Chapte Twenty Part Two: Inference for Difference in Means

Recall the notation for comparing means that we covered in part one:

Population 1

- μ_1:
- n_1:
- $\bar{y_1}$:
- s_1:

Population 2

- μ_2:
- n_2:
- $\bar{y_2}$:
- s_2:

We will consider two type of inference for difference in means:

Confidence Interval for the Differene in Population Means

$$\text{CI for } \mu_1 - \mu_2$$

Hypothesis Test for the Differene in Population Means

$$\text{HT for } \mu_1 - \mu_2$$

In these situations, the parameter and statistic are:

parameter:
statistic:

Confidence Interval for Difference in Means

Conditions

1. **Randomization condition**:

2. **10% condition**:

3. **Nearly normal condition:**

4. **Independent Groups:**

Formula

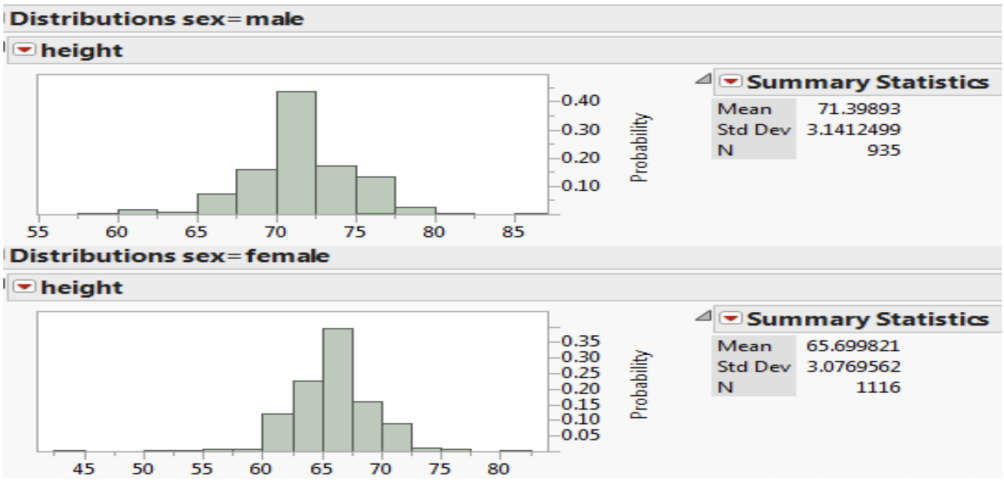
If the conditions above are met, the C% confidence interval for $\mu_1 - \mu_2$ is:

the t* value has degrees of freedom computed using the formula below:

Example *At the beginning of the semester for severl years, students in Stat 101 completed a survey. In this survey, the sex and height (in inches) of the students were recorded.*

Caluclate a 95% CI for the mean difference in heights between males and females of the population of Stat 101 students.

- ***Populations***
  - _
  - _
- ***Samples***
  - _
  - _
- ***Parameter**:*
- ***Statistic**:*
  - _
  - _

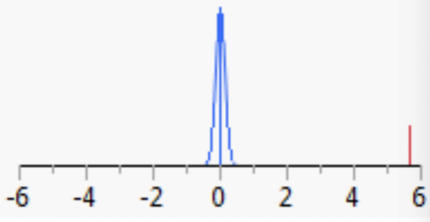


t Test

male-female

Assuming unequal variances

Difference	5.69911	t Ratio	41.3055
Std Err Dif	0.13797	DF	1971.824
Upper CL Dif	5.96970	Prob > |t|	<.0001*
Lower CL Dif	5.42852	Prob > t	<.0001*
Confidence	0.95	Prob < t	1.0000



Hypothesis Test for the Difference in Means

Step 1: Hypotheses

Null Hypothesis

-
-

Alternative Hypothesis

-
-

Step 2: Assumptions

Check the following conditions:

1. **Randomization condition**:
2. **10% condition**:
3. **Nearly Normal Condition:**
4. **Independent Groups:**

Step 3: Test Statistic

Then our t-statistic is calculated as follows:

Step 4: Find p-value

Remember, the p-value is found using a t-distribution with degrees of freedom. To compute the degrees of freedom, we use the following formula:

We have three different options based on our alternative hypotheses:

$H_a : \mu_1 < \mu_2$

$H_a : \mu_1 > \mu_2$

$H_a : \mu_1 \neq \mu_2$

Step 5: List your decision

P-value	Evidence (against Ho)
Greater than .10	Little to no evidence
Between .05 and .10	Weak evidence
Between .01 and .05	Moderate Evidence
Less than .01	Strong evidence

Step 6: Conclusion

Make a statement about the relationship between μ_1 and μ_2 given the information from the hypothesis test.

