Lab 7 (100 pts.): One-Way ANOVA
Objectives: Analyze data via the One-Way ANOVA method.

A. (50 pts.) Do isoflavones increase bone mineral density? (ex12-45bmd.txt) Kudzu is a plant that was imported to the United States from Japan and now covers over seven million acres in the South. The plant contains chemicals called isoflavones that have been shown to have beneficial effects on bones. One study used three groups of rats to compare a control group with rats that were fed either a low dose or a high dose of isoflavones from kudzu. One of the outcomes examined was the bone mineral density in the femur (in grams per square centimeter). Here are the data:

Treatment	Bone mineral density (g/cm^2)							
Control	0.228	0.207	0.234	0.220	0.217	0.228	0.209	0.221
	0.204	0.220	0.203	0.219	0.218	0.245	0.210	
Low dose	0.211	0.220	0.211	0.233	0.219	0.233	0.226	0.228
	0.216	0.225	0.200	0.208	0.198	0.208	0.203	
High dose	0.250	0.237	0.217	0.206	0.247	0.228	0.245	0.232
	0.267	0.261	0.221	0.219	0.232	0.209	0.255	

1. (10 pts.) Make side-by-side boxplots and an effects plot of the data. Also, make a table giving the sample size, mean, and standard deviation for each treatment group. From this information, do you think that all of the means are the same? Be sure to comment on each of the plots.
2. (10 pts.) Examine the assumptions necessary for ANOVA. Is it appropriate to continue the analysis? Be sure to state each of the assumptions and comment on each of them using the appropriate plots/data. Remember, you need to generate the normal probability plots and histograms for each population.
3. (15 pts.) Report the results of the ANOVA significance test (4* steps) using a significance level of 0.05. Are your results in this step consistent with part 1?
4. (10 pts.) Use an appropriate multiple-comparison method to determine if isoflavones from kudzu have any effect on bones. Explain why you chose this method. Present a graphical representation of the results if appropriate for your method. Write a short statement for your conclusion.
5. (5 pts.) Write a short report explaining the effect of kudzu isoflavones on the femur of the rat. Be sure to answer the question posed in the initial statement and whether this data can be generalized to humans or not with a reason. This paragraph should be written in complete English sentences and should be understandable to someone who has not taken a course in Statistics.

B. (50 pts.) Exercise and healthy bones. (ex12-47jump.txt) Many studies have suggested that there is a link between exercise and healthy bones. Exercise stresses the bones and this causes them to get stronger. One study examined the effect of jumping on the bone density of growing rats. There were three treatments: a control with no jumping, a low-jump condition (the jump height was 30 centimeters), and a high-jump condition (60 centimeters). After 8 weeks of 10 jumps per day, 5 days per week, the bone density of the rats (expressed in milligrams per cubic centimeter) was measured. Here are the data:

Group	Bone density (mg/cm^3)									
Control	611	621	614	593	593	653	600	554	603	569
Low jump	635	605	638	594	599	632	631	588	607	596
High jump	650	622	626	626	631	622	643	674	643	650

1. (10 pts.) Make side-by-side boxplots and an effects plot of the data. Also, make a table giving the sample size, mean, and standard deviation for each group of rats. From this information, do you think that all of the means are the same? Be sure to comment on each of the plots.
2. (10 pts.) Examine the assumptions necessary for ANOVA. Is it appropriate to continue the analysis? Be sure to state each of the assumptions and comment on each of them using the appropriate plots/data. Remember, you need to generate the normal probability plots and histograms for each population.
3. (15 pts.) Report the results of the ANOVA significance test (4* steps) using a significance level of 0.01. Are your results in this step consistent with part 1?
4. (10 pts.) Use an appropriate multiple-comparison method to determine if the height of jumping affects the bone density of growing rats. Present a graphical representation of the results if appropriate for your method. Write a short statement for your conclusion.
5. (5 pts.) Write a short report explaining the effect of the height of jumping on the bone density of growing rats. Be sure to answer the question of the study concerning whether there is a link between exercise (jumping) and the development of healthy bones and whether this data can be generalized to humans or not with a reason. This paragraph should be written in complete English sentences and should be understandable to someone who has not taken a course in Statistics.