

STAT 514 Homework 5

1. An experiment is conducted to study the impact of two types of hormone (I, II), each with two levels, on the liver of rat. We consider the following four treatments: (1) Hormone I at high level; (2) Hormone I at low level; (3) Hormone II at high level; (4) Hormone II at low level. Each treatment is applied to six randomly selected rats. The response is the amount of glycogen (in mg) in the liver of a rat after a certain period of time.

Treatment	Responses					
1	106	101	120	86	132	97
2	51	98	85	50	111	72
3	103	84	100	83	110	91
4	50	66	61	72	85	60

Suppose we are interested in the following three contrasts:

Comparison	A	a	B	b
Hormone I vs Hormone II	1	1	-1	-1
Low Level vs High level	1	-1	1	-1
Equivalence of Level	1	-1	-1	1

- a). Use ANOVA to check if there exists difference between the treatments ($\alpha = 5\%$).
- b). Show that the contrasts are orthogonal to each other.
- c). Use contrast sum of squares to test if the contrasts are significant ($\alpha = 5\%$). Interpret the results. (You need to organize data before entering data into SAS Code window).

2. An experiment is run to determine whether four specific firing temperatures have different effects on the density of a certain type of brick. The experiment generates the following data.

```

temperature density
1 22.8 1 22.5 1 21.5 1 21.6 1 22.1
2 21.2 2 19.5 2 20.3 2 20.6 2 19.8
3 20.8 3 21    3 22.2 3 21.6 3 20.4
4 23.7 4 23.3 4 22.4 4 22.6 4 22.9
    
```

The temperature levels 100, 125, 150 and 175 are coded as 1, 2, 3 and 4, respectively.

- a). Test if the firing temperatures have different effects? Use $\alpha = .05$.
- b). Since temperature is a quantitative factor, the experimenter is further interested in

modeling the functional relationship between brick density and temperature. Use orthogonal contrasts to fit an orthogonal polynomial model. Test if the linear, quadratic and cubic effects are significant ($\alpha = 5\%$).

c) Estimate the regression coefficients in the the polynomial model obtained in b).

3. The tensile strength of portland cement is being studied. Four different mixing techniques are commonly used in producing the cement. The following data are collected from an experiment investigating the four techniques.

mixing tensile

1	3129	1	3000	1	2865	1	2890
2	3200	2	3300	2	2975	2	3150
3	2800	3	2900	3	2985	3	3050
4	2600	4	2700	4	2600	4	2765

a). Test if the mixing techniques have different effects on the strength of the cement. Use $\alpha = 5\%$

b). For the confidence intervals for the difference between two treatment sample means, what is the half interval size if you use the following methods

b1. the LSD comparison procedure?

b2. Tukey's method?

b3. Bonferroni's method?

b4. Scheffe's method?

c). How do you group the levels using each method?