

Homework for the t -test for the difference between two independent means.**FOR EACH OF THE FOLLOWING PROBLEMS:**

- a. State the scientific hypothesis and skeptical-scientific hypothesis. Also state the PCH of chance.
- b. Is the scientific hypothesis directional or non-directional? Why?
- c. Translate the scientific hypothesis and the PCH of chance into statistical hypotheses--that is, state H_0 and H_1 .
- d. Name the test statistic you will use to decide between the statistical hypotheses.
- e. What is the alpha level (level of significance, p -value) that you will use?
- f. In your own words what does this p -value mean?
- g. Calculate your df .
- h. Is H_1 one- or two-tailed? Why?
- i. Look up the critical value (or values) in the table in your book.
- j. Draw a line representing the range of your test statistic. What is the center value predicted by H_0 ? Draw it on the line. Also draw in the critical value (or values) on the line. Label the "Reject H_0 " region (or regions). Label the "Do not reject H_0 " region.
- k. Why does H_0 predict a value of zero for your test statistic?

NOW FOR THE DATA:

- l. Does the pattern of data favor the scientific or skeptical-scientific hypothesis?
 - m. Now calculate the value of your test statistic from the data. Take this calculated value of your test statistic and put it on the number line made in (j). Does it fall in a rejection region?
 - n. Do you reject H_0 or not?
 - o. Verbally summarize the issue of statistical conclusion validity (PCH of chance) in this case. That is, do you think this study has statistical conclusion validity or not?
1. A language researcher believes that students learn faster if they only experience the language they are learning rather than if they experience a combination of the language they are learning and their native language.
- Seventy-two college students enrolled in French 101 were randomly divided into two equal groups and subjected to one of two teaching techniques: Class 1 in which the instructor spoke in both English and French to students, and Class 2, in which the instructor spoke only in French to students.
- At the end of the quarter, all students are given a standardized language exam with the following results:

Class 1: Mean = 260, Variance = 3600, $n = 36$

Class 2: Mean = 294, Variance = 4300, $n = 36$

2. Scientists are asked to select between two diets to be used to produce weight-gain in under-nourished children. One of these two diets will be used as a treatment for under-nourishment at a certain clinic.
In StatTool open: HW_t_ind.dat

The gains in weight over a nine-month period are shown below:

Diet 1: 14.0, 12.5, 10.2, 9.8, 10.5, 11.2, 15.0, 22.0, 13.0, 9.6

Diet 2: 14.4, 18.2, 19.5, 21.2, 15.3, 11.6, 12.8, 13.1, 11.3

T-Test Ind Means

1. Scientific- Students learn French faster if they only speak in that language while learning rather than French & English.

Skeptical: There is no difference in learning speeds

PCH of chance: If there is a difference it is only due to chance

b. directional expect French only will learn faster than French & English

c. $H_0: \mu_{\text{French}} = \mu_{\text{French \& English}}$

$H_1: \mu_{\text{French}} > \mu_{\text{French \& English}}$

d. t-test for independent means.

e. $\alpha = .05$

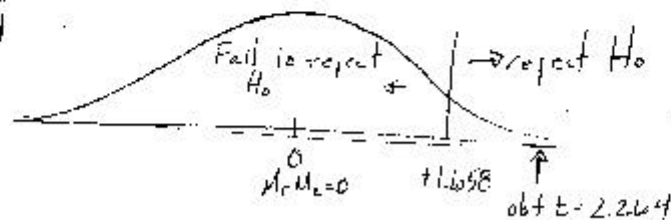
f. Probability of rejecting H_0 when H_0 is true

g. $df = n_1 + n_2 - 2 = 36 + 36 - 2 = 70$

h. H_1 is one tailed as it is a directional hypothesis

i. $\text{crit } t(70)_{.05} = +1.658$

j.



- K. Expecting no difference between the means
 I. yes M for French only is greater

$$\begin{aligned}
 t &= \frac{M_1 - M_2 - \mu_0}{\sqrt{\frac{n_1 s_1^2 + n_2 s_2^2}{n_1 + n_2 - 2} \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}} \\
 &= \frac{294 - 260 - 0}{\sqrt{\frac{(36)(3600) + (36)(4800)}{36 + 36 - 2} \left(\frac{1}{36} + \frac{1}{36} \right)}} \\
 &= \frac{34}{\sqrt{\frac{129,600 + 154,800}{70} \left(\frac{2}{36} \right)}} \\
 &= \frac{34}{\sqrt{225}} \\
 &= \frac{34}{15.02} \\
 &= 2.264 \quad \text{obt } t
 \end{aligned}$$

- a. Reject H_0
 c. It appears to have statistical conclusion validity
 obt t is significantly more extreme than crit t

2 Scientific There is a difference between the two diets in terms of weight gain in under-size children

Skeptical There is no difference.

PCH: Any differences found are due to chance.

b Non-directional Not making an assumption about which one is either better or worse

c $H_0: \mu_{D1} = \mu_{D2}$

$H_1: \mu_{D1} \neq \mu_{D2}$

d t-test for independent means

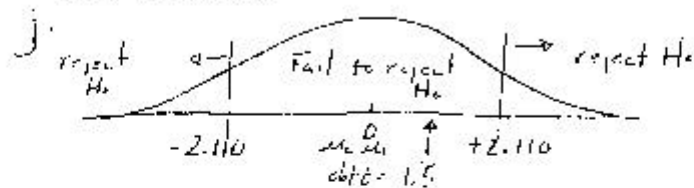
e $\alpha = .05$

f Probability of rejecting H_0 when H_0 is true

g $df = n_1 + n_2 - 2 = 10 + 9 - 2 = 17$

h two-tailed

i $\text{crit } t(17)_{.05} = \pm 2.110$



K expect no difference between the means

L Scientific ~ Difference between means

$$\begin{aligned}
 M \quad t &= \frac{\bar{M}_{D2} - \bar{M}_{D1} - \mu}{\sqrt{\frac{n_1 s_1^2 + n_2 s_2^2}{n_1 + n_2 - 2} \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}} \\
 &= \frac{15.27 - 12.78 - 0}{\sqrt{\frac{10(2.48) + 9(1.11)}{10 + 9 - 2} \left(\frac{1}{10} + \frac{1}{9} \right)}} \\
 &= \frac{2.49}{\sqrt{13.16 \left(\frac{19}{90} \right)}} = \frac{2.49}{1.66} = 1.5 \text{ obt } t
 \end{aligned}$$

- n Fail to reject H_0
- o It does not have statistical conclusion validity as probability of getting obtained score due to channel alone is too great

MALLOY 3000

HW # INDEPENDENT MEAS 7