STAT 802

Assignment 2

1. In order to assess the effect of a drug on the level of 3 chemicals in the brain a group of 24 mice was randomly divided into 2 groups of 12 – treatment and control. In the control group 2 mice died of causes thought unrelated to the drug. Data are in the file

   `~lockhart/Teaching/Courses/802/Data/Asst2Q1`

   Does the drug have an impact on the levels of the brain chemicals? If you conclude it does use multiple comparison procedures to determine which of chemicals A, B and C have affected levels.

2. At a certain institution 64 patients are rated by three staff members on three 7 point behavioural scales. The means for the 64 patients on the 3 scales are 3.05, 3.31 and 2.92 while the sample variance covariance matrix is

1.28	1.05	0.75
	1.35	0.93
		1.12

   Is there any difference between the three staff members ratings? If it appears that the answer is yes give simultaneous 95% confidence intervals for the differences in means. Discuss briefly the real world interpretation of the population means.

3. Two samples of rats are weighed initially and at one week intervals. The initial weight x_0 is recorded along with the weight gains d_i for $I = 1, \ldots, 4$. One group is treated with Thiouracil; the other is a control. Are the growth curves parallel in the two groups and are the actual levels of weight gain the same in the two groups?

Control					Thiouracil				
x_0	d_1	d_2	d_3	d_4	x_0	d_1	d_2	d_3	d_4
57	29	28	25	33	61	25	23	11	9
60	33	30	23	31	59	21	21	10	11
52	25	34	33	41	53	26	21	6	27
49	18	33	29	35	59	29	12	11	11
56	25	23	17	30	51	24	26	22	17
46	24	32	29	22	51	24	17	8	19
51	20	23	16	31	56	22	17	8	5
63	28	21	18	24	58	11	24	21	24
49	18	23	22	28	46	15	17	12	17
57	25	28	29	30	53	19	17	15	18

4. Seven subjects are given an alcoholic drink at time 0. Blood glucose levels are recorded at 14 time intervals (from 10 minutes before the drink to 5 hours after). The experiment is repeated after the patients are treated with a dietary additive of guar gum. Here is the data; an electronic version is in

   ```
   ~lockhart/teaching/courses/802/Data/Asst2Q4
   ```

   For each subject the first line is with guar and the second without; the measurements are milligrams of glucose per 10 liters of blood.

	Time (minutes after alcohol)													
Subj	-10	0	20	40	60	80	100	120	150	180	210	240	270	300
1	2.2	2.8	4.4	5.6	5.8	4.5	3.6	3.3	3.2	3.3	3.0	3.0	3.2	3.1
	3.0	3.0	4.7	6.0	6.3	4.3	3.0	2.0	4.5	3.8	3.2	2.6	2.6	2.6
2	4.1	4.2	6.3	7.0	8.3	5.7	2.9	3.0	3.4	3.5	3.2	3.8	4.3	3.7
	4.0	3.6	6.0	8.6	8.8	7.2	5.0	3.8	4.2	4.0	2.6	2.5	2.6	3.8
3	3.8	3.8	5.0	5.5	7.0	5.0	3.8	3.6	3.6	3.5	3.5	3.5	3.5	4.0
	3.5	3.5	6.0	7.3	7.5	6.2	5.0	4.1	4.3	4.1	3.4	3.8	3.8	3.9
4	3.6	3.6	4.3	5.5	6.3	5.7	5.3	4.7	4.0	3.5	3.6	3.7	4.0	3.7
	3.8	3.8	4.4	6.0	6.8	5.7	4.6	3.8	4.3	4.5	4.5	4.2	3.8	4.2
5	3.8	3.8	4.7	7.0	7.7	6.0	5.0	4.7	4.3	4.2	3.7	3.4	3.7	3.8
	3.7	4.0	5.2	7.0	6.6	6.0	5.2	4.7	4.5	4.5	4.2	3.5	3.7	3.8
6	3.6	3.5	4.4	6.2	7.0	5.9	4.8	3.9	3.9	4.0	3.7	3.5	3.8	3.8
	3.5	3.1	3.1	3.6	4.2	3.8	3.5	4.2	3.7	4.1	3.2	3.4	3.4	3.2
7	3.3	2.9	4.2	5.8	5.8	5.8	4.4	4.0	3.8	3.7	3.4	3.6	3.6	3.6
	3.0	2.9	5.0	6.2	7.7	5.9	3.9	5.8	5.0	5.2	4.3	4.0	3.5	3.5

   For each subject you have 28 measurements and you only have 7 subjects. You will not, therefore be able to use a Hotelling's T^2 test on the raw data. You must use plots of the data against time to select linear combinations of the responses to lower the number of response variables and then look to see if the guar affects either overall blood sugar levels or the pattern of changes in blood sugar levels after drinking.

5. A sample of 15 male undergraduates exercised on a treadmill until their pulse rates reached 180 beats per minute. They were then treated with either an abdominal cold pack, a cold shower or just rest. (All 15 subjects were tried with each of the 3 treatments.) They then exercised on the treadmill until their heart rates again reached 180 beats per minute. Measurements made were, for each of the three treatments: initial heart rate, time to get to 180 beats per minute the first time and time to get to 180 beats per minute after the treatment. Here is a table of the data:

Treatment

	Cold Pack			Shower Pack			Rest		
	HR	TR		HR	TR		HR	TR	
Subj		First	Second		First	Second		First	Second
1	73	113	132	78	105	100	78	102	86
2	66	84	149	66	224	105	66	210	110
3	78	86	100	78	70	80	78	70	65
4	54	89	101	54	70	67	54	64	72
5	78	75	102	72	54	60	72	100	52
6	90	61	121	90	160	192	78	87	79
7	54	173	201	54	200	80	60	90	106
8	66	83	116	66	60	135	66	68	110
9	60	61	72	60	75	141	72	73	58
10	54	75	125	54	95	160	48	101	86
11	96	70	194	96	85	107	96	96	66
12	72	78	259	66	82	122	72	110	80
13	66	80	110	66	70	84	66	73	86
14	78	76	190	72	70	71	72	85	71
15	96	71	141	85	83	74	96	73	66

Here HR stands for heart rate in beats per minute and TR is time on the treadmill in seconds.

The question is to discover whether any of the treatments differs from the others in its effect on fatigue as measured by the second treadmill time. I want you to consider both a simple analysis which ignores the base line information and a more sophisticated analysis which adjusts for initial heart rate and first treadmill time. For the simple analysis I want you to do both a one sample MANOVA analysis and a mixed model analysis of variance analysis. Look at statistics to diagnose the appropriateness of the mixed model analysis.

6. From the text question 6.5.

7. From the text questions 6.13 and 6.14.

8. From the text question 6.18. Data are in

   `~lockhart/teaching/courses/802/Data/Asst2Q8`

9. From the text question 6.27. Data are in

   `~lockhart/teaching/courses/802/Data/Asst2Q9`