Stats 13.1 Fall 2008: Homework 6 Solutions

http://www.stat.ucla.edu/~dinov/courses_students.dir/08/Fall/STAT13.1.dir/

1. Problem 1

- Here, we will use a 2-sample T-test to compare the means of 2 independent samples

H_0: $\mu_1 - \mu_2 = 0$
H_A: $\mu_1 - \mu_2 \neq 0$

$$T_0 = \frac{\bar{y}_1 - \bar{y}_2 - 0}{SE(\bar{y}_1 - \bar{y}_2)} = \frac{31.72 - 29.22}{\sqrt{\frac{8.73^2}{5} + \frac{7.19^2}{5}}} = 0.494$$

Now, we compare this to a Students T-distribution with **$n_1 + n_2 - 2 = 8$ degrees of freedom** using SOCR to find **$p(T(df=8) > T_0 = 0.494) = 0.32$**

In this case we have a 2-tailed test, and so our **p-value is 2*0.32 = 0.64**.
Conclusion: We **fail to reject the null hypothesis** since **0.64>0.10**. We conclude that according to our data the mean weight of thymus glands after being incubated for 14 days is not different than the mean weight after being incubated for 15 days. In other words, there is no statistically significant mean difference in thymus glands weights.

- Although the mean weight of thymus glands after 15 days of incubation is lower, this is most likely due to variability and small sample size.

- Our result matches SOCR 2 independent sample T-test (*see figure 1*)

Figure 1

2. Problem 2

- Here, we will use a 2-sample T-test to compare the means of 2 independent samples

H_0: $\mu_1 - \mu_2 = 0$
H_A: $\mu_1 - \mu_2 \neq 0$

$$T_0 = \frac{\bar{y}_1 - \bar{y}_2 - 0}{SE(\bar{y}_1 - \bar{y}_2)} = \frac{41.8 - 32.4}{\sqrt{\frac{15.6^2}{8} + \frac{22.8^2}{7}}} = 0.919$$

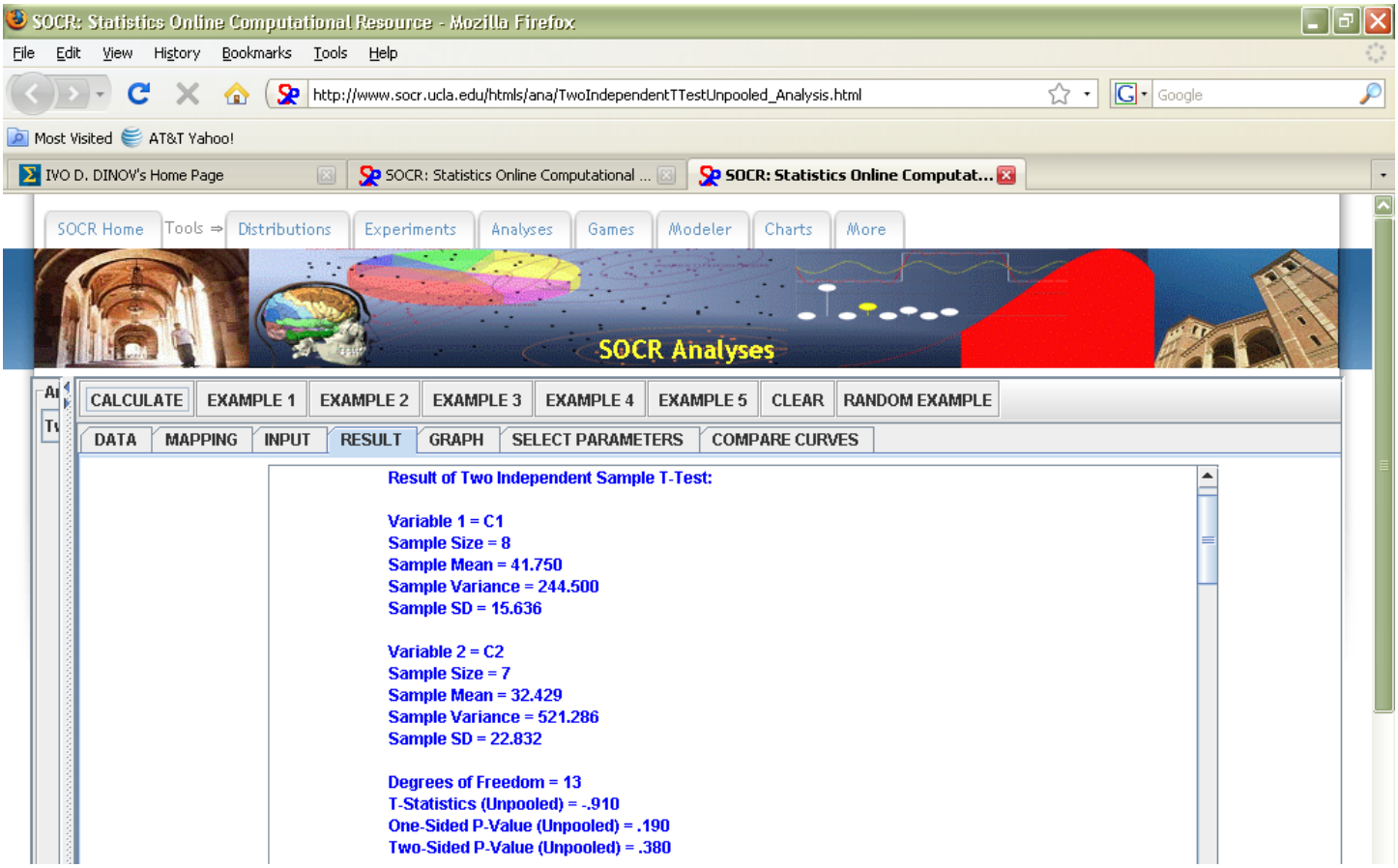
Now, we compare this to a Students T-distribution with **$n_1 + n_2 - 2 = 13$ degrees of freedom** using SOCR to find **$p(T(df=13) > T_0 = 0.919) = 0.19$**

