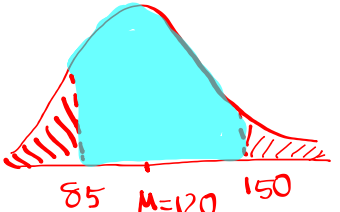
Statistics
Fall 2021
Lecture 21

Class QZ 11

Consider $N(120, 20)$ (μ, σ) — Normal dist



Find

1) $P(x<85 \text{ or } x>150)$

$= 1 - \text{normalcdf}(85, 150, 120, 20) = .107$ ✓

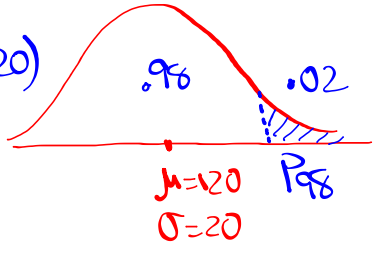
(1 = Total Area)

2) $x = P_{98}$, Round to a whole #.

98% below, 2% above

$x = P_{98} = \text{invNorm}(.98, 120, 20)$ (.98 = Left Area)

$= 161.075 \approx 161$ ✓



Assume ages of all students at the college are normally dist. with $\mu = 30.5$ and $\sigma = 5.5$.

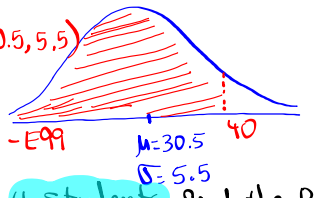
$N(30.5, 5.5)$

If we randomly select one student, find the Prob. that his/her age (x) is below 40 Yrs.

$P(x < 40)$

= normalcdf(-E99, 40, 30.5, 5.5)

= .958 $\approx 96\%$

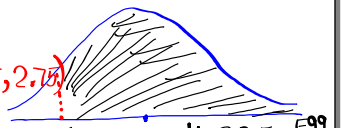


If we randomly select 4 students, find the Prob. that their mean age ($\bar{x}$) is above 25 Yrs.

$P(\bar{x} > 25)$

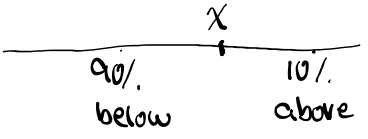
= normalcdf(25, E99, 30.5, 2.75)

= .977 $\approx 98\%$



CLT $\begin{cases} \mu_{\bar{x}} = \mu = 30.5 \\ \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{5.5}{\sqrt{4}} = 2.75 \end{cases}$

Find the age of a student that separates the bottom 90% from the rest.



$x = P_{90}$ = invNorm(.9, 30.5, 5.5)

= 37.549 $\approx$ 37.5

Find the mean age ($\bar{x}$) for randomly selected a group of 5 students that separates the bottom 20% from the rest.

$\bar{x} = P_{20}$ = invNorm(.2, 30.5, 5.5/$\sqrt{5}$)

= 28.430 $\approx$ 28.4

$\bar{x}$ CLT $\begin{cases} \mu_{\bar{x}} = \mu = 30.5 \\ \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{5.5}{\sqrt{5}} \end{cases}$

NBA → National Basketball Association

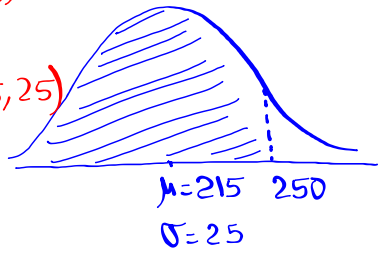
Assume total points scored in games in NBA has a normal dist with mean of 215 pts and standard deviation of 25 points.

