

Math 110
Winter 2021
Lecture 17



Find minimum sample size needed if we wish to
 construct 96% confidence interval for population
proportion with margin of error not to exceed 3%.

and

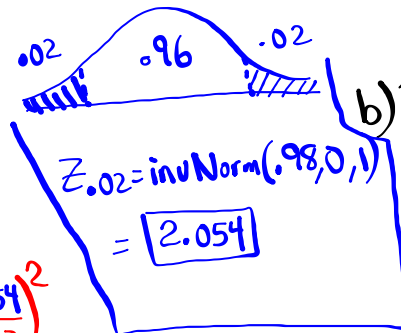
a) $\hat{p} = .25$

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

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

$$= 878.94 \dots$$

$$\boxed{n = 879}$$



b) $\hat{p} \approx \hat{q}$ unknown

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

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

$$= 1171.92 \dots$$

$$\boxed{n = 1172}$$

Find minimum Sample Size needed if we wish to
Construct 94% Conf. interval for population mean
with margin of error not to exceed 20 and
assume the standard deviation of all is 95.

$$n = \left(\frac{Z_{\alpha/2} \cdot \sigma}{E} \right)^2 = \left(\frac{1.881 \cdot 95}{20} \right)^2$$

$$= 79.829 \dots$$

$$\boxed{n=80}$$



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

12 SAT exams had a mean of 1250 and
Stand. dev. of 100.

$$n=12 \quad \bar{x}=1250 \\ S=100$$

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

σ unknown $\Rightarrow t_{\alpha/2}$
 $df = n - 1 = 11$



$$t_{.005} = \text{invT}(.995, 11) \\ = 3.106$$

2) Find 99% Conf. interval for the mean of all
SAT exams. C-level: .99

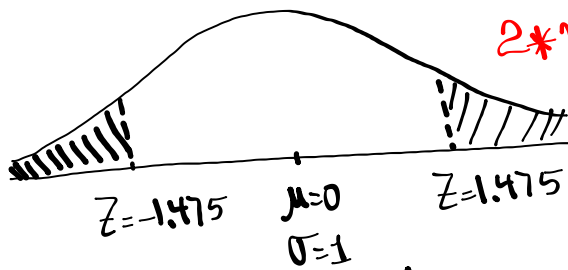
$$\boxed{1160 < \mu < 1340}$$

σ known $\Rightarrow Z$ Interval
 σ unknown $\Rightarrow T$ Interval

3) Find the margin of error.

$$E = \frac{1340 - 1160}{2} \\ = \boxed{90}$$

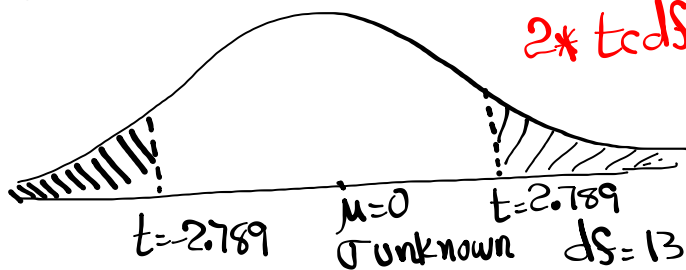
Find the Shaded area below



$$2 * \text{Normalcdf}(1.475, E99, 0, 1)$$

$$= \boxed{.140}$$

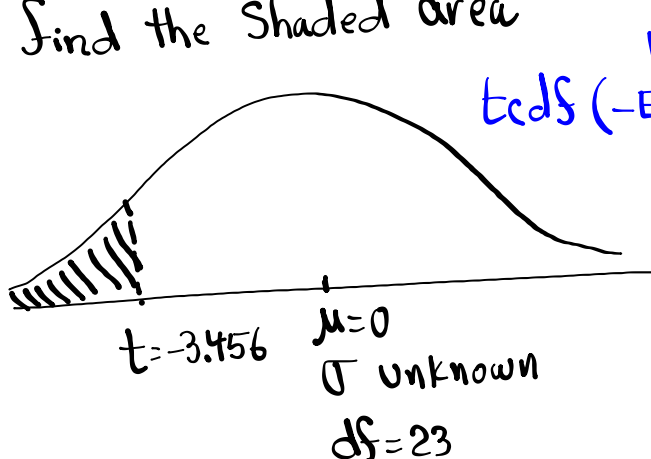
Find the Shaded area below



$$2 * \text{tcdf}(2.789, E99, 13)$$

$$= \boxed{.015}$$

Find the Shaded area



$$\text{tcdf} \left(\overset{L}{-E99}, \overset{U}{-3.456}, \overset{df}{23} \right)$$

