# Stat Support Activity: Drawing Distributions with P-value, Significance Levels, Test Statistics & Critical Values

**Notes**

- **When drawing the distribution, it is important to remember that proportions are the area under the curve corresponding to a particular cutoff value below.**
- **In a left or right-tailed test, the Significance level is the proportion area under the curve in the tail corresponding to critical value. In a two-tailed test, the half of the significance level is the area under the curve in the tails corresponding to the two critical values.**
- **In a left or right-tailed test, the P-value is the proportion area under the curve in the tail corresponding to test statistic. In a two-tailed test, the half of the P-value is the area under the curve in the tails corresponding to the test statistic and the opposite of the test statistic. (So in a two-tailed test, if we multiply the area in the tail corresponding to the test statistic by 2, we will get the P-value.)**

**Problems**

**(#1-6) Problem Directions: Draw a picture of the Z, T, $\chi^2$, or F distribution curves. Use the given information to label the tail or tails, critical value or values, significance level proportion or proportions, the test statistic and the P-value. Remember the significance level is the tail proportion corresponding to the critical value. The P-value is the tail proportion corresponding to the test statistic. Does the test statistic fall in a tail corresponding to a critical value? Is the P-value smaller or larger than the significance level?**

1.

Draw and label the following distribution. Label the tail or tails, critical value or values, test statistic, significance level, and P-value.

Distribution: Standard Normal Z Distribution

Right-Tailed Hypothesis Test

10% Significance Level ($\alpha = 0.1$)

Critical Value = +1.282

Z-test statistic = +1.98

P-value = 0.024

Does the test statistic fall in a tail corresponding to a critical value?

Is the P-value smaller or larger than the significance level?

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2.

Draw and label the following distribution. Label the tail or tails, critical value or values, test statistic, significance level, and P-value.

Distribution: Student T Distribution (Normal) (df = 39)

Left-Tailed Hypothesis Test

1% Significance Level (α = 0.01)

Critical Value = $-2.425$

T-test statistic = $-1.529$

P-value = 0.067

Does the test statistic fall in a tail corresponding to a critical value?

Is the P-value smaller or larger than the significance level?

3.

Draw and label the following distribution. Label the tail or tails, critical value or values, test statistic, significance level, and P-value.

Distribution: Standard Normal Z Distribution

Two-Tailed Hypothesis Test

5% Significance Level (α = 0.05) *(Note: Split into two tails means that each tail will have 0.025)*

Critical Values = $\pm 1.96$

Z-test statistic = $+2.64$

P-value = 0.0082 *(Note: Split into two tails means that 0.0041 is the proportion in the right tail to the right of +2.64 and 0.0041 is the proportion in the left tail to the left of* $-2.64$*)*

Does the test statistic fall in a tail corresponding to a critical value?

Is the P-value smaller or larger than the significance level?

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4.

Draw and label the following distribution. Label the tail or tails, critical value or values, test statistic, significance level, and P-value.

Distribution: Chi-Square $(\chi^2)$ Distribution *(skewed right curve) (df = 4)*

Right-Tailed Hypothesis Test

1% Significance Level (α = 0.01)

Critical Value = +13.277

$\chi^2$-test statistic = +16.015

P-value = 0.0030 (or $3.0 \times 10^{-3}$)

5.

Draw and label the following distribution. Label the tail or tails, critical value or values, test statistic, significance level, and P-value.

Distribution: Student T Distribution (Normal) (df =29)

Two-Tailed Hypothesis Test

10% Significance Level (α = 0.05) *(Note: Split into two tails means that each tail will have 0.05)*

Critical Values = $\pm 1.699$

T-test statistic = $-1.226$

P-value = 0.230 *(Note: Split into two tails means that 0.115 is the proportion in the right tail to the right of +1.226 and 0.115 is the proportion in the left tail to the left of* $-1.226$*)*

Does the test statistic fall in a tail corresponding to a critical value?

Is the P-value smaller or larger than the significance level?

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6.

Draw and label the following distribution. Label the tail or tails, critical value or values, test statistic, significance level, and P-value.

Distribution: $F$ — Distribution *(skewed right curve) (numerator df = 3, denominator df = 41)*

Right-Tailed Hypothesis Test

5% Significance Level (α = 0.05)

Critical Value = +2.833

$F$-test statistic = +1.335

P-value = 0.276

Does the test statistic fall in a tail corresponding to a critical value?

Is the P-value smaller or larger than the significance level?

**(#7-10) Problem Directions: Now answer the following questions based on your answers to #1-6.**

7.

When the test statistic falls in the tail, will the P-value be smaller or larger than the significance level?

8.

When the test statistic does NOT fall in the tail, will the P-value be smaller or larger than the significance level?

9.

When the P-value is larger than the significance level (high P-value), will the test statistic fall in the tail determined by the critical value or not in the tail?

10.

When the P-value is smaller than the significance level (low P-value), will the test statistic fall in the tail determined by the critical value or not in the tail?