Statistics
Fall 2022
Lecture 23

Class Qz 16

1) Consider a geometric Prob. dist. with $p=.3$,

Find $P(x \le 3)$ = geometcdf(.3, 3) = .657 ✓

2) Consider a Poisson Prob. dist. with $\mu=5$, $\lambda=5$

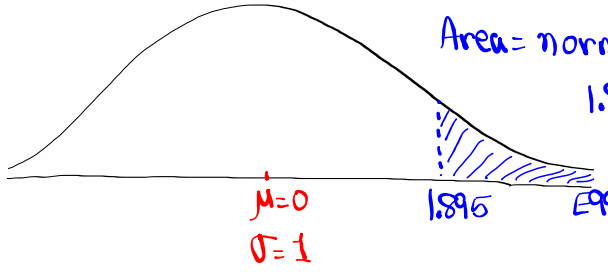
Find $P(x \ge 8) = 1 - P(x \le 7) = 1 - \text{poissoncdf}(5, 7)$

$= .133$ ✓✓

we don't want 7 | we want 8

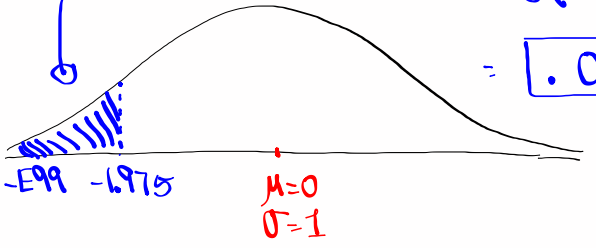
Total Prob.

Find the area to the right of $Z = 1.895$.



Area = normalcdf(1.895, E99, 0, 1) = .029

Find twice the area to the left of $Z = -1.975$



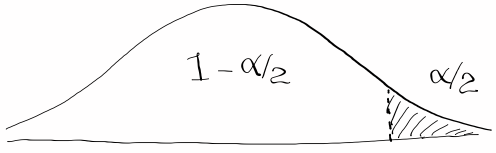
2 * normalcdf(-E99, -1.975, 0, 1) = .048

α Alpha

$0 < \alpha < 1$

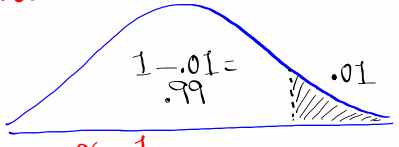
Significance level

$\alpha/2$ is the area on the right side of the graph of prob. dist. curve.



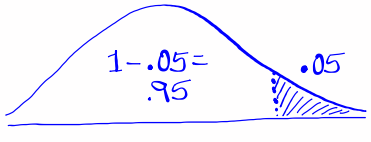
Ex: Suppose $\alpha = .02$

$\alpha/2 = .02/2 = .01$

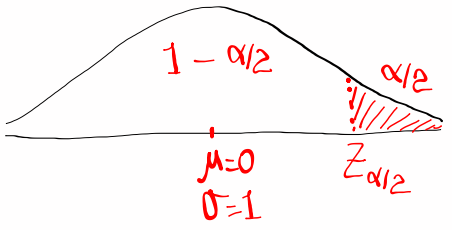


Your turn: Suppose $\alpha = .1$

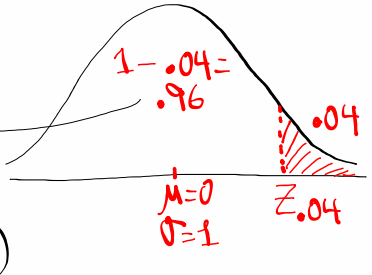
$\alpha/2 = .1/2 = .05$



$Z_{\alpha/2}$ is a critical value with right-tail area of $\alpha/2$.



$Z_{.04}$ ← Right-Tail Area



How to find it?