$N(215, 25)$

If we randomly select one game, find the Prob. that total points (x) scored is below 250 pts. $P(x < 250)$

= normalcdf(−E99, 250, 215, 25)

= .919 ≈ 92%

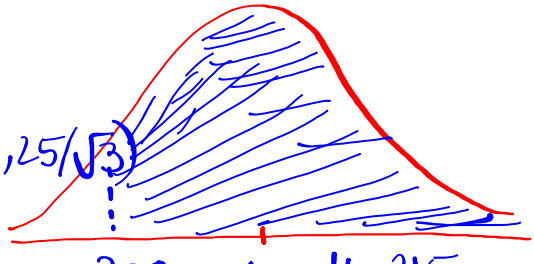


If we randomly select 3 games, find the Prob. that the mean of total pts ($\bar{x}$) scored in each game is above 200 pts.

$P(\bar{x} > 200)$

= normalcdf(200, E99, 215, 25/√3)

= .851 ≈ 85%

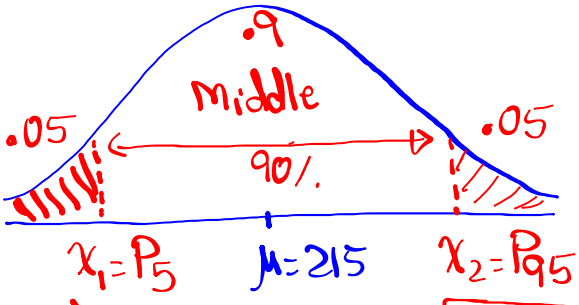


$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{25}{\sqrt{3}}$

Find two total points scored that separate the middle 90% from the rest. Round to a whole #.

$1 - .9 = .1$

$.1 \div 2 = .05$



$x_1 = P_5 = \text{invNorm}(.05, 215, 25)$

$\approx \boxed{174}$

$\sigma = 25$

$x_2 = P_{95} = \text{invNorm}(.95, 215, 25)$

$\boxed{256}$

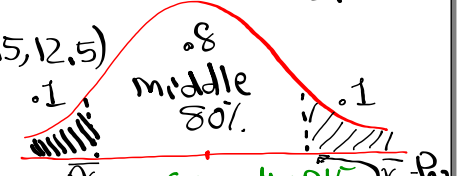
Find two means (of Total Points) for randomly selected group of 4 NBA games, that separate the middle 80% from the rest. $1 - .8 = .2$, $.2 \div 2 = .1$

$\bar{x}_1 = P_{10} = \text{invNorm}(.1, 215, 12.5)$

$\approx \boxed{199}$

$\bar{x}_2 = P_{90} = \text{invNorm}(.9, 215, 12.5)$

$\approx \boxed{231}$



CLT $\begin{cases} \mu_{\bar{x}} = \mu = 215 \\ \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{25}{\sqrt{4}} = 12.5 \end{cases}$

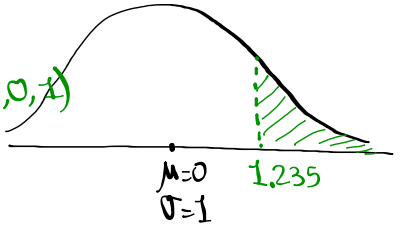
SG 18 - SG 21 ✓

Syllabus, (Extra Credit 1) is due on exam day Next Thursday

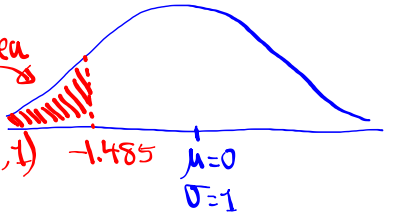
SG 22

Standard Normal Prob. dist
Bell-Shape, Symmetric, Total area = 1,
$\mu = 0$, $\sigma = 1$, use Z-variable.

$P(Z > 1.235)$
= normalcdf(1.235, E99, 0, 1)
= .108



Find twice the area to the left of $Z = -1.485$



2 * normalcdf(−E99, −1.485, 0, 1)
= .138

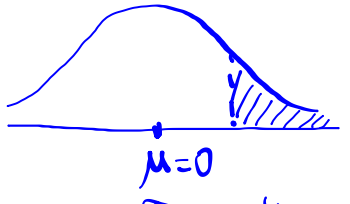
T-Dist.

