t-Test for Population Mean μ

1. **State Hypotheses:** H_0: $\mu = \mu_0$ *null hypothesis*

   H_a: $\mu > \mu_0$ *three possible alternatives*
   H_a: $\mu < \mu_0$
   H_a: $\mu \neq \mu_0$

2. **Test Statistic (t-ratio):** $t = \dfrac{\bar{y} - \mu_0}{\frac{s}{\sqrt{n}}}$

3. **p-value:** probability of getting more extreme test statistic than our observed t if H_0 is true

Consider t-distribution having degrees of freedom $df = n - 1$

H_a: $\mu > \mu_0$ p-value = % of t-distribution values larger than our t
(area under t-curve to the right of our t)

H_a: $\mu < \mu_0$ p-value = % of t-distribution values smaller than our t
= % of t-distribution values *larger* than $-t$ (i.e., "$-t$" is minus our t)
use for computation → (area under t-curve to the right of our $-t$)

H_a: $\mu \neq \mu_0$ p-value = % of t-distribution values larger than our $|t|$ in absolute value
($2 \times$ area under t-curve to right of our $|t|$)

4. **Interpretation of p-value:** Small p-values (i.e., the t-tatio t that we observe seems unusual under the null hypothesis H_0) are evidence against H_0 in favor of H_a.
(See page 47 in text for a discussion.)

Rough Guidelines:

small p-value (less than 0.01): strong evidence against H_0 in favor of alternative H_a

moderate p-value (between 0.01 and 0.05): moderate evidence against H_0 in favor of H_a

suggestive p-value (between 0.05 and 0.1): suggestive but inconclusive evidence against H_0

large p-value (greater than 0.1): weak evidence against H_0 in favor of H_a

5. **Conclusion:** In terms of the problem and H_a, roughly again

small p-value $\Rightarrow$ statistically significant evidence for H_a

large p-value $\Rightarrow$ no statistically significant evidence for H_a