$Z_{.04}$ = invNorm(.96, 0, 1)

= 1.751

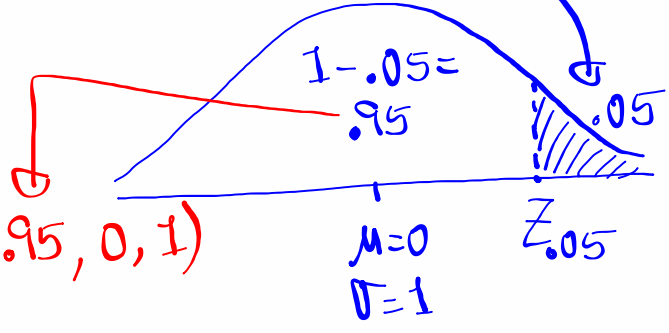
$\alpha/2 = .04$

Multiply by 2 → $\alpha = .08$

Given $\alpha = .1$

Find $Z_{\alpha/2} = Z_{.05}$ ← Right-Tail Area

$\alpha/2 = .1/2 = .05$



$Z_{.05}$ = invNorm(.95, 0, 1)

= 1.645

Given $\alpha = .01$

Find $Z_{\alpha/2} = Z_{.005}$

Right-Tail Area

$\alpha/2 = .01/2 = .005$

2.576

$1 - .005 = .995$

.005

$\mu = 0$

$\sigma = 1$

$Z_{.005}$

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

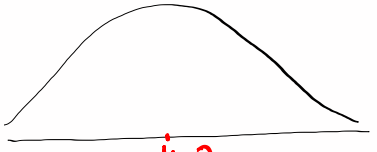
t - Distribution

1) It has a bell-Shape dist. Curve.

2) It is Symmetric with total Area = 1.

3) $\mu = 0$ but σ is unknown

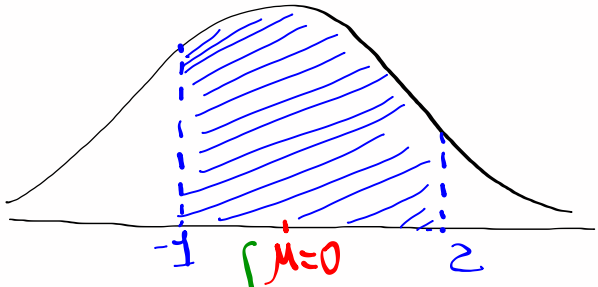
4) It comes with degrees of freedom.



To find $P(a < t < b)$ use tcdf(L, U, df) 2nd VARS

To find $t_{\alpha/2}$ use invT(LeftArea, df)

Find $P(-1 < t < 2)$ with $df = 9$.

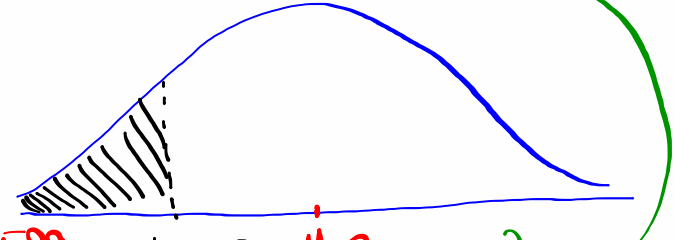


2nd VARS

L U df → t-dist { μ=0, σ unknown, df=9

tcdf(-1, 2, 9) = .790

Find the area to the left of $t = -1.385$ with $df = 15$.

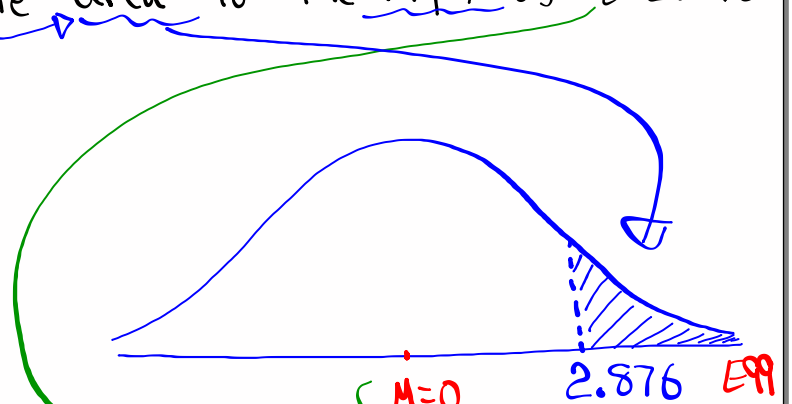


L U df → t-dist { μ=0, σ unknown, df=15

tcdf(-E99, -1.385, 15)

= .093

Find twice the area to the right of $t=2.876$ with $df=19$.

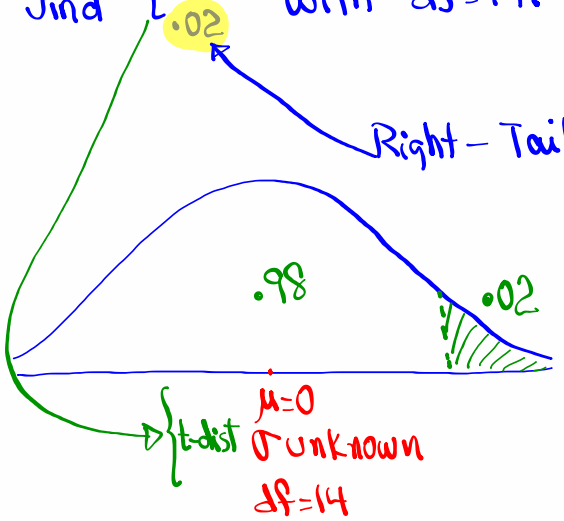


t-dist. { $\mu=0$, σ unknown, $df=19$

$2 * tcdf(2.876, E99, 19)$ (L, U, df)

$= .010$

Find $t_{.02}$ with $df=14$.



Right-Tail Area

Left Area

$t_{.02} = invT(.98, 14)$ (df)

$= 2.264$

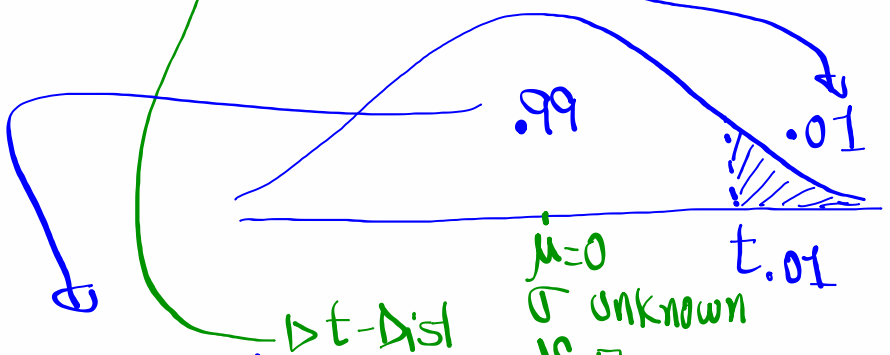
t-dist $\mu=0$, σ unknown, $df=14$

If you don't have invT ⇒ Download one of those Apps recommended in the Syllabus

Find $t_{\alpha/2}$ for $\alpha = .02$ with $df = 7$.

$\alpha/2 = .02/2 = .01$

So we want $t_{.01}$ ← Right-Tail Area



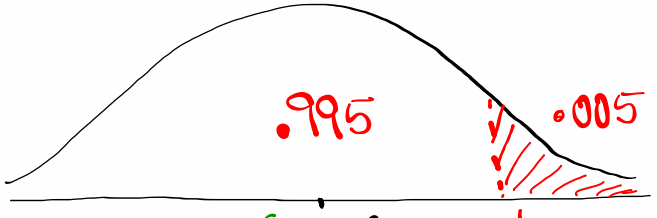
$t_{.01} = \text{invT}(.99, 7) = \boxed{2.998}$

Find $t_{.005}$ with $df = 24$.

$\frac{\alpha}{2} = .005$

$\alpha = 2(.005) = \boxed{.01}$

Right-Tail Area



Left Area

t-Dist { μ=0, σ unknown, df = 24

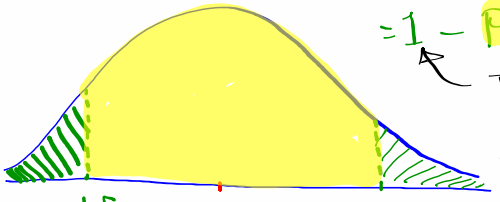
$t_{.005} = \text{invT}(.995, 24)$

$= \boxed{2.797}$

Find $P(t<-1.5 \text{ OR } t>1.875)$ with $df=15$.

$= 1 - P(-1.5<t<1.875)$ ← Total Area

$= 1 - tcdf(-1.5, 1.875, 15)$ (L, U, df)



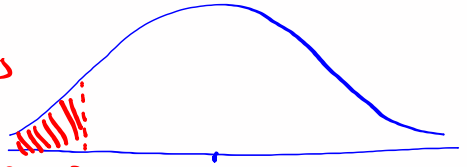
↑ unknown
$df=15$

$= .117$

Find twice the area to the left of $t=-3.456$ with $df=18$.

$2*tcdf(-E99, -3.456, 18)$

$= .003$



↑ unknown, $df=18$

Chi-Square dist.:

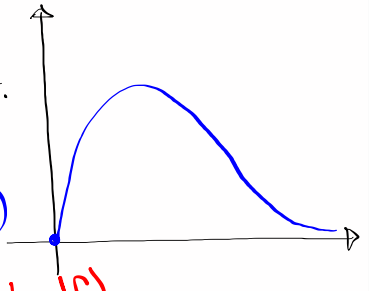
χ^2-dist.

1) Graph begins at 0, and it is skewed to the right.

2) Total Area = 1, but no Symmetry

3) $\chi^2 \geq 0$

4) It comes with df.



To find $P(a<\chi^2<b)$

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

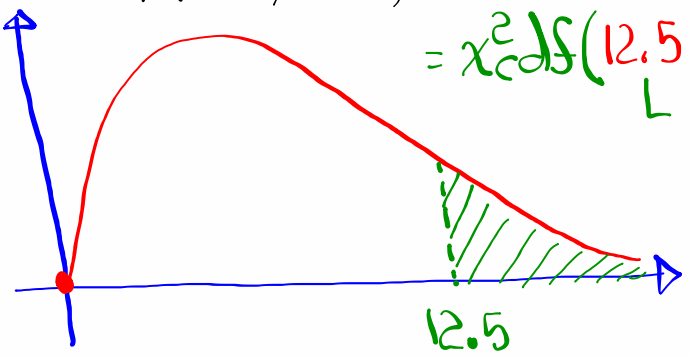
↑

2nd VARS

Find $P(\chi^2 > 12.5)$ with $df = 6$

$= \chi^2cdf(12.5, E99, 6, df)$
(L, U)

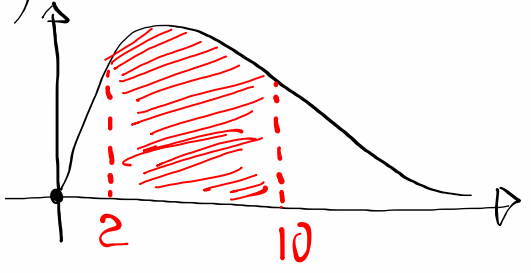
$= .052$



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

$= \chi^2cdf(2, 10, 8)$

$= .716$

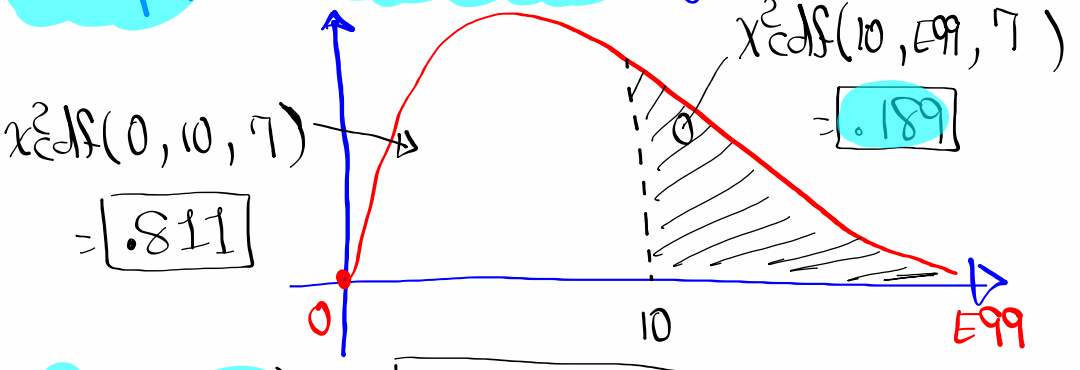


Find twice the area to the left of $\chi^2 = 1.5$ with $df = 10$.

