P Value

with

F Distribution

What is **P Value**?

Assuming H_0 is valid, the p-value is is the probability of getting a value of the Computed Test Statistics that is at least as extreme as the one representing the sample data.

What does **P Value** provide?

The p-value provides the smallest level of significance for which the null hypothesis H_0 would be rejected and the alternative hypothesis H_1 would be supported.

What is **F Distribution**?

The F-distribution is a probability distribution used in hypothesis testing to determine the equality of variances from normally distributed populations.

The F distribution has the following properties:

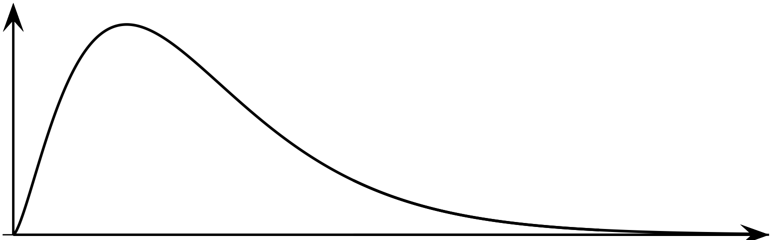
- The density curve is not symmetric.
- The density curve is not bell-shaped.
- The density curve begins at 0 and it is skewed to the right.
- The total area under the density curve is 1.
- It comes with two different degrees of freedom.

- The two degrees of freedom are referred to as

  numerator degrees of freedom (Ndf) and

  denominator degrees of freedom (Ddf).

Here is how the F distribution curve look like.



$Ndf > 2$

Where does **F Distribution** curve peak?

- When $0 < Ndf < 2$, the F distribution curve $\to \infty$ as $F \to 0$.
- When $Ndf = 2$, the F distribution curve begins at $(0, 1)$ and decreasing from there.
- When $Ndf > 2$, the F distribution curve has a peak point at

$$\boxed{F = \frac{(Ndf - 2) \cdot Ddf}{Ndf \cdot (Ddf + 2)}}$$

Example:

Find the F value where F distribution curve peak with $Ndf = 5$ and $Ddf = 8$.

Solution:

We simply plug in the given Ndf and Ddf in the equation and simplify.

$$\begin{aligned} F &= \frac{(Ndf - 2) \cdot Ddf}{Ndf \cdot (Ddf + 2)} = \frac{(5-2) \cdot 8}{5 \cdot (8+2)} \\ &= \frac{3 \cdot 8}{5 \cdot 10} = \frac{24}{50} \\ &= 0.48 \end{aligned}$$

The peak value of the F distribution curve with the given information takes place at the F value of 0.48.

P Value & CTS F:

Testing Type	TI Command
Right-Tail Test	Fcdf(CTS, $E99$, Ndf, Ddf)
Left-Tail Test	Fcdf(0, CTS, Ndf, Ddf)
Two-Tail Test	• Find the area on both sides of F • Multiply the smaller area by 2

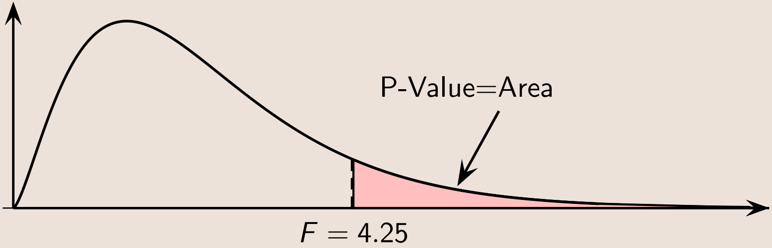
2ND , **VARS** , **↓** , **Fcdf**

Example:

Find the corresponding P-Value for a Right-Tail Test with $CTS\ F = 4.25$, $Ndf = 5$, and $Ddf = 9$. Round to 3-decimal places.

Solution:

We start by drawing the F distribution curve, then shade and label accordingly.



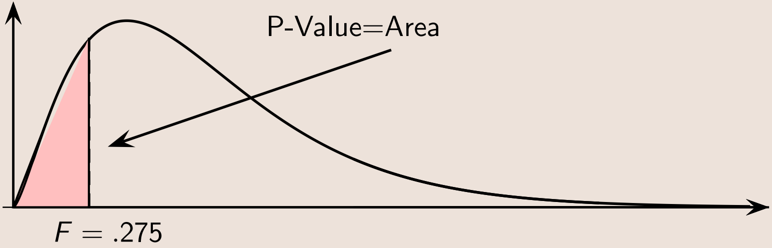
Now we can use the TI command,
$P - Value = Fcdf(4.25, E99, 5, 9) \approx 0.029$.

Example:

Find the corresponding P-Value for a Left-Tail Test with $CTS\ F = 0.275$, $Ndf = 8$, and $Ddf = 10$. Round to 3-decimal places.

Solution:

We start by drawing the F distribution curve, then shade and label accordingly.



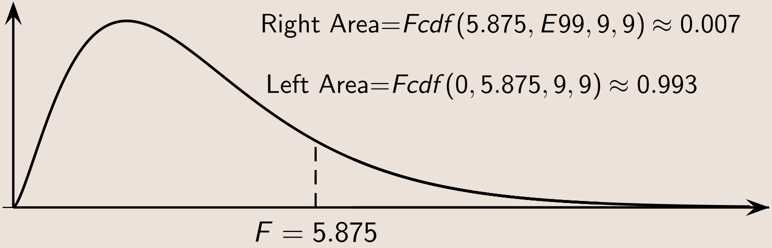
Now we can use the TI command,
$P - Value = Fcdf(0, .275, 8, 10) \approx 0.040.$

Example:

Find the corresponding P-Value for a Two-Tail Test with $CTS\ F = 5.875$, $Ndf = 9$, and $Ddf = 9$. Round to 3-decimal places.

Solution:

We start by drawing the F distribution curve and clearly label.



Now we can use the TI command,

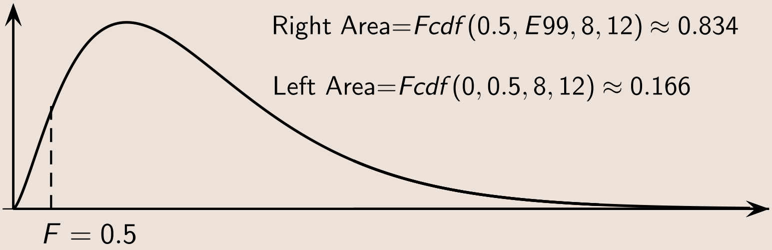
$P - Value = 2 \cdot \boxed{\textbf{Smaller Area}} \approx 2 \cdot 0.007 \approx 0.014$

Example:

Find the corresponding P-Value for a Two-Tail Test with $CTS\ F = 0.5$, $Ndf = 8$, and $Ddf = 12$.

Solution:

We start by drawing the F distribution curve and clearly label.



Now we can use the TI command,

$P - Value = 2 \cdot \boxed{\textbf{Smaller Area}} \approx 2 \cdot 0.166 \approx 0.332$