$$= \boxed{.001}$$

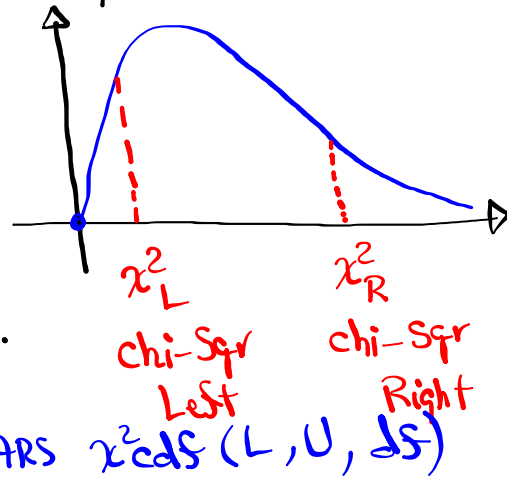
Chi-Square Dist

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

2) Total Area = 1

3) Not Symmetric

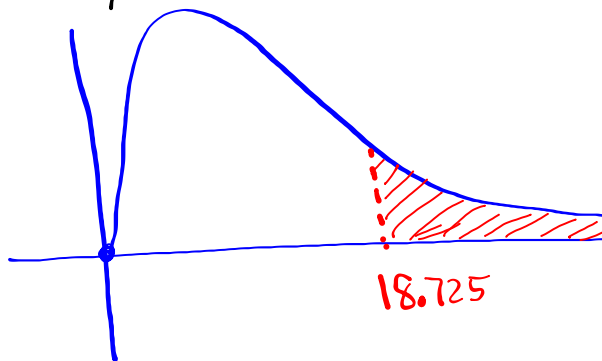
4) It comes with df .



Find $P(\chi^2 > 18.725)$ with $df = 9$.

$$\chi^2cdf(18.725, E99, 9)$$

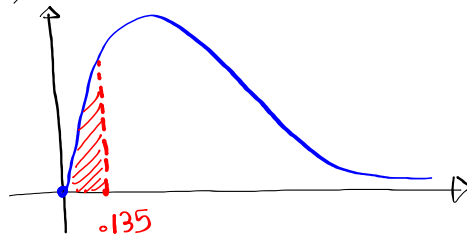
$$= \boxed{.028}$$



Find $P(\chi^2 < .135)$ with $df=12$

$$= \chi^2_{cdf}(0, .135, 12)$$

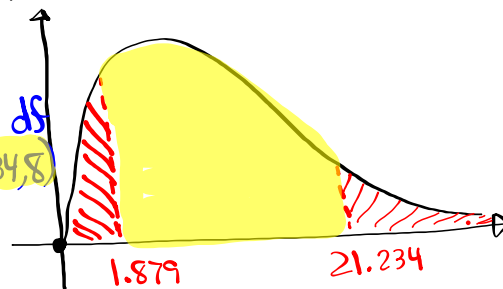
$$= \boxed{1.24 \times 10^{-10}}$$



Find $P(\chi^2 < 1.879 \text{ OR } \chi^2 > 21.234)$ with $df=8$

$$= 1 - \chi^2_{cdf}(L, U, df)$$

$$= \boxed{.022}$$



F Dist

1) Graph is similar to chi-sqr dist.

