Math 107
Final Exam

Part I

Hypothesis: During the grey, gloomy month of December, children who are exposed to bright light for 5 minutes a day are happier.
Proposed Experiment: During December, take a pre-school class of 40 children (20 boys and 20 girls) and divide them up into boys and girls. Expose the girls to bright light for 5 minutes a day. At the end of a week, have a child psychologist rank the happiness level of eachg child from 1 to 100.

1.) What is the population?

2.) What is the sample? What is the sample size?

3.) Which is the control group? Which is the experimental group?

4.) What are possible sources of bias in the selection process?

5.) Sketch a method of selecting members for the experimental group which would eliminate this bias, using the table of random digits.

6.) Use row 132 on the table of random digits to select the first 5 members of the experimental group.

Say we use your methodology for selecting members of the experimental group. We run the test and get the following rankings:

Control Group

82	77	43	61	68
98	37	56	57	95
65	78	68	42	71
52	83	62	57	75

Experimental Group

94	85	49	83	100
37	98	98	75	68
65	76	57	92	84
76	100	96	84	92

7.) Arrange the data in 2 back-to-back stemplot diagrams.

8.) Describe the shape of the control group.

9.) Describe the shape of the experimental group.

10.) What method of presenting data would be the best for the control group? Why?

11.) What method of presenting data would be the best for the experimental group? Why?

12.) Calculate the 5-number summary and draw a boxplot for the experimental group.

13.) Calculate the mean and standard deviation for the control group.

14.) Calculate the mean and standard deviation for the experimental group.

15.) Using the mean and standard deviation, calculate the proabability of a child being very happy (scoring at least a 90) with the light therepy.

16.) Using the mean and standard deviation, calculate your probability of a child being very happy (scoring at least a 90) without the light therepy.

17.)What's the chance that at least one out of the 20 children *not* exposed to the light therepy will be very happy (score at least a 90)?

Part II

Hypothesis:Making employees exercise for 10 minutes each morning makes them more productive.
Experiment: Collect a pool of 100 volunteers. Randomly divide them into 2 groups of 50 people each: a control group and an experimental group. Make those in the experimental group exercise for 10 minutes each morning before starting the work day. Monitor everyone's productivity each day and find the average productivity score for each group. Record the average productivity scores for each group separately. From the control group, calculate an expected productivity score and standard deviation, then plot the experimental group averages in a control chart using this data.

Data

Control Group
Average = 50 = μ
Standard deviation for 1 person = 12 = σ

Experimental Group

Day	*average score*
1	48
2	52
3	50
4	46
5	53
6	48
7	46
8	48
9	53
10	55

1.) In the set-up of the experiment, how did we overcome the possible biases which natrually arise when taking volunteers?

2.) Make a control chart presenting the above data.

3.) Do you see any patterns?

4.) What's the line of regression for the data (days in the experiment versus average number of push ups)? Graph the line of regression on the control chart.

5.) What's the correlation coefficient?

6.) Predict the expected productivity score if the experimental group continued exercising each morning for 20 days.

7.) Using the control group data, what's the 95% confidence interval for the productivity score for one person?

8.) Using the control group data, what's the 95% confidence interval for the productivity score for 100 people?

9.) Are our deductions in questions 7 and 8 reliable? That is, did our method for eliminating biases mentioned in question 1 protect us from biases which could skew the data for questions 7 and 8? Why or why not?