$1 - \alpha = .96$

Confidence level
Middle Area



$Z_{.02} = \text{invNorm}(.98, 0, 1)$

$= \boxed{2.054}$

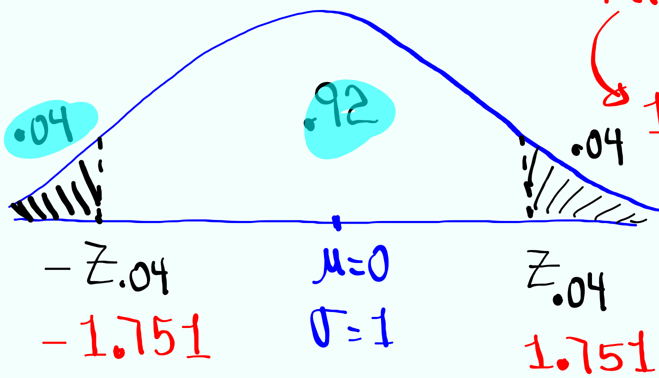
Nov 6-1:38 PM

find $\pm z_{\alpha/2}$ for $\underbrace{92\%\text{ Conf. level}}_{\text{Middle Area } .92}$.

$1 - \alpha = .92$

$\alpha = .08$

$\alpha/2 = .04$



$z_{.04} = \text{invNorm}(.96, 0, 1) = \boxed{1.751}$ C.V.

Nov 6-1:42 PM

find $t_{.01}$ with $df = 14$.

Right Area

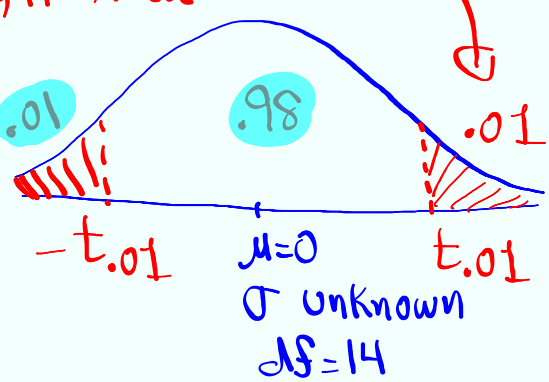
$\frac{\alpha}{2} = .01$

$\alpha = .02$

$1 - \alpha = .98$

C-level 98%

Middle Area



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

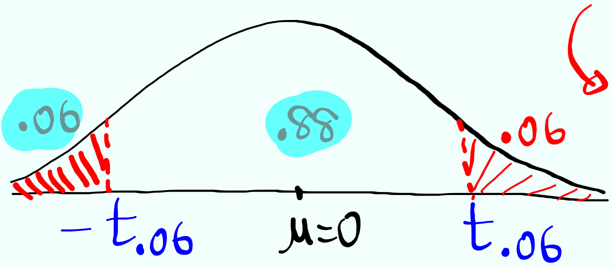
Nov 6-1:46 PM

find $\pm t_{\alpha/2}$ for 88% C-level with $df = 19$.

Middle Area

$.88$

$1 - \alpha = .88$



$\alpha = .12$

$\frac{\alpha}{2} = .06$

$t_{.06} = \text{invT}(.94, 19)$

$= \boxed{1.628}$

C.V.

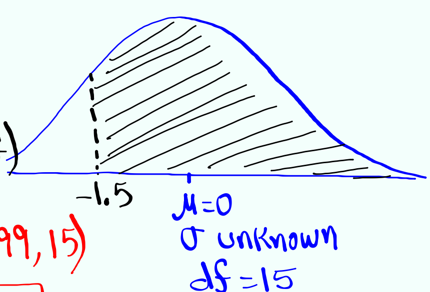
Nov 6-1:50 PM

find $P(t > -1.5)$ with $df = 15$.