1) Bell-Shape, Symmetric, Total Area = 1

2) $\mu = 0$, σ unknown

3) This dist. comes with degrees of freedom (df)

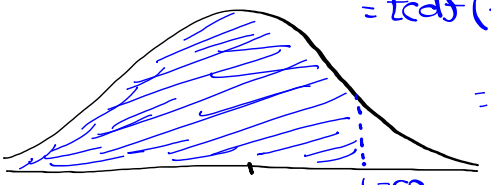
4) Use tcdf to find areas
2nd VARS ↓ tcdf Lower Upper df



Find $P(t<1.789)$ with $df=10$

$= tcdf(-E99, 1.789, 10)$

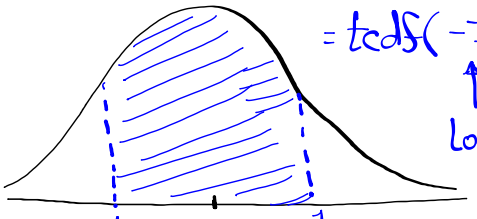
$= .948$



Find $P(-1<t<1)$ with $df=24$.

$= tcdf(-1, 1, 24)$ (Lower, Upper, df)

$= .673$

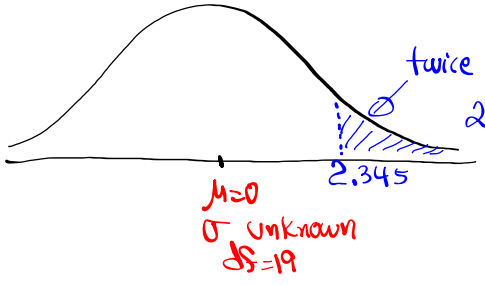


Find twice the area to the right of $t=2.345$ with $df=19$.

twice this area

$2 * tcdf(2.345, E99, 19)$

$= .030$



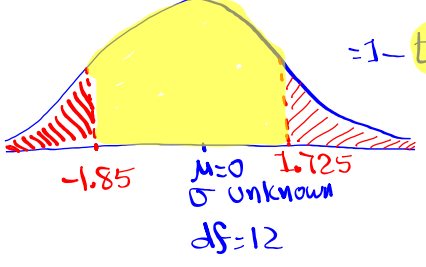
Find $P(t<-1.85 \text{ OR } t>1.725)$ with $df=12$.

$= 1 - tcdf(-1.85, 1.725, 12)$

$= .0996\ldots$

$= .100 \simeq .1$

$= 10\%$



χ^2 - Dist

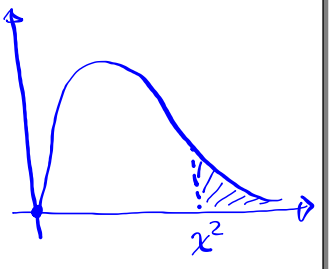
↑

Chi-Square dist

1) Not Bell-shape, Not Symmetric, Total Area=1

2) Starts at 0, and Skewed to the right

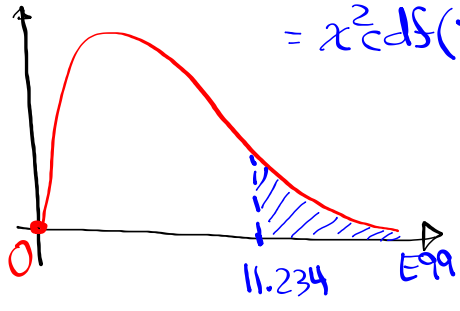
3) χ^2-Dist also comes with degrees of freedom df



4) Use χ^2cdf to find shaded area

2nd | VARS | χ^2cdf | Lower | Upper | df

Find $P(\chi^2 > 11.234)$ with df = 8.

