Stat 141 (Experimental Designs 1)

1st Semester AY 2025-2026

Laboratory Exercise 7

Instruction: Answer the following as indicated.

1. The surface finish of metal parts made on four randomly selected machines is being studied. An experiment is conducted in which each machine is run by three different operators and two specimens from each operator are collected and tested. Because of the location of the machines, different operators are used on each machine, and the operators are chosen at random. The data are shown in the table below. The machines and operators are denoted by M and O, respectively.

   a. Write the appropriate model for this experiment and define each term in the model accordingly.

   b. Derive the expected mean squares for each term in the model.

   c. Construct the ANOVA table and perform the necessary tests of hypotheses at $\alpha = 0.05$. Use the results in (b) for the correct F ratios. Draw appropriate conclusions.

   d. If possible, identify which operators differ in which machines. Summarize your answer in a bar plot with error bars and letter designations.

M1			M2			M3			M4		
O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12
79	94	46	92	85	76	88	53	46	36	40	62
62	74	57	99	79	68	75	56	57	53	56	47

2. An experiment was carried out to compare the effects of three concentrations of a chemical seed dressing on the yield of oats. Three varieties were used in the trial because it is suspected that the response to the seed treatment would depend on the variety used. A split design was laid out in five randomized blocks. Varieties were assigned at random to the main plots within each block, and the seed treatment and control were assigned at random to the subplots within each main plot. The data is contained in *Sheet1* of **Lab Exer 7.xlsx**.

   a. Perform the analysis and draw appropriate conclusions.

   b. Generate visualizations of significant effects.