9.3 Tests about a population mean

Conditions

1. Random
2. 10% condition
3. Large counts: $n \geq 30$, if $n < 30$ we will graph to assess for skew or outliers

Test statistic: for means, we use the t-statistic which is the standardized value of how far the sample diverges from the paramater value (H_0).

$$\text{test statistic} = \frac{\text{statistic} - \text{parameter}}{\text{standard deviation of the statistic}}$$

$$t = \frac{\bar{x} - \mu_0}{s_x/\sqrt{n}} \quad \text{where } H_0: \mu = \mu_0$$

Ex: A rock music radio station claims to play 50 minutes of music per hour. However, whenever you listen you feel like your listening to a commercial.

We want to test:

$$H_0: \mu = 50$$
$$H_a: \mu < 50$$

if $\bar{x} = 47.9$ and $S_x = 2.81$ using a sample of 12 hours of music.

$$t = \frac{\bar{x} - \mu_0}{s_x/\sqrt{n}} = \frac{47.9 - 50}{2.81/\sqrt{12}} = -2.59$$

On table $t = 2.59$

in between P values of .02 and .01.

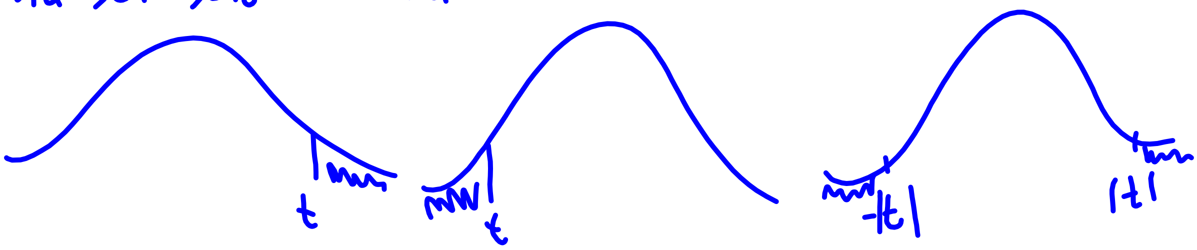
One sample t test for a mean

Suppose conditions are met. To test $H_0: \mu = \mu_0$

compute $t = \dfrac{\bar{x} - \mu_0}{\frac{s_x}{\sqrt{n}}}$

Find the Pvalue by calculating the probability of getting a t-statistic as large or larger in the direction of H_a in the t_{n-1} distribution.

$H_a: \mu > \mu_0$ $H_a: \mu < \mu_0$ $H_a: \mu \neq \mu_0$



check your understanding p. 583

$H_0: \mu = 8$

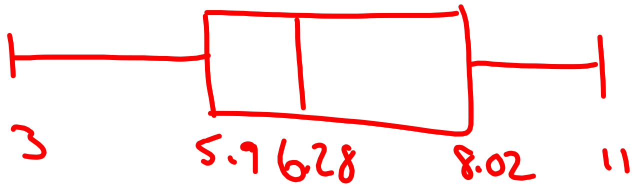
$H_a: \mu < 8$

μ = averge hours of sleep for students in collge

We are testing the claim at a significance level of .05.

conditions

- Random
- 28 students in less than 10% of all college students so 10% cond. is met.
- large counts. since 28<30 we graph



so no skew or outliers so it is roughly normal.

we will perform a 1 samplet test for μ

$$t = \frac{6.64 - 8}{1.98/\sqrt{28}} = -3.63$$

Pvalue: .00058

We will reject the H_0 since $.00058 < .05$ So there is convincing evidence that the people in college get less than 8hrs. sleep each night.

The 2 sided significance test for μ at the α significance level gives us similar information as the $100(1-\alpha)\%$ CI.

Ex: check your understanding p. 586.

① P value = .275 $H_0: \mu = 128$ $H_a: \mu \neq 128$

$\alpha = .05$

Fail to reject the H_0 because .275 > .05 meaning there is not convincing evidence the blood pressure differs from 128 in males from 35-44

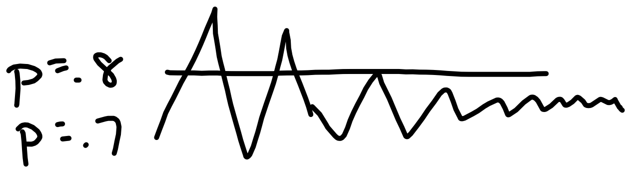
② CI = (126.43 to 133.43)

Paired Data: data from study designs that involve making 2 observations on the same individuals or 1 observation of 2 similar individuals.

When paired data result from measuring the same quantitative variable twice we can make comparisons by analyzing differences in each pair. We can use 1 sample t procedures to perform inferences about the mean difference, μ_d. This is often called pair t procedures

Using Tests Wisely

1. Determine Sample size
   - significance level → how much Type I error and type II are you capable of dealing with.
     ↓ α, ↓ P(type I error) but ↑ P(Type II error)
   - Effect size: how large of a difference be H_0 and the actual value is important to detect.
     smaller difference = larger sample



   - Power: higher Power = larger sample to give a better chance of detecting a difference when there is one.

2. Statistical significance is not the same as practical importance.

3. Beware of multiple analyses.