Carleton University
School of Mathematics and Statistics
STAT 2509 A - Assignment #5

DUE: August 7th, 2025 (to be submitted on BrightSpace before 10:00am)

1. An experiment was conducted by a private research corporation to investigate the toxic effects of three chemicals (I, II and III) used in the tire-manufacturing industry. In this experiment 1-inch squares of skin on rats were treated with the chemicals and then scored from 0 to 10, depending on the degree of irritation. Three adjacent 1-inch squares were marked on the back of each of eight rats, and each of the three chemicals was applied to each rat. The data are as shown in the table.

	Rat Number							
Chemical	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
I	6	9	6	5	7	5	6	6
II	5	9	9	8	8	7	7	7
III	3	4	3	6	8	5	5	6

You may assume that all assumptions required for any analysis are valid, including the assumption of equal variances.

(a) At $\alpha = 0.01$, is there enough evidence to conclude a difference in the treatment means?

(b) At $\alpha = 0.01$, is there enough evidence to conclude that the blocking variable was useful (i.e. whether there are differences among the blocks)?

(c) If appropriate, compute all Tukey pairwise comparisons for the treatment means at $\alpha = 0.01$.

(d) Assume the normality assumption is violated. Conduct Friedmann-Rank test and if needed use Nemenyi's follow-up procedure to determine which treatments differ. Use $\alpha = 0.01$.

(e) Verify your results using SPSS.

2. A small builder of speculative homes builds three basic house designs and employs two foremen. The builder has used each foreman to build two houses of each design and has obtained the profits (in thousands of dollars) given below:

Factor B (House Design)

Factor A (Foreman)	**I**	**II**	**III**
1	10.2, 11.1	12.2, 11.7	19.4, 18.2
2	9.7, 10.8	11.6, 12.0	13.6, 12.7

Use SPSS output to answer part a) and b)

(a) Is interaction between Foreman and House Design significant? Use $\alpha = 0.05$.

(b) Based on results in part a), is it necessary to test the main effects (Foreman, House Design)? If yes, conduct a hypothesis test on the main effects?

(c) Use SPSS to produce interaction plot and compare your answer to the one in part a).

3. A small coffee shop sells 3 types of coffee; Latte, Espresso, Cappuccino. The shop owner is interested in knowing whether the three types are purchased equally. She selects a random sample of 300 customers and records their purchase. The following table contains the results.

Type of Coffee	Latte	Espresso	Cappuccino
Number of Customers	85	93	122

At $\alpha = 0.05$, is there enough evidence to conclude that the three types sell equally. Verify your results using SPSS.