Statistics

Lecture 26

Feb 19-8:47 AM

Chi-Square Dist.

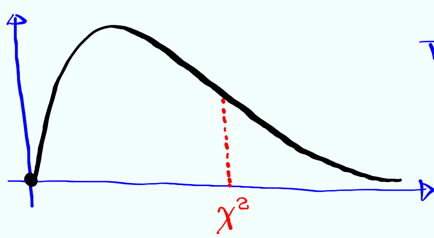
χ^2

1) Graph begins at 0 and it is positively Skewed.

2) Not Symmetric, Not bell-Shape

3) Total area under the curve is 1.

4) It comes with degrees of freedom.



To find Prob. (Area), we use TI

$\boxed{2nd}$ $\boxed{VARS}$

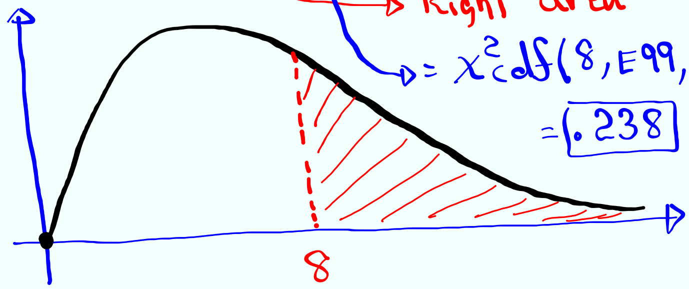
$\boxed{\chi^2 cdf}$

Lower, upper, df

Dec 3-10:44 AM

ex: find $P(\chi^2 > 8)$ with $df = 6$.

Right area

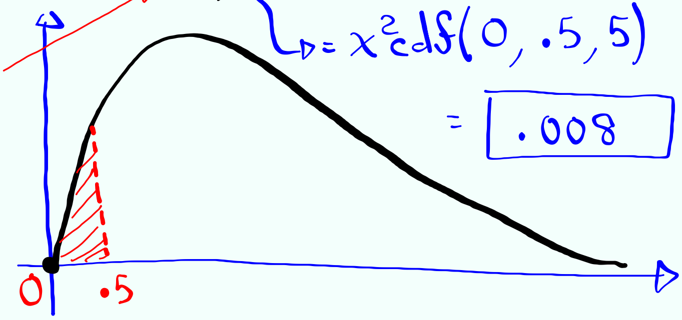


$= \chi^2cdf(8, E99, 6)$

$= \boxed{.238}$

ex: find $P(\chi^2 < .5)$ with $df = 5$.

Left-Area



$= \chi^2cdf(0, .5, 5)$

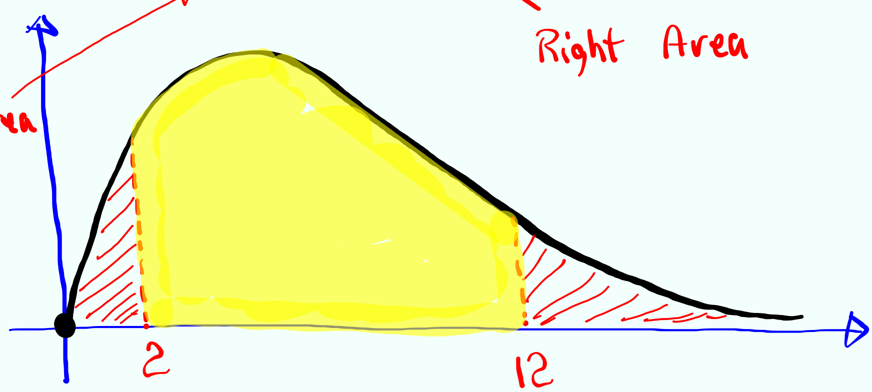
$= \boxed{.008}$

Dec 3-10:49 AM

find $P(\chi^2 < 2 \text{ OR } \chi^2 > 12)$ with $df = 8$.

Left-Area

Right Area



$= 1 - P(2 < \chi^2 < 12) = 1 - \chi^2cdf(2, 12, 8)$

Total Area

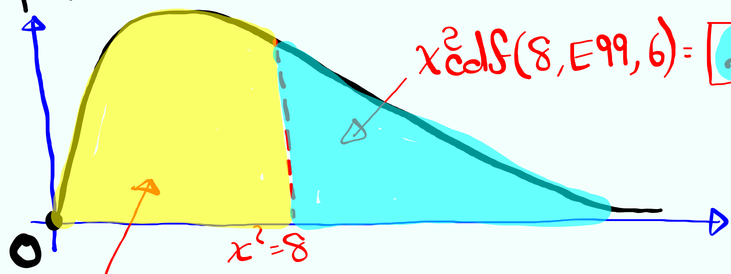
$= \boxed{.170}$

Dec 3-10:55 AM

Given $\chi^2 = 8$, $df = 6$

Find the area on each side of $\chi^2 = 8$, then multiply the smaller area by 2.