In this case we have a 2-tailed test, and so our **p-value is 2*0.19 = 0.38**.
Conclusion: We **fail to reject the null hypothesis** since **0.38>0.10**.

- We conclude that according to our data, there is no statistically significant mean difference in the number of bacteria colonies formed when using a "soap" solution or sterile water.

- Our result matches SOCR 2 independent sample T-test (*see figure 2*)

Figure 2



3. Problem 3

- A reasonable scientific question might be: "Does darkness have an effect on the concentration of soluble ferulic acid in corn seedlings?" In this case, our parameter of interest is the **difference of the means ($\mu_1 - \mu_2$)**.

- 92% CI

$$92\%CI = \bar{x}_1 - \bar{x}_2 \pm t_{n1+n2-2df,\frac{.08}{2}} SE(\bar{x}_1 - \bar{x}_2)$$

$$= 92 - 115 \pm 2.10 * \sqrt{\frac{2 * 13^2}{4}} = -23 \pm 19.3 = (-42.3, -3.7)$$

- 82% CI

$$82\%CI = \bar{x}_1 - \bar{x}_2 \pm t_{n1+n2-2df,\frac{.18}{2}} SE(\bar{x}_1 - \bar{x}_2)$$

$$= 92 - 115 \pm 1.52 * \sqrt{\frac{2 * 13^2}{4}} = -23 \pm 13.97 = (-36.97, -9.03)$$

4. <u>Problem 4</u>

- 95% CI

$$95\%CI = \bar{x}_1 - \bar{x}_2 \pm t_{n1+n2-2df,\frac{.05}{2}} SE(\bar{x}_1 - \bar{x}_2)$$

$$= 8.500 - 8.441 \pm 2.03 * \sqrt{\frac{0.289^2}{22} + \frac{0.262^2}{17}} = 0.059 \pm 0.180 = (-0.121, 0.239)$$

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We can say that we are 95% confident that the true difference in mean head widths between female crickets that were successful and female crickets that were unsuccessful in mating is somewhere between -0.121 and 0.239. We might also suggest that since 0 falls in this interval, then there is evidence to suggest that there is no difference in head widths between the two groups, and therefore the body size does not play a role in mating success.