Math 263: Excel Assignment 8 on ANOVA(Version 2)

Note: You do not need to hand in your Excel sheet with the answers to your questions.

The longevity of male fruit flies is believed to be associated with adult size. In addition, the theory of evolution predicts that there is a physiological "cost" to reproduction: Increased reproduction is believed to alter lifespan. The file *Fruitfly.xlsx* contains data on the lifespan and thorax size (a measure of adult size) of 125 male fruit flies. These fruit flies were kept in identical living condition except that they were randomly assigned to one of the following groups:

- In one group, the males had no partners.
- In one group, each male was with a pregnant female, who would not mate for two days, and who was replaced by a new pregnant female every other day.
- In one group, each male was with a virgin female, replaced by a new virgin female every other day to provide reproductive opportunities.
- In one group, each male was with 8 pregnant females, who would not mate for two days, and who were replaced by 8 new pregnant females every other day.
- In one group, each male was with 8 virgin females, who were replaced by 8 new virgin females every other day to provide reproductive opportunities.

By examining the virgin females, the researchers confirmed that the males were indeed reproducing.[1]

Is there an Association between Lifespan and Thorax Size?

1. Using the page *Data*, make a scatterplot of lifespan and thorax size. Paste the scatterplot in your solutions.

2. Is there an association between lifespan and thorax size? If so, is it positive or negative? Find the correlation coefficient.

Is there Evidence that the Groups Contain Adult Flies of Similar Thorax Size?

3. Use the page *ByThoraxLength*, where the thorax size data from all five groups has been assembled. Use ANOVA to decide whether the groups contain males of approximately equal thorax sizes. Write out your reasoning clearly, showing the Excel printout and including

   - the hypotheses,
   - the value of the test statistic,
   - the *p*-value,

[1] From "Sexual Activity Reduces Lifespan of Male Fruitflies", L. Partridge and M. Farquar, *Nature*, 1981. Reported in *The Practice of Statistics for the Life Sciences*, Baldi and Moore, 2nd edn

- your conclusion and its interpretation in terms of the thorax length of fruit flies.

Is there Evidence that Reproduction Affects Lifespan?

4. Use the page *ByLifespan*, where the lifespan data from all five groups has been assembled. Use ANOVA to decide whether reproduction affects lifespan. Write out your reasoning clearly, showing the Excel printout and including

   - the hypotheses,
   - the value of the test statistic,
   - the p-value,
   - your conclusion and its interpretation in terms of the life span of fruit flies.

5. If you see evidence of different life spans, use the Summary in the ANOVA printout to describe the direction of the effect. (That is, which groups have longer or shorter life spans?)

Conclusion

6. Write a conclusion about the impact of reproductive activity on lifespan. Your answer should include references to:
   - The implications of your answers to Questions 1-3
   - The implications of your answers to Questions 4-5
   - Causation

ANOVA on Excel

To do ANOVA on a Windows machine, you will need the Data Analysis Tool-Pak installed, as you did for the histograms. To use this:

1. Sort the data. Each sample should be in its own row or column, with labels at the top or to the left. The samples must all be next to each other. (This has been done for you in the pages *ByLifespan* and *ByThorax Length*.)
2. Open the Date Analysis Tool-Pak and select ANOVA one factor.
3. Fill in the dialog box that comes up.