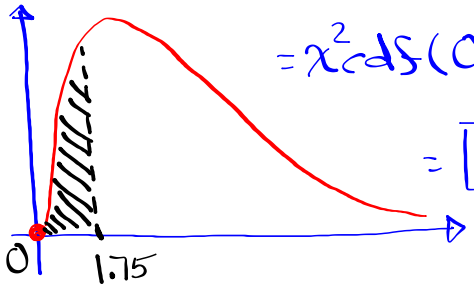


$= \chi^2$cdf(11.234, E99, 8)

Lower, Upper, df

$= .189$

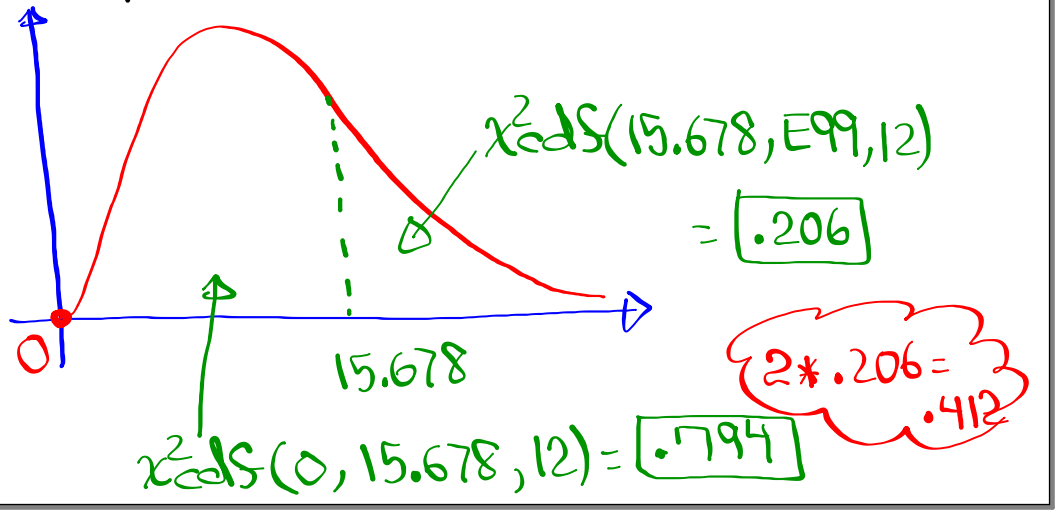
Find $P(\chi^2 < 1.75)$ with df = 19.



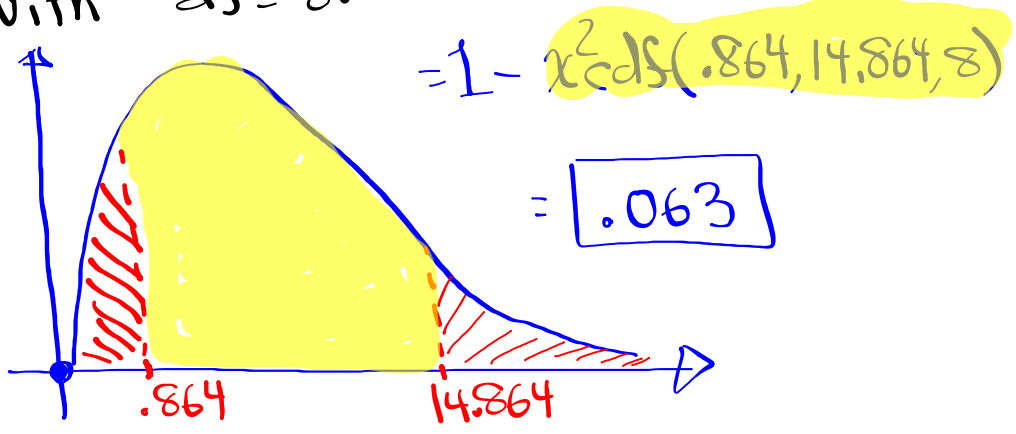
$= \chi^2$cdf(0, 1.75, 19)

$= 1.1 \times 10^{-7}$

Use df = 12, find the area to the left and to the right of $\chi^2 = 15.678$, then multiply the smaller area by 2.



