生物統計 HW#4

Scientists concerned with treatment of tar sand wastewater studied three treatment methods for the removal of organic carbon. (Based on W. R. Pirie, *Statistical Planning and Analysis for Treatments of Tar Sand Wastewater*, Technical Information Center, Office of Scientific and Technological Information, United States Department of Energy.) The three treatment methods used were air flotation (AF), foam separation (FS), and ferric-chloride coagulation (FCC). The organic carbon material measurements for the three treatments yielded the following data:

AF	FS	FCC
34.6	38.8	26.7
35.1	39.0	26.7
35.3	40.1	27.0
35.8	40.9	27.1
36.1	41.0	27.5
36.5	43.2	28.1
36.8	44.9	28.1
37.2	46.9	28.7
37.4	51.6	30.7
37.7	53.6	31.2

data = wastewater

(*a*) Test H_0: $\mu_1 = \mu_2 = \mu_3$ at the $\alpha = .10$ level.

2

A study is conducted of the effect of light on the growth of ferns. Since plants grow at various rates at different ages, this variable is controlled by blocking. Four young plants (plants grown in the dark for 4 days) and four older plants (plants grown in the dark for 12 days) are utilized in the study, thus producing two blocks each of size 4. Four different light treatments are investigated. Each treatment is randomly assigned to one plant in each block. The treatments consist of exposing each plant to a single dose of light, returning it to the dark, and measuring the cross-sectional area of the fern tip 24 hours after the light is administered. These data resulted (cross-sectional area is given in square micrometers):

Block (age)	Treatment (wavelength of light)			
	420 nm	460 nm	600 nm	720 nm
Young	1017.6	929.0	939.8	1081.5
Old	854.7	689.9	841.5	797.4

data = fern

(*a*) Find the sample treatment, block, and grand totals and means.
(*b*) Test the null hypothesis of equal treatment means.

3

代謝產物

Cotinine is a major metabolite of nicotine. It is currently considered to be the best indicator of tobacco smoke exposure. A study is conducted to detect possible racial differences in cotinine level in young adults. These data are obtained on the cotinine level in milligrams per milliliter:

	White	Black
Male	210	245
	300	347
	150	125
	325	250
(1085)	100	260 (1227)
Female	177	252
	300	152
	106	315
	150	267
(893)	160	275 (1261)

data = cotinine

(*a*) Construct a two-way analysis-of-variance table for these data and use it to test the null hypothesis of no interaction.
(*b*) If no interaction is found, test for main effects.
(*c*) If interaction is detected, construct a diagram similar to that shown in Figure 10.6 to investigate the nature of the interaction.
(*d*) If interaction is detected, compare the mean cotinine level between whites and blacks for females via a one-way analysis of variance. Do the same for males.

(Based on means reported in Lynne Wagenknecht et al., "Racial Differences in Serum Cotinine Levels Among Smokers in the Coronary Artery Risk Development in Young Adults Study," *American Journal of Public Health*, September 1990, pp. 1053–1056.)