

ST4241: Design and Analysis of Clinical Trials

2009/2010: Semester I

Tutorial 5

1. The following is the results of a factorial study as given in Question 2 of Tutorial 4.

Block	Preparation 1		Preparation 2	
	Dose A	Dose B	Dose A	Dose B
1	3.0	5.5	5.0	6.0
2	2.0	4.0	4.5	5.5
3	2.5	5.0	4.0	5.0
4	3.0	4.5	4.5	6.0
5	3.0	4.0	2.5	5.5
6	3.5	4.5	4.5	5.5

Consider the four combinations of Preparation and Dose as four treatments. Conduct the Friedman's test for the significance of treatment effect at level 0.05.

2. The data for the comparison of the antidepressant drug Imipramine and a placebo in a matched pair design is as follows.

Pair	Imi	Pla	d	Pair	Imi	Pla	d
1	6	4	2	16	6	8	-2
2	4	7	-3	17	10	10	0
3	6	12	-6	18	3	9	-6
4	7	10	-3	19	5	8	-3
5	5	2	3	20	4	5	-1
6	6	11	-5	21	6	8	-2
7	8	9	-1	22	7	7	0
8	7	5	2	23	5	6	-1
9	8	11	-3	24	6	9	-3
10	3	8	-5	25	3	3	0
11	9	7	2	26	10	5	5
12	4	6	-2	27	5	11	-6
13	8	8	0	28	4	7	-3
14	11	9	2	29	4	3	1
15	12	9	3	30	7	10	-3

(i) Complete the following anova table for the data above:

Source of variation	df	SS	MS	F ratio
Treatment				
Pairs				
Residuals				

Confirm that the value of the F-ratio is the squared value of the t statistic given by

$$t = \frac{\bar{d}\sqrt{n}}{s_d}.$$

(ii) In general, show that whenever $g = 2$ treatments are compared in a randomized blocks design study, the F ratio from the anova table is identically equal to the square of the t -statistic given above.

3. Refer to the data below on the blood samples from 8 persons.

Subject	Treatment				Mean
	1	2	3	4	
1	8.4	9.4	9.8	12.2	9.950
2	12.8	15.2	12.9	14.4	13.825
3	9.6	9.1	11.2	9.8	9.925
4	9.8	8.8	9.9	12.0	10.125
5	8.4	8.2	8.5	8.5	8.400
6	8.6	9.9	9.8	10.9	9.800
7	8.9	9.0	9.2	10.4	9.375
8	7.9	8.1	8.2	10.0	8.550
Mean	9.300	9.713	9.938	11.025	9.994
sd	1.550	2.294	1.514	1.815	

(i) Define dummy variables for the subjects and treatments. Describe the data by a linear model using the dummy variables.

(ii) Using the R function `lm`, obtain the anova table for the data.

(iii) Using the results from the object obtained by `lm`, test the significance of the following contrasts:

$$C_1 = \mu_{.1} - \mu_{.3},$$

$$C_2 = \mu_{.2} - (\mu_{.1} + \mu_{.3})/2,$$

$$C_3 = \frac{1}{3}(\mu_{.1} + \mu_{.2} + \mu_{.3}) - \mu_{.4}.$$

where μ_j is the mean response of treatment j . Use an appropriate criterion to control the overall error rate at level 0.05.

Note: for those who are required to submit the assignment, please submit the solutions to Question 1 and 2 only.