$\boxed{\text{2nd}}$

$\boxed{\text{VARS}}$

$\text{tcdf}(L, U, df)$

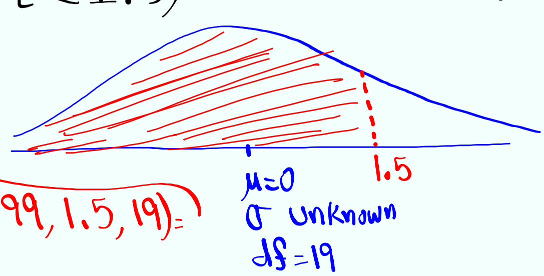


$\text{tcdf}(-1.5, E99, 15)$

$\approx \boxed{.923}$

find $P(t < 1.5)$ with $df = 19$.

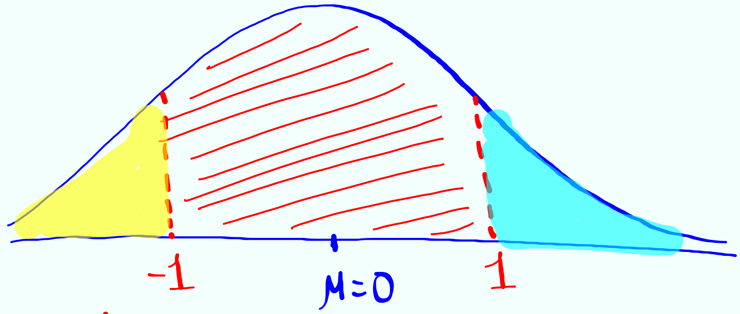
$\boxed{.925}$



$= \text{tcdf}(-E99, 1.5, 19) =$

Nov 6-1:55 PM

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



σ unknown
df = 999

$= tcdf(-1,1,999) = \boxed{.682}$

$P(t<-1$ or $t>1)$ with $df=999$

$= 1 - .682 = \boxed{.318}$

Nov 6-2:00 PM

Chi - Square dist.

χ^2 Dist.

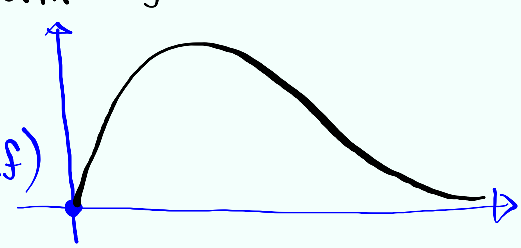
1) Not Symmetric.

2) begins at 0, and Skewed to the right

3) Total Area = 1

4) It Comes with degrees of freedom.

we use
$\chi^2 cdf(L,U,df)$

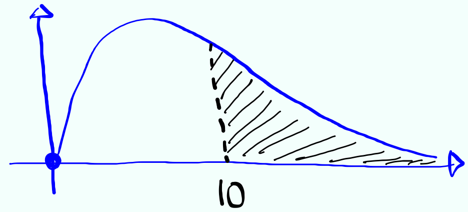


Nov 6-2:06 PM

Find $P(\chi^2 > 10)$ with $df = 8$.

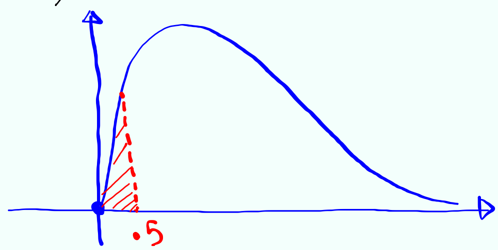
2nd VARS

↓



$= \chi^2\text{cdf}(10, E99, 8) = \boxed{.265}$

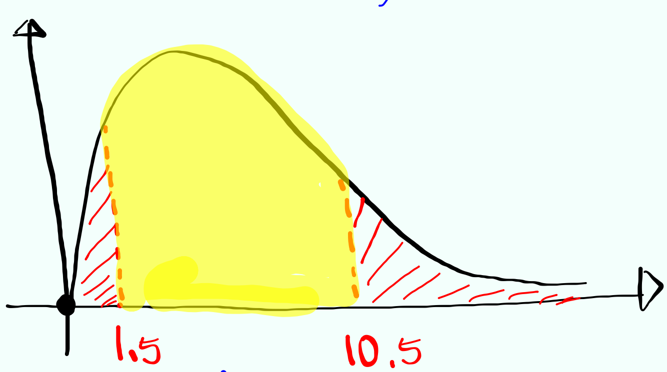
Find $P(\chi^2 < .5)$ with $df = 9$.



