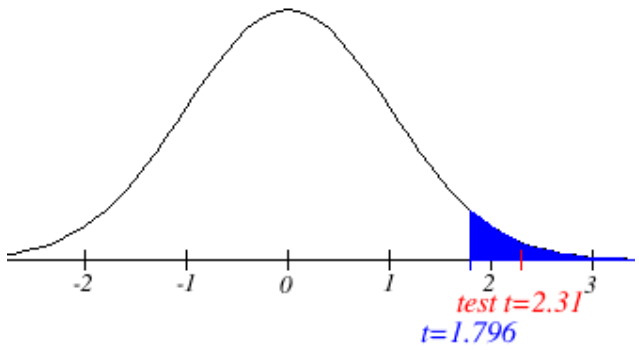


**Math 10 – Hypothesis Testing 3**

**ANSWERS gw16**

1. An environmentalist estimates that the mean waste recycled by adults in the United States is more than 1 pound per person per day. You want to test this claim. You find that the mean waste recycled per person per day for a random sample of 12 adults in the United States is 1.2 pounds and the sample standard deviation is 0.3 pound. At  $\alpha = 0.05$ , can you support the claim?

<p><b>(a) (DESIGN)</b> State your Hypothesis in words and parameters</p> <p><b>Ho:</b> The mean waste recycled by adults in the United States is not more than 1 pound per person per day</p> <p><b>Ha:</b> The mean waste recycled by adults in the United States is more than 1 pound per person per day</p> <p><b>Ho: <math>\mu \leq 1</math>    Ha: <math>\mu &gt; 1</math></b></p>	<p><b>(d) (DESIGN)</b> Determine decision rule by determining the rejection region.(critical-value method)</p>  <p><b>Reject Ho if <math>t &gt; 1.796</math></b></p> <p><b>(e) (DATA)</b> Conduct the test, mark the test statistics on the graph above, and <b>circle</b> your decision</p> <p><b><math>t = (1.2-1.0)/(0.3/\text{sqrt}(12)) = 2.31</math></b></p> <p><b>Reject Ho</b></p> <p><b>(f) (CONCLUSION)</b> State your overall conclusion in language that is clear, relates to the original problem and is consistent with your decision.</p> <p><b>The environmentalist is correct.</b></p> <p><b>Mean waste recycled exceeds more than one pound per person per day.</b></p>
<p><b>(b) (DESIGN)</b> State Significance Level of the test and explain type I error in context</p> <p><b><math>\alpha=.05</math>, which represents the maximum design probability of Type I error, which would be claiming the environmentalist was correct when saying more than mean waste recycled is more than one pound per person per day, when in fact that is not true.</b></p>	
<p><b>(c) (DESIGN)</b> Determine the statistical model (test statistic)</p> <p><b>One sample t test of Mean population standard deviation unknown.</b></p> $t = \frac{\bar{X} - \mu_0}{s/\sqrt{n}} \quad df = 11$ <p><b>Due to the small sample size, we must assume the data is approximately normal (or at least not heavily skewed) for the central limit theorem to apply.</b></p> <p><b>This is a one-tail test, so <math>\alpha</math> will be only in the upper tail.</b></p>	

2. A government association claims that 44% of adults in the United States do volunteer work. You work for a volunteer organization and are asked to test this claim. You find that in a random sample of 1165 adults, 556 do volunteer work. At  $\alpha = 0.05$ , do you have enough evidence to reject the association's claim?

(a) (DESIGN) State your Hypothesis

**Ho: The proportion of adults in the United States do volunteer work is 0.44**

**Ho: The proportion of adults in the United States do volunteer work is not 0.44**

**Ho:  $p = 0.44$**

**Ha:  $p \neq 0.44$**

(b) (DESIGN) State Significance Level of the test and explain what Type II error would be.

$\alpha = .05$

**Type II error: Failing to claim that the proportion of adults in the United States do volunteer work is not 0.44, when in fact the proportion is not 0.44**

(a) (DESIGN) Determine the statistical model (test statistic)

**One sample Z test of Proportion**

$$Z = \frac{\hat{p} - p_0}{\sqrt{\frac{(p_0)(1 - p_0)}{n}}}$$

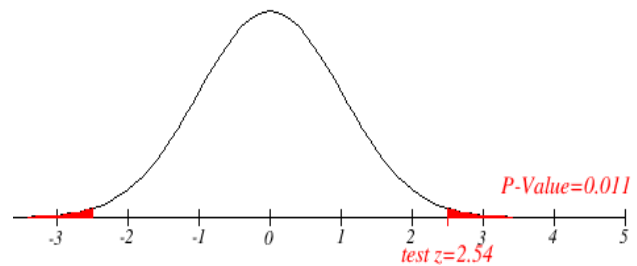
Since  $np > 10$  and  $n(1-p) > 10$ , we can use the normal approximation.

This is a two-tail test, so  $\alpha$  and the p-value will be split into the upper and lower tails.

(d) (DESIGN) Determine decision rule (p-value method)

**Reject Ho if p-value  $< 0.05$  ( $\alpha$ )**

(e) (DATA) Conduct the test, graph and shade the test statistic find the p-value and circle your decision.



$$\hat{p} = \frac{556}{1165} = 0.477$$

$$Z = \frac{0.477 - 0.44}{\sqrt{\frac{(0.44)(1 - 0.44)}{1165}}} = 2.54$$

$$P(Z < -2.54) = .0055$$

$$P(Z > 2.54) = .0055$$

$$\text{p-value} = 2(0.0052) = 0.0110 < \alpha (.05)$$

**Reject Ho**

(f) (CONCLUSION) State your overall conclusion in language that is clear, relates to the original problem and is consistent with your decision.

**The government association is wrong; the percentage of US adults who do volunteer work is not 44%. In fact, it is more than 44%**