Math 110

Winter 2021

Lecture 17

Find minimum sample size needed to construct 96% conf. interval for population proportion and margin of error not to exceed 3% is

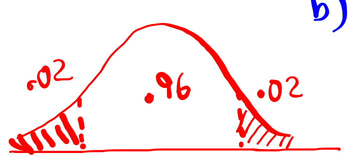
a) $\hat{p} = .25 \quad \hat{q} = .75$

$n = \hat{p}\hat{q}\left(\frac{Z_{\alpha/2}}{E}\right)^2$

$= (.25)(.75)\left(\frac{2.054}{.03}\right)^2$

$= 878.94\ldots$

$\boxed{n = 879}$



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

$= 2.054$

b) $\hat{p}$ and $\hat{q}$ are unknown

$n = .25\left(\frac{Z_{\alpha/2}}{E}\right)^2$

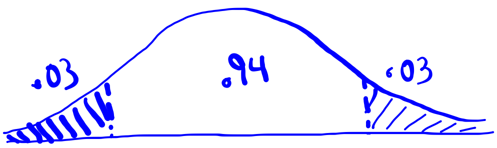
$= .25\left(\frac{2.054}{.03}\right)^2$

$= 1171.921\ldots$

$\boxed{n = 1172}$

Find minimum Sample Size needed if we wish to construct 94% Conf. interval for population mean and margin of error not to exceed 25 assuming that Population standard deviation is 80.

$$n = \left(\frac{z_{\alpha/2} \cdot \sigma}{E}\right)^2 = \left(\frac{1.881 \cdot 80}{25}\right)^2 = 36.23\ldots$$



$$\boxed{n = 37}$$

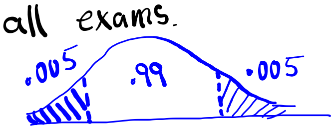
$z_{.03} = \text{invNorm}(.97, 0, 1) = 1.881$

15 randomly Selected exams had a mean of 82.5 with standard deviation of 9.2.

$n = 15$, $\bar{x} = 82.5$

$s = 9.2$

1) Find $z_{\alpha/2}$ or $t_{\alpha/2}$ for constructing 99% Conf. interval for the mean of all exams.



Since σ unknown

$\Rightarrow$ use t-dist

$df = n-1 = 14$ $\quad t_{.005} = \text{invT}(.995, 14) = 2.977$

2) Find 99% Conf. interval for the mean of all exams.

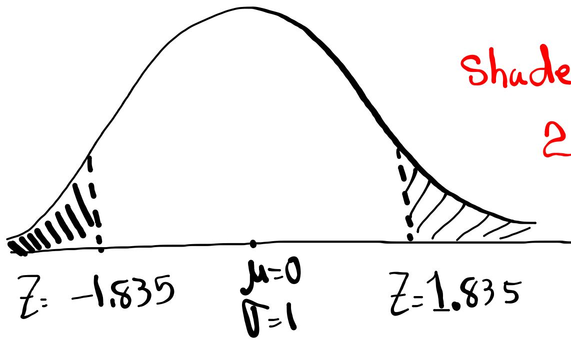
$\boxed{75.4 < \mu < 89.6}$

σ Known $\Rightarrow$ Z Interval

$\boxed{\sigma \text{ Unknown} \Rightarrow \text{T Interval}}$

3) Find the margin of error. $E = \dfrac{89.6 - 75.4}{2} = \boxed{7.1}$

Find the shaded area

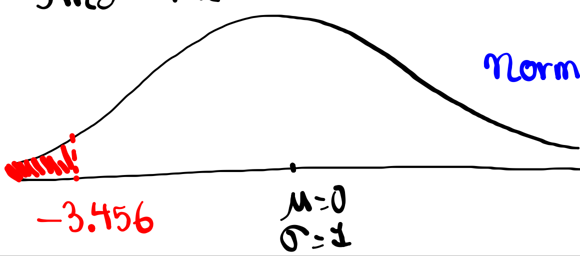


Shaded area=

2 * normalcdf(1.835, E99, 0, 1)

= $\boxed{.067}$

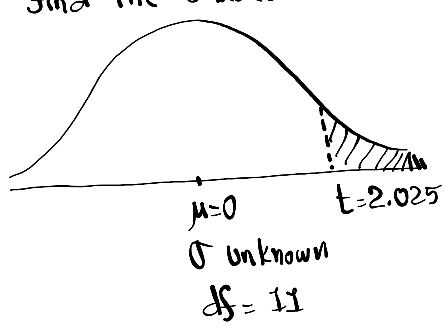
Find the shaded area below



normalcdf(-E99, -3.456, 0, 1)

= $\boxed{2.7 \times 10^{-4}}$

Find the shaded area below

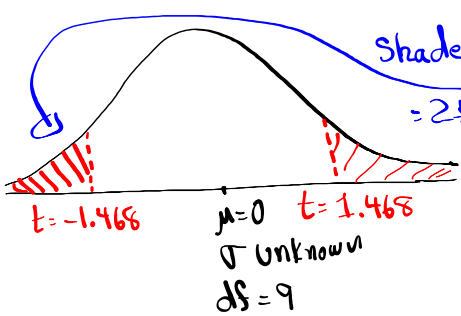


L U df

tcdf(2.025, E99, 11)

= $\boxed{.034}$

Find the shaded area below:



Shaded area

= 2 * $\boxed{\text{tcdf}(-E99, -1.468, 9)}$

$\boxed{.176}$

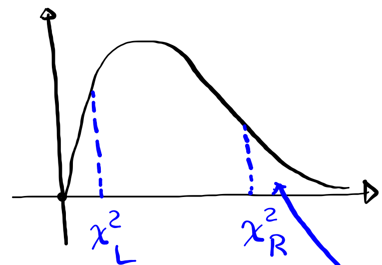
Chi-Square distribution

1) graph starts at 0, and skewed to the right

2) Not Symmetric

3) Total Area = 1

4) It comes with df as well.



chi-sqr Left

chi-sqr Right

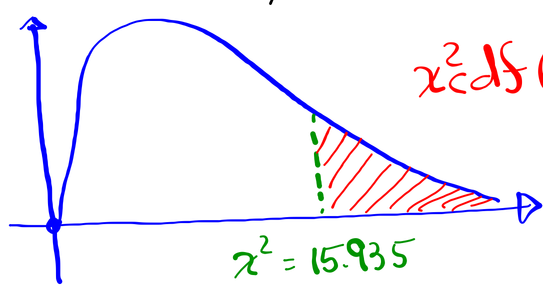
To find the area

2nd

VARS

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

Find $P(\chi^2 > 15.935)$ with $df = 8$



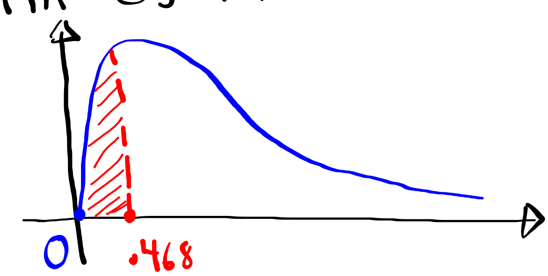
$\chi^2cdf(15.935, E99, 8)$

$= \boxed{.043}$

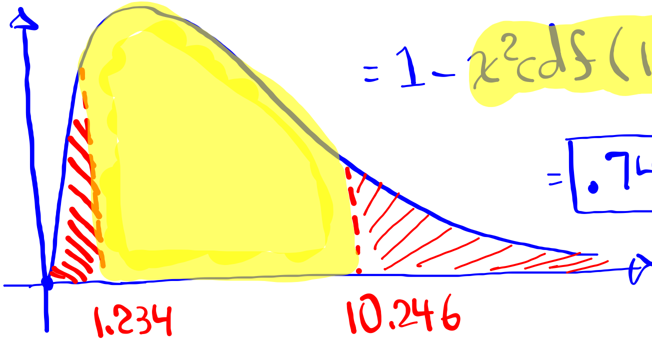
Find $P(\chi^2 < .468)$ with $df = 12.$

$\chi^2cdf(0, .468, 12)$

$= \boxed{1.87 \times 10^{-7}}$



Find $P(\chi^2 < 1.234 \text{ OR } \chi^2 > 10.246)$ with $df = 14$.



$= 1 - \chi^2cdf(1.234, 10.246, 14)$

$= \boxed{.744}$

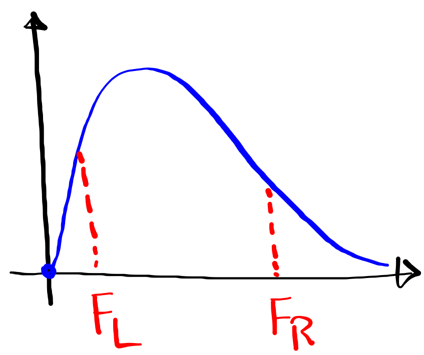
F Distribution

1) Graph is Similar to Chi-sqr dist.

2) This comes with two degrees of freedom:

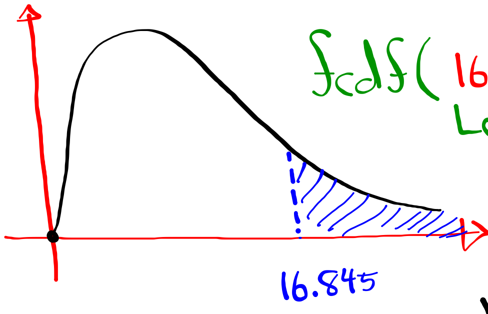
Numerator df $\Rightarrow$ Ndf

Denominator df $\Rightarrow$ Ddf



Use 2nd VARS Fcdf

Find $P(F > 16.845)$ with Ndf=4 & Ddf=20



Fcdf(16.845, E99, 4, 20)
Lower, upper, Ndf, Ddf

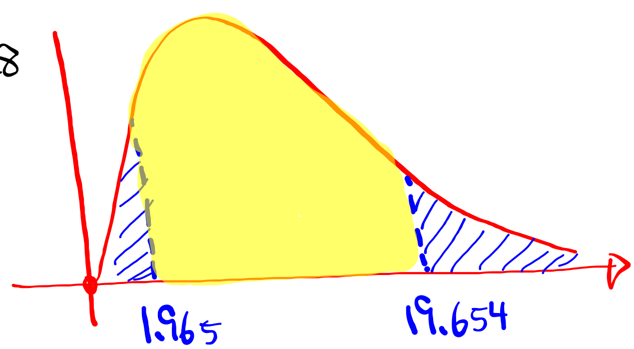
$= \boxed{3.4 \times 10^{-6}}$

Find $P(F < .864)$ with Ndf=5, Ddf=25.

Fcdf (0, .864, 5, 25)

$= \boxed{.481}$

Find $P(F < 1.965$ OR $F > 19.654)$ with Ndf= 4, Ddf=28



$= 1 -$ Fcdf(1.965, 19.654, 4, 28) $= \boxed{.873}$

SG 25✓

Ch. 8 Testing Claims

Claims can be made about one Population

- Proportion P
- Mean μ
- Standard deviation σ

Our goal is to test the claim

Conclusion is to

- Reject the claim
- Fail-to reject the claim. (support the claim)

With every testing, we must have a Significance level α, $0<\alpha<1$

Some Common Significance level are

.1, .05, .02, .01

If α not given $\Rightarrow$ use .05

Testing Methods:

- Traditional Method

- P-Value Method

Regardless of the method, Conclusion must be the Same.

- Reject the claim

- Fail-to-Reject the claim.

