BIOS 145 Lab #11 11/26/97

1st hour: KKM Ch.17: #2ab, 4 (with #2 questions); Ch.20:#5

2nd hour: questions

Other:

1. Computer Exercise #3 posted

2. Answers for Ch. 17, 20, 19, 18 posted

KKM Ch.17 #2

The following data are replicate measurements of sulfur dioxide conc. in each of three cities:

City I:	2, 1, 3	$\overline{Y}_1 = 2,\ S_1 = 1$
City II:	4, 6, 8	$\overline{Y}_2 = 6,\ S_2 = 2$
City III:	2, 5, 2	$\overline{Y}_3 = 3,\ S_3 = 1.732$

a) Determine the appropriate ANOVA table for simultaneously comparing the mean sulfur dioxide concentrations in the three cities.

See SAS attachment p.1

b) Test whether the three cities differ significantly in mean sulfur dioxide concentration levels.

See F-test in SAS attachment p.1

KKM Ch.17 #4

$Y =$ proportion of treated patients discharged after 1 yr. of trt

Drug 1: $0.10,\ 0.12,\ 0.08,\ 0.14$ $(\overline{Y}_1 = 0.11,\ S_1 = 0.0192)$
Drug 2: $0.12,\ 0.14,\ 0.19$ $(\overline{Y}_2 = 0.15,\ S_2 = 0.0361)$
Drug 3: $0.20,\ 0.25,\ 0.15$ $(\overline{Y}_3 = 0.20,\ S_3 = 0.0500)$

a) Determine the appropriate ANOVA table for this dataset.

See SAS attachment p.3

b) Test to see if there are significant differences among drugs with regard to the average proportion of patients discharged.

See F-test in SAS attachment p.3

c) What is the estimated effect associated with each drug?

$$\overline{Y}^* = \frac{\overline{Y}_1 + \overline{Y}_2 + \overline{Y}_3}{3} = \frac{.11 + .15 + .20}{3} = .1533$$

$$\alpha_1 = \overline{Y}_1 - \overline{Y}^* = .11 - .1533 = -.0433$$
$$\alpha_2 = \overline{Y}_2 - \overline{Y}^* = .15 - .1533 = -.0033$$
$$\alpha_3 = \overline{Y}_3 - \overline{Y}^* = .20 - .1533 = .0467$$

d) State precisely the appropriate ANOVA fixed-effects model for these data

$$Y_{ij} = \mu + \alpha_i + E_{ij} \qquad i = 1, 2, 3;\ j = \text{pt. with drug } i$$

where

$Y_{ij} = j$-th patient using drug i,

$\mu = \dfