STA 135 (Spring 2025) Homework 4

There are **three** problems. Due on May 16th 9:00 am PST. Please submit your HW online to CANVAS.

Problem 1

Haltica oleracea					*Haltica carduorum*				
Experiment Number	y_1	y_2	y_3	y_4	Experiment Number	y_1	y_2	y_3	y_4
1	189	245	137	163	1	181	305	184	209
2	192	260	132	217	2	158	237	133	188
3	217	276	141	192	3	184	300	166	231
4	221	299	142	213	4	171	273	162	213
5	171	239	128	158	5	181	297	163	224
6	192	262	147	173	6	181	308	160	223
7	213	278	136	201	7	177	301	166	221
8	192	255	128	185	8	198	308	141	197
9	170	244	128	192	9	180	286	146	214
10	201	276	146	186	10	177	299	171	192
11	195	242	128	192	11	176	317	166	213
12	205	263	147	192	12	192	312	166	209
13	180	252	121	167	13	176	285	141	200
14	192	283	138	183	14	169	287	162	214
15	200	294	138	188	15	164	265	147	192
16	192	277	150	177	16	181	308	157	204
17	200	287	136	173	17	192	276	154	209
18	181	255	146	183	18	181	278	149	235
19	192	287	141	198	19	175	271	140	192
					20	197	303	170	205

Figure 1: Four Measurements on Two Species of Flea

Four measurements were made on two species of flea beetles (Lubischew 1962) are provided in Figure 1. Using suitable statistics to test

$$\mathbf{H}_0 : \Sigma_1 = \Sigma_2 \quad \text{Vs} \quad \mathbf{H}_a : \Sigma_1 \neq \Sigma_2.$$

(a). (4 pts) What is the statistic you will use? Write down the formula.

(b). (8 pts) What is the value of the statistic?

(c). (3 pts) Should you accept or reject the null hypothesis?

Problem 2

For the data sets in Figure 1, carry out a profile analysis to test the parallelism, i.e.,

$$\mathbf{H}_0 : \begin{pmatrix} \mu_{12} - \mu_{11} \\ \mu_{13} - \mu_{12} \\ \vdots \\ \mu_{1p} - \mu_{1,p-1} \end{pmatrix} = \begin{pmatrix} \mu_{22} - \mu_{21} \\ \mu_{23} - \mu_{22} \\ \vdots \\ \mu_{2p} - \mu_{2,p-1} \end{pmatrix}.$$

(a). (4 pts) What is the statistic you will use? Write down the formula.

(b). (8 pts) What is the value of the statistic?

(c). (3 pts) Should you accept or reject the null hypothesis?

Problem 3

Method 1				Method 2				Method 3			
y_1	y_2	y_3	y_4	y_1	y_2	y_3	y_4	y_1	y_2	y_3	y_4
5.4	6.0	6.3	6.7	5.0	5.3	5.3	6.5	4.8	5.0	6.5	7.0
5.2	6.2	6.0	5.8	4.8	4.9	4.2	5.6	5.4	5.0	6.0	6.4
6.1	5.9	6.0	7.0	3.9	4.0	4.4	5.0	4.9	5.1	5.9	6.5
4.8	5.0	4.9	5.0	4.0	5.1	4.8	5.8	5.7	5.2	6.4	6.4
5.0	5.7	5.0	6.5	5.6	5.4	5.1	6.2	4.2	4.6	5.3	6.3
5.7	6.1	6.0	6.6	6.0	5.5	5.7	6.0	6.0	5.3	5.8	6.4
6.0	6.0	5.8	6.0	5.2	4.8	5.4	6.0	5.1	5.2	6.2	6.5
4.0	5.0	4.0	5.0	5.3	5.1	5.8	6.4	4.8	4.6	5.7	5.7
5.7	5.4	4.9	5.0	5.9	6.1	5.7	6.0	5.3	5.4	6.8	6.6
5.6	5.2	5.4	5.8	6.1	6.0	6.1	6.2	4.6	4.4	5.7	5.6
5.8	6.1	5.2	6.4	6.2	5.7	5.9	6.0	4.5	4.0	5.0	5.9
5.3	5.9	5.8	6.0	5.1	4.9	5.3	4.8	4.4	4.2	5.6	5.5

Figure 2: Judges' Scores on Fish Prepared by Three Methods

Baten, Tack, and Baeder (1958) compared judges' scores on fish prepared by three methods. Twelve fish were cooked by each method, and several judges tasted fish samples and rated each on four variables. The data are in Figure 2. Each entry is a score for the judges on that fish. We want to compare the means of the three methods i.e., test

$$\mathbf{H}_0 : \boldsymbol{\mu}_1 = \boldsymbol{\mu}_2 = \boldsymbol{\mu}_3.$$

(a). (14 pts) Conduct the test using Wilk's Lambda. Should you accept or reject the null the hypothesis?

(b). (6 pts) Conduct the test using Roy's largest root test. Should you accept or reject the null the hypothesis?