There are three types of testing:

1) Left-Tail Test $\Rightarrow$ LTT

2) Right-Tail Test $\Rightarrow$ RTT

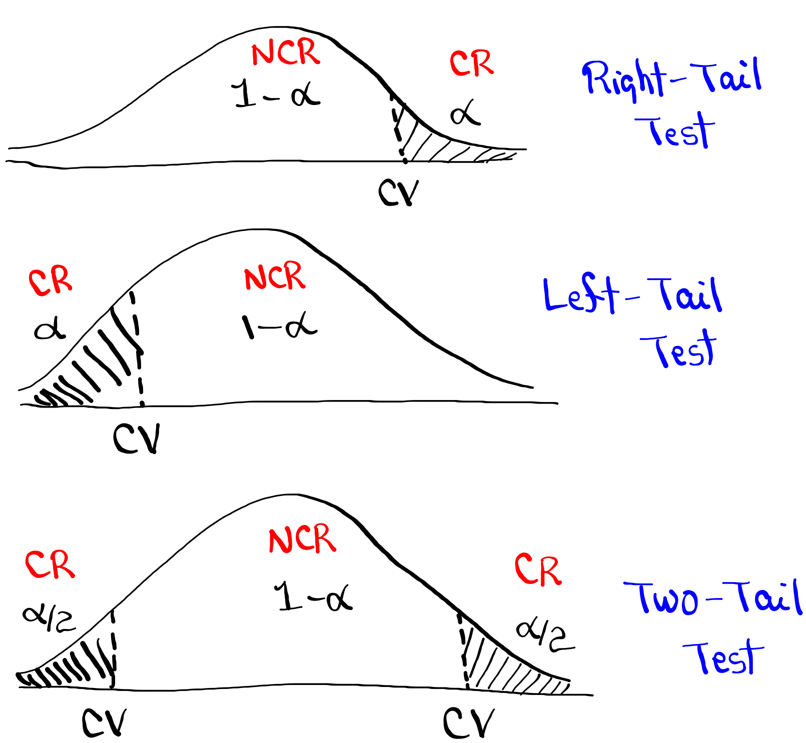
3) Two-Tail Test $\Rightarrow$ TTT

Possibilities of making error:

If we reject a valid claim.

If we support a false claim.

Significance level α represents an area in the graph of distribution called Critical Region, the rest of area is called Non-Critical Region. The value that separates CR from NCR is called Critical Value.



$H_0 \Rightarrow$ Null Hypothesis

$H_1 \Rightarrow$ Alternative Hypothesis

H_0 must contain = Sign $\Rightarrow =, \geq, \leq$

H_1 Cannot contain = Sign. $\Rightarrow \neq, <, >$

Key words for H_0:

is, get, equal, at least, at most, ...

Key words for H_1:

is not, not equal, different, more than, less than

exceed, fewer than, ...

$P(H_0 \text{ is True}) = 1-\alpha = P(H_1 \text{ is False})$

$P(H_1 \text{ is True}) = \alpha = P(H_0 \text{ is False})$

Possible outcomes

	H_0 True	H_0 False
Support H_0	✓	Type II Error
Reject H_0	Type I Error	✓

$P(\text{Type I error}) = \alpha$

$P(\text{Type II error}) = 1 - \alpha$

$H_0: =$	$H_0: \geq$	$H_0: \leq$
$H_1: \neq$	$H_1: <$	$H_1: >$
Two-Tail Test	Left-Tail Test	Right-Tail Test

CNN claims that 35% of all students are in favor of remote learning.

$H_0: P = .35$ Claim

$H_1: P \neq .35$ TTT

If H_0 is true but I reject it

Type I error.

Fox News claims that the mean Salary of all nurses is at least $6200/mo.

$\mu \geq 6200$

$H_0: \mu \geq 6200$ claim

$H_1: \mu < 6200$ LTT

Assume H_0 is false but I support it.

Type II error.

Dept. of education claims that standard deviation of all SAT exams is more than 100.

>100

$H_0: \sigma \leq 100$

$H_1: \sigma > 100$ claim, RTT

SG 26 ✓

Final exam: Next Thursday