**IE 4362 JMP Assignment 1 Due on Moodle by due date in course schedule**

**Directions:** Type your responses to each question in a Word or pdf document. Hand-written work will not be accepted. All analysis should be completed using JMP. Type all answers and use JMP-generated tables and graphs in a single Word/pdf document.

Show all steps and all work. You may assume an alpha level of 0.05 unless otherwise noted. To answer each question, copy the output from JMP, showing enough detail to understand the analysis setup and the critical output used to answer the question. Then, type your answer based on this output, even if it means repeating the same numbers shown in the JMP output. This is your formal answer, supported by analysis in JMP.

Exception: you do not need to write out equations and numbers for finding means and standard deviations.

**Submitting your assignment:** Upload one Word document to Moodle by the due date indicated on the course schedule. The file name must be in the following format: LastNameFirstInitial\_JMP1.docx or LastNameFirstInitial\_JMP1.pdf (10% penalty otherwise).

**Problem 1 (38 points total):** Ten workers complete a training program, and their productivity was measured before and after. The scores before and after, and improvement in productivity are shown in the table.

|  |  |  |  |
| --- | --- | --- | --- |
| Worker # | Before | After | Improvement |
| 1 | 95 | 105 | 10 |
| 2 | 97 | 111 | 14 |
| 3 | 94 | 106 | 12 |
| 4 | 103 | 106 | 3 |
| 5 | 97 | 104 | 7 |
| 6 | 98 | 105 | 7 |
| 7 | 95 | 102 | 7 |
| 8 | 100 | 106 | 6 |
| 9 | 95 | 102 | 7 |
| 10 | 105 | 111 | 6 |

1. (4 points) What is the mean and standard deviation of productivity before and after the training? (Calculate these in JMP and show the JMP output.)
2. (9 points) Was there any improvement in productivity after training? Show your JMP output, and use formal hypothesis testing to determine your answer.
3. (4 points) If you made a Type I error in part b, explain how your conclusion would differ from reality, and one potential negative consequence of this error.
4. (5 points) If you were to model improvement, could you say improvement in productivity is normally distributed? Provide an explanation, including numbers, using JMP output.
5. (6 points) Find the 95% confidence interval on improvement. What could you tell upper management about the expected change in productivity as a result of the training?
6. (10 points) Driven by economic analysis, the company will invest in training as long as workers improve productivity by 5 points or more. Determine if the company should continue the training program, using a formal hypothesis test with an alpha level of 0.10.

**Problem 2 (39 points total):** A chemical engineer investigates the relationship between cooking time of paper pulp and the resulting shear strength of the paper. The coded data are below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  | | --- | --- | | Cooking Time | Shear Strength | | 10 | 70 | | 10 | 86 | | 11 | 89 | | 12 | 95 | | 12 | 97 | | 12 | 99 | | 13 | 102 | | 13 | 111 | | 13 | 121 | | 14 | 125 | | 14 | 125 | | 15 | 130 | |

1. (4 points) Construct a scatterplot in JMP to show how cooking time might predict shear strength.
2. (3 points) Using JMP, find the correlation coefficient between the two variables and discuss whether there is a significant linear relationship between the variables. Show your JMP output.
3. (3 points) Develop a simple linear regression model in JMP that shows the linear relationship between cooking time and shear strength. Show your JMP output and type the equation. Be sure to define any variables.
4. How well does the model fit the data? Answer this question by providing the following JMP output and your own interpretation of each:
   1. (3 points) The coefficient of determination
   2. (7 points) The 95% confidence interval on the slope of the regression
   3. (2 points) A plot of the residuals
   4. (2 points) Give a final yes/no answer as to whether you would use this model to help predict shear strength, and support your answer with the above three items.
5. (2 points) Assuming you will use the model, what shear strength do you expect to be developed with 12 hours cooking time? Show your calculations.
6. (10 points) What is the 90% confidence interval on this expected strength? Show your calculations.
7. (4 points) Quality standards require a minimum shear strength of 120 for 95% of batches produced. Based on your model, how much cooking time should be scheduled per batch?