Find $P(\chi^2 < .864 \text{ OR } \chi^2 > 14.864)$ with df = 8.



F-Dist.

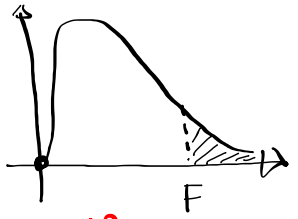
1) Graph is similar to χ^2-Dist.

2) This dist comes with two degrees of freedom.

Ndf Numerator degrees of freedom

Ddf Denominator

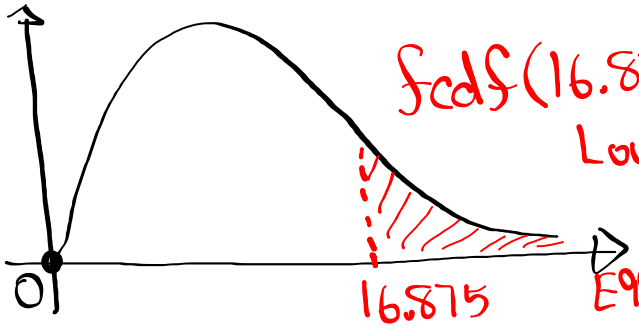
4) Use Fcdf to find the shaded area



2nd VARS Fcdf

Lower, upper, Ndf, Ddf

Find the area to the right of F=16.875 with Ndf=4 & Ddf=30.



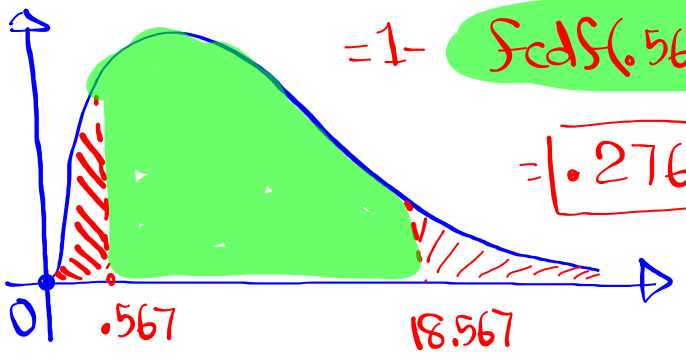
fcdf(16.875, E99, 4, 30)

Lower upper

$= 2.4 \times 10^{-7}$

Find $P(F<.567 \text{ or } F>18.567)$ with

$Ndf = 5$ & $Ddf = 25$.



$= 1 - \text{Fcdf}(.567, 18.567, 5, 25)$

$= .276$

SG 22 (pages 1, 2, and 3)

Class QZ 12

Consider $N(80, 10)$

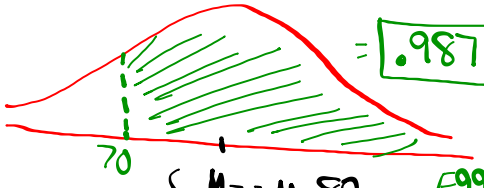
For randomly selected Samples of size 5,

Find

$P(\bar{x} > 70)$

$= \text{normalcdf}(70, E99, 80, 10/\sqrt{5})$

$= .987$



CLT $\begin{cases} \mu_{\bar{x}} = \mu = 80 \\ \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{10}{\sqrt{5}} \end{cases}$

$P(\bar{x} < 90) =$

$\text{normalcdf}(-E99, 90, 80, 10/\sqrt{5})$

$= .987$

CLT $\begin{cases} \mu_{\bar{x}} = \mu = 80 \\ \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{10}{\sqrt{5}} \end{cases}$