WST 311

Assignment I: 23-26 April 2018

This example comes from the textbook:
Daniel, W.W. (1974). *Biostatistics: A Foundation for Analysis in the Health Sciences*. New York: Wiley.

Blood sugar levels (mg/100g) were measured on 10 animals from each of five breeds. The results are presented in the table below.

Blood sugar levels (mg/100g) for 10 animals from each of five breeds (A - E)

A	B	C	D	E
124	111	117	104	142
116	101	142	128	139
101	130	121	130	133
118	108	123	103	120
118	127	121	121	127
120	129	148	119	149
110	122	141	106	150
127	103	122	107	149
106	122	139	107	120
130	127	125	115	116

1. Give the summary statistics (n, mean and standard deviation) for the data as a whole as well as by breed.

2. Give a boxplot of the data by breed.

3. Answer the following questions by using PROC GLM with the statements
   proc glm;
   class breed;
   model sugar=breed;

   (a) Test the hypothesis of equality of means for the five breeds.

   (b) Do Tukey's test for pairwise comparisons of the five means and draw a conclusion from the results.

   (c) Test the hypothesis $H_0 : \mu_A = \mu_B$.

   (d) Test the hypothesis $H_0 : \dfrac{\mu_A + \mu_B + \mu_C}{3} = \dfrac{\mu_D + \mu_E}{2}$.

4. Use PROC GLM to fit the following model to the data:

$$y = \mu + \tau_1 D_1 + \tau_2 D_2 + \tau_3 D_3 + \tau_4 D_4 + \varepsilon$$

where the values of the dummy variables D_1, D_2, D_3 and D_4 are as follows for the different breeds:

Breed	D_1	D_2	D_3	D_4
A	1	0	0	0
B	0	1	0	0
C	0	0	1	0
D	0	0	0	1
E	-1	-1	-1	-1

Use the model to answer the questions that follow.

   (a) Give and interpret the estimates for the one-way ANOVA model.

   (b) Test the hypothesis $H_0 : \mu_D = \mu_E$.

   (c) Test the hypothesis $H_0 : \dfrac{\mu_A + \mu_B}{2} = \mu_C$.

5. Answer the following questions by using SAS/IML using the same design matrix as in 4.

   (a) Calculate the error sum of squares (SSE), the sum of squares for the model (SSR) and the total sum of squares (SST).

   (b) Give the estimates of the parameters.

   (c) Test the hypothesis $H_0 : \dfrac{\mu_A + \mu_B + \mu_C}{3} = \dfrac{\mu_D + \mu_E}{2}$.