STAT 13 Homework 6 Solutions

1) Thymus gland
    a. H0: mu1 - mu2 = 0
       H1: mu1 - mu2 =/= 0
    b. T statistic = (ybar1 - ybar2) / sqrt(sd1^2/n1 + sd2^2/n2)
       = (31.72 - 29.22) / sqrt(8.73^2/5 + 7.19^2/5) = 0.4943
    c. Df = 5 + 5 - 2 = 8
    d. P-value = 0.634
    e. P-value > 0.10 : Do not reject Null Hypothesis
    f. We might expect that the chicks that were incubated longer to have larger
       thymus glands. Our samples show that the chicks incubated for only 14 days
       have a larger thymus gland on average. However, our t-test reveals that this
       difference could be a result of random chance. The seemingly backwards result is
       actually not evidence that one group has a larger thymus gland than the other.

> **Result of Two Independent Sample T-Test:**
>
> Variable 1 = C2
> Sample Size = 5
> Sample Mean = 31.720
> Sample Variance = 76.197
> Sample SD = 8.729
>
> Variable 2 = C3
> Sample Size = 5
> Sample Mean = 29.220
> Sample Variance = 51.677
> Sample SD = 7.189
>
> Degrees of Freedom = 8
> T-Statistics (Unpooled) = -.494
> One-Sided P-Value (Unpooled) = .317
> Two-Sided P-Value (Unpooled) = .634

    g. Our results from SOCR match.

2) Petri Dishes
    a. H0: mu1 - mu2 = 0
       H1: mu1 - mu2 > 0
    b. T statistic = (ybar1 - ybar2) / sqrt(sd1^2/n1 + sd2^2/n2)
       = (41.8 – 32.4) / sqrt(15.6^2/8 + 22.8^2/7) = -0.910
    c. Df = 8 + 7 - 2 = 13
    d. P-value = 0.190
    e. P-value > 0.10 : Do not reject Null Hypothesis

f. These results indicate that we do not have evidence to show there is a difference in the average (mean) bacteria content of petri dishes with soap vs petri dishes without soap. In other words, we do not have evidence showing a reduction in bacteria with soap.

Result of Two Independent Sample T-Test:

Variable 1 = C2
Sample Size = 8
Sample Mean = 41.750
Sample Variance = 244.500
Sample SD = 15.636

Variable 2 = C3
Sample Size = 7
Sample Mean = 32.429
Sample Variance = 521.286
Sample SD = 22.832

Degrees of Freedom = 13
T-Statistics (Unpooled) = -.910
One-Sided P-Value (Unpooled) = .190
Two-Sided P-Value (Unpooled) = .380

g. Our results match SOCR.

3) Ferulic Acid
   a. A reasonable question is: Does growing corn in the dark vs light/dark photo periods cause a change in the concentration of ferulic acid?
   b. DF = 4+4-2=6
   c. t-star value for 92% CI with 6df= 2.10
   d. t-star value for 82% CI with 6df= 1.52
   e. 92% CI = 115-92 +/- 2.10 * sqrt(13^2/4 + 13^2/4)
      = 3.70 to 42.30
   f. 92% CI = 115-92 +/- 1.52 * sqrt(13^2/4 + 13^2/4)
      = 9.03 to 36.97
4) Mormon Cricket
   a. t-star value for 95% CI with 37df= 2.03
   b. 95% CI = 8.500-8.441 +/- 2.03 * sqrt(0.289^2/22 + 0.262^2/17)
      = -0.121 to 0.239
   c. The confidence interval goes from -0.121 to 0.239. It means we are 95% confident that the difference between the average head size of successful mates and the head size of unsuccessful mates is between those two values.
   d. The CI contains 0, which ultimately means we are not sure if one group has larger heads than the other. So we do not have evidence showing a difference in head size between the two groups.