$\chi^2\text{cdf}(0, .5, 9) = \boxed{3 \times 10^{-5}}$

Nov 6-2:10 PM

Find $P(\chi^2 < 1.5 \text{ OR } \chi^2 > 10.5)$ with $df = 7$.

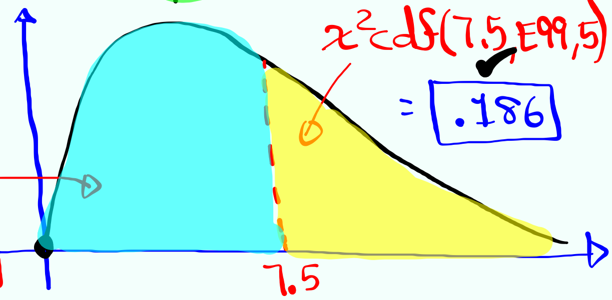


$= 1 - \chi^2\text{cdf}(1.5, 10.5, 7) = \boxed{.180}$

Nov 6-2:15 PM

Find the area on each side of $\chi^2 = 7.5$ with $df = 5$, then multiply the smaller area by 2.

$\chi^2cdf(7.5, E99, 5) = \boxed{.186}$



$\chi^2cdf(0, 7.5, 5) = \boxed{.814}$

$2(.186) = \boxed{.372}$

Nov 6-2:19 PM

F - Dist

1) It is similar to chi-Sqr Dist.

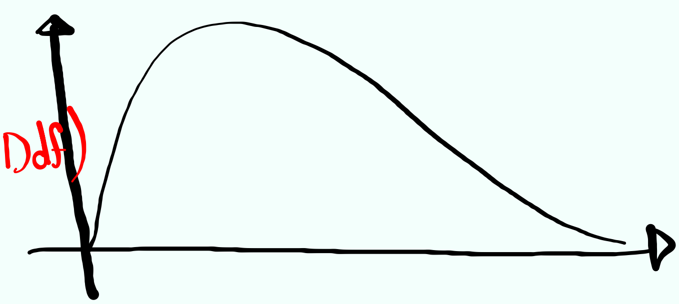
2) It comes with two degrees of freedom

Num. df   Ndf

Deno. df   Ddf

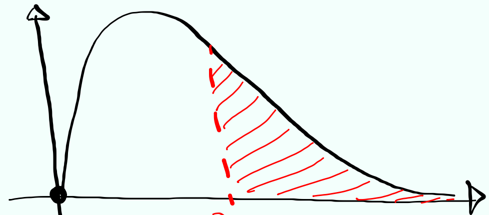
We use

Fcdf(L, U, Ndf, Ddf)



Nov 6-2:26 PM

Find $P(F > 3.75)$ with $Ndf = 5$, $Ddf = 25$.

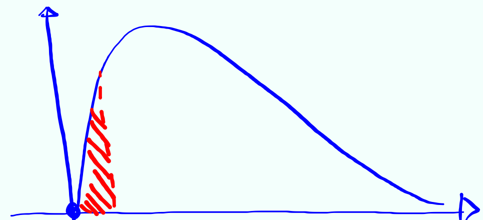


$fcdf(3.75, E99, 5, 25) = \boxed{.011}$

Find $P(F < 1)$ with $Ndf = 4$, $Ddf = 20$.

$fcdf(0, 1, 4, 20)$

$= .569$



Nov 6-2:29 PM

Given $Ndf = 6$, $Ddf = 30$

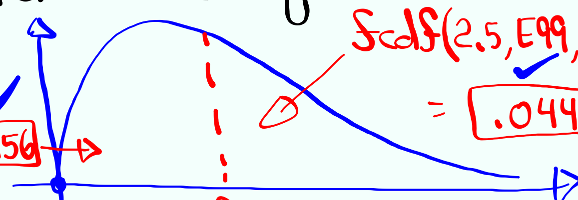
Find area on each side of $F = 2.5$,

multiply smaller area by 2.

$fcdf(2.5, E99, 6, 30)$

$= \boxed{.044}$

$fcdf(0, 2.5, 6, 30) = \boxed{.956}$



$2(.044) = \boxed{.088}$

Nov 6-2:34 PM