$2 * \chi^2cdf(0, 1.5, 10) = 1.5 \rightarrow .002$

Given: $\chi^2 = 10$, $df = 7$

Find the area on each side of $\chi^2 = 10$, then multiply the smaller area by 2.

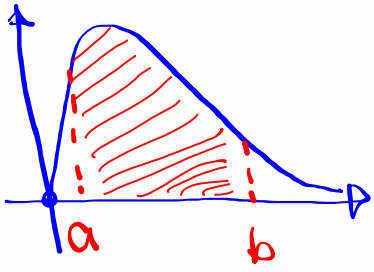


$2(.189) = .378$

F – Dist.:

1) Graph is similar to χ^2-Dist. graph

2) It comes with two df.
   Numerator df $\Rightarrow$ Ndf
   Denominator df $\Rightarrow$ Ddf



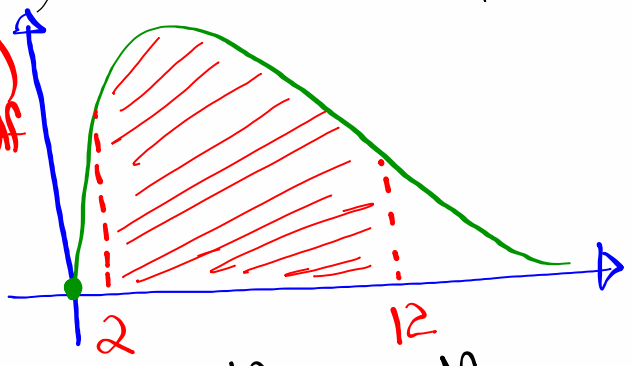
To find $P(a < F < b)$

use fcdf(L, U, Ndf, Ddf)

Find $P(2 < F < 12)$ with Ndf = 5 & Ddf = 20

fcdf(2, 12, 5, 20)
L, U, Ndf, Ddf

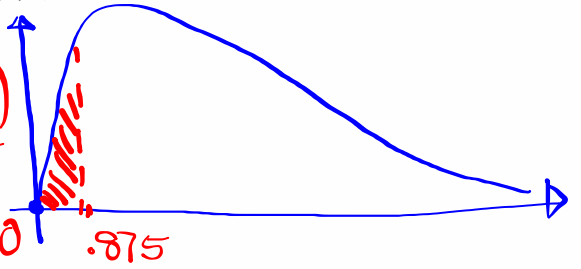
= .122



Find $P(F < .875)$ with Ndf = 4, Ddf = 30

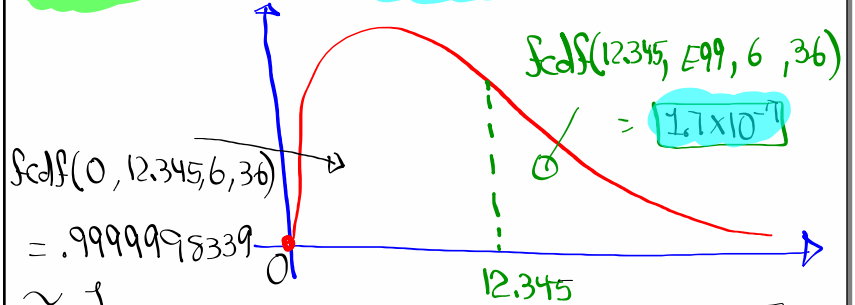
fcdf(0, .875, 4, 30)
L, U, Ndf, Ddf

= .510



Find the area on each side of $F = 12.345$ with Ndf = 6 & Ddf = 36.

Multiply the smaller area by 2.



$2(1.7 \times 10^{-7}) = 3.3 \times 10^{-7}$

2 * fcdf(12.345, E99, 6, 36)