$\chi^2cdf(8, E99, 6) = \boxed{.238}$ ✓



$\chi^2cdf(0, 8, 6) = \boxed{.762}$ ✓

$2 \cdot \text{Smaller Area} = 2(.238) = \boxed{.476}$

Dec 3-10:59 AM

Testing one population Standard deviation σ:

$H_0: \sigma = \sigma_0$	$H_0: \sigma \geq \sigma_0$	$H_0: \sigma \leq \sigma_0$
$H_1: \sigma \neq \sigma_0$	$H_1: \sigma < \sigma_0$	$H_1: \sigma > \sigma_0$
TTT	LTT	RTT

CTS $\chi^2 = \dfrac{(n-1)s^2}{\sigma^2}$ P-Value: use $\boxed{\chi^2cdf}$

$df = n - 1$

Dec 3-11:06 AM

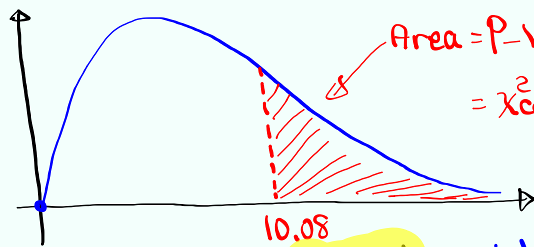
Given: $\boxed{H_0: \sigma \le 10}$ $\boxed{\text{claim is } H_0}$

$df = n-1 = 7$ $n = 8$ $S = 12$ $\boxed{\alpha = .02}$

Test the claim. $H_0: \sigma \le 10$ claim

$H_1: \sigma > 10$ RTT

CTS $\chi^2 = \dfrac{(n-1)S^2}{\sigma^2} = \dfrac{(8-1)\cdot 12^2}{10^2} = \boxed{10.08}$



Area = P-Value

$= \chi^2\text{cdf}(10.08, E99, 7)$

$= \boxed{.184}$

P-Value > α H_0 valid → Valid claim

H_1 invalid

FTR the claim

Dec 3-11:10 AM

College claims that standard deviation of ages of all students is at least 8 yrs.

$\sigma \ge 8$ ← H_0

$df = n-1 = 9$ $n = 10$

I randomly selected 10 students, the standard deviation of their ages was 6 yrs.

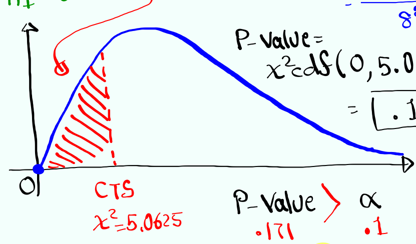
$S = 6$

Test the claim using $\boxed{\alpha = .1}$

$H_0: \sigma \ge 8$ claim

$H_1: \sigma < 8$ LTT

CTS $\chi^2 = \dfrac{(n-1)\cdot S^2}{\sigma^2} = \dfrac{(10-1)\cdot 6^2}{8^2} = 5.0625$



P-Value =

$\chi^2\text{cdf}(0, 5.0625, 9)$

$= \boxed{.171}$

P-Value > α

.171 .1

H_0 valid H_1 invalid

Valid claim

FTR the claim

Dec 3-11:18 AM

The math department claims that standard deviation of all math exam scores is 10.

$\sigma = 10 \leftarrow H_0$

$df = 11 \rightarrow n = 12$ $\qquad S = 15$

I randomly selected 12 exams, standard dev. of their scores was 15. Test the claim.

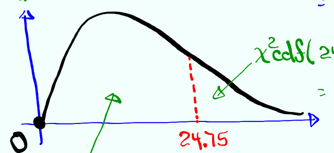
No $\alpha \rightarrow .05$

$H_0: \sigma = 10$ claim

$H_1: \sigma \neq 10$ TTT

CTS $F = \dfrac{(n-1)\cdot S^2}{\sigma^2}$

$= \dfrac{(12-1)\cdot 15^2}{10^2} = \boxed{24.75}$



$\chi^2cdf(24.75, E99, 11)$

$= \boxed{.010}$ ✓

$\chi^2cdf(0, 24.75, 11) = \boxed{.990}$ ✓

P-Value = 2·Smaller

$= 2(.010) = \boxed{.02}$

P-Value $\leq \alpha$

$.02 \qquad .05$

H_0 invalid $\rightarrow$ Invalid claim

H_1 valid

Reject the claim

Suggest a value for α to reverse the conclusion.

P-Value $> \alpha$

$.02 > \alpha$ $\rightarrow$ choose $\alpha = .01$

H_0 valid, valid claim

FTR

Dec 3-11:30 AM