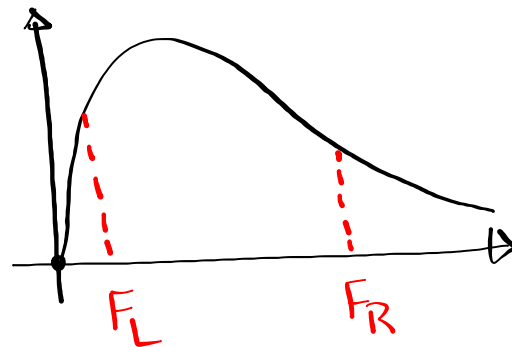
2) Not symmetric

3) Total area = 1

4) It comes with two degrees of freedom

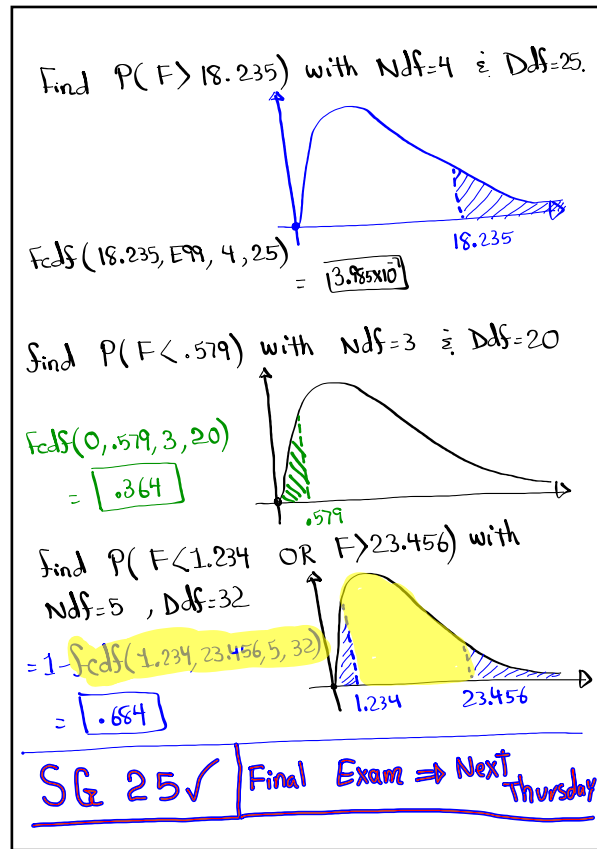
Numerator $df \Rightarrow Ndf$

Denominator $df \Rightarrow Ddf$



2nd VARS

$F_{cdf}(L, U, Ndf, Ddf)$



TESTING Claims SG 26-28

The claim could be about one Population

- Proportion P
- Mean μ
- Stand. Dev. σ

Our objective is to
make Conclusion:

Reject the claim

OR

Fail-to-Reject the claim
Support

Methods of Testing:

- Traditional Method

- P-value Method

Regardless of the method, final conclusion is

Reject the claim OR Fail-to-Reject the claim

Type of testings:

1) Left-Tail Test

2) Right-Tail Test

3) Two-Tail Test

with every testing,

there is a

Significance level α .

$$0 < \alpha < 1$$

Some Common Values

for Significance level:

.1, .05, .02, .01

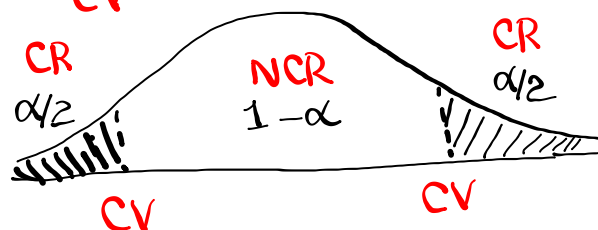
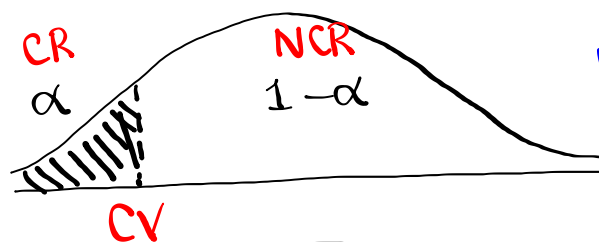
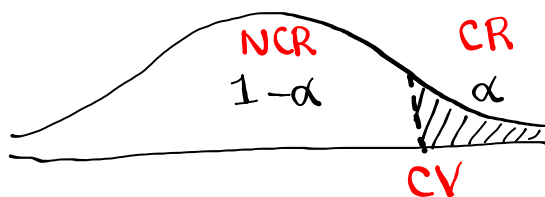
If α not given \Rightarrow use .05

What is α represent?

α is the area of the region of distribution called **Critical region**.

$1-\alpha$ is the area of the **non-critical region**.

The value that separates the **CR** and **NCR** is called Critical Value.



H_0 & H_1 :

$H_0 \Rightarrow$ Null Hypothesis \Rightarrow Must contain = Sign
 $=, \geq, \leq$

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

Key words:

is, get, equal, become, at least H_0
 at most

is not, not equal, different, more than,
 less than, exceed, below, above,
 fewer than H_1

$H_0: =$

$H_0: \geq$

$H_0: \leq$

$H_1: \neq$

$H_1: <$

$H_1: >$

Two-Tail
Test

Left-Tail Test

Right-Tail test

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

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

Possible outcomes & Actions

Action \ Reality	H_0 True	H_0 False
Support H_0	✓	Type II Error
Reject H_0	Type I Error	✓

CNN reported that 30% of all students are in favor of remote learning.

$H_0: P = .3$ claim

$H_1: P \neq .3$ TTT

Assume H_0 is valid but I reject it.

Type I error

I reject the claim that 30% of all students are in support of remote learning.

FOX News claims that the mean Salary of all nurses is at most \$6500/mo.

$$H_0: \mu \leq 6500 \text{ claim}$$

$$H_1: \mu > 6500 \text{ RTT}$$

Assume H_0 is false, but I support it
Type II error

I support that the mean Salary of all nurses is at most 6500.

LA Times claims that stand. dev. of monthly rent of all apartments is less than \$250/mo.

$$H_0: \sigma \geq 250$$

$$H_1: \sigma < 250 \text{ claim, LTT}$$

I support the claim that stand. dev. of all is at least 250.

I support H_0

If H_0 is false and I support it \Rightarrow Type II error.

SG 26✓