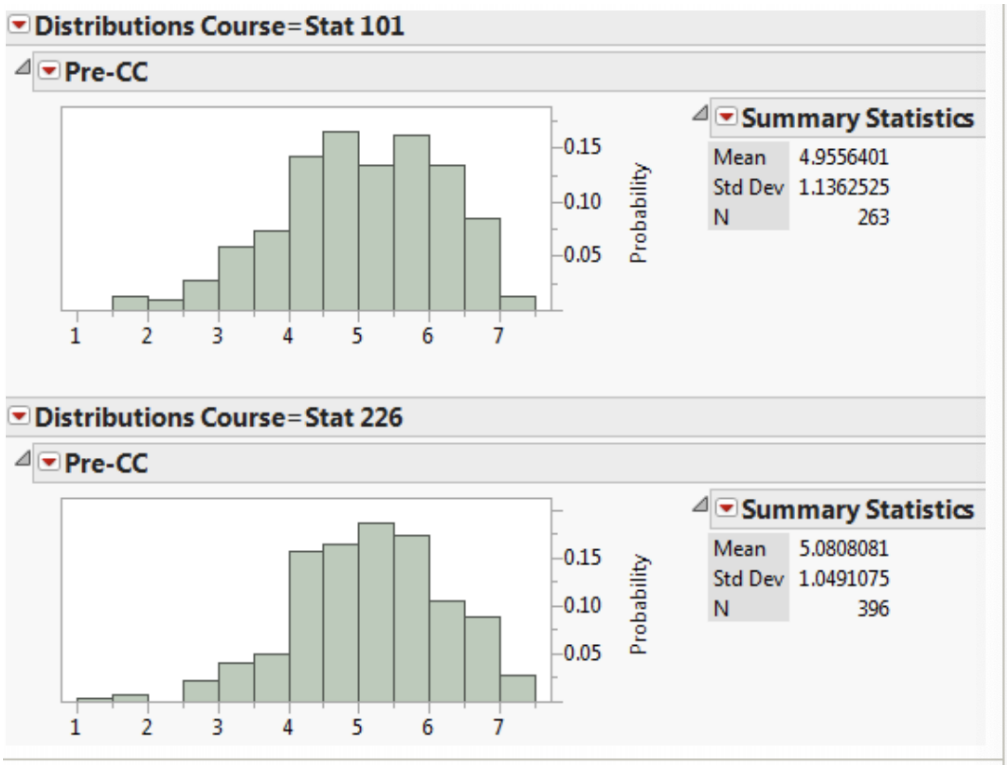
Be sure to include:

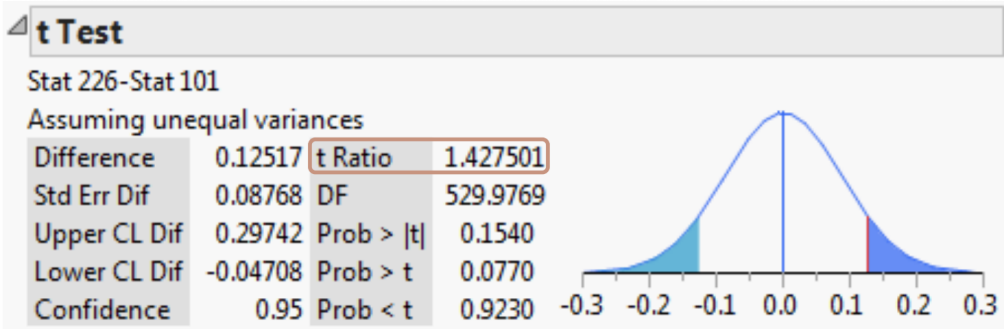
-
-
-

Example *At ISU, several different intro stats courses are offered. Each course is structured according to a particular audience of majors. At the beginning of the Fall 2006 semester, a "Survey of Attitudes Toward Statistics" was administered to students in Stat 101 and Stat 226. One of the components of this survey is called the "cognitive competence" attitude, which is rated on a scale of 1-7 where:*

- *1-3 = negative attitudes*
- *4 = neutral attitude*
- *5-7 = positive attides*

We want to determine if there is evidence that stat 226 students have a higher mean attitude towards "cognitive competence" than stat 101 students. There were 396 stat 226 students and 264 stat 101 students sampled. Our parameter of interest is $\mu_1 - \mu_2$ which means that the population mean attitude score of all stat 226 students minus the population mean attitude score of all stat 101 students.


Distributions Course=Stat 101
Pre-CC
Summary Statistics
Mean 4.9556401
Std Dev 1.1362525
N 263
0.15
0.10
0.05
Probability
1 2 3 4 5 6 7
Distributions Course=Stat 226
Pre-CC
Summary Statistics
Mean 5.0808081
Std Dev 1.0491075
N 396
0.15
0.10
0.05
Probability
1 2 3 4 5 6 7


t Test
Stat 226-Stat 101
Assuming unequal variances
Difference 0.12517 t Ratio 1.427501
Std Err Dif 0.08768 DF 529.9769
Upper CL Dif 0.29742 Prob > |t| 0.1540
Lower CL Dif -0.04708 Prob > t 0.0770
Confidence 0.95 Prob < t 0.9230
-0.3 -0.2 -0.1 0.0 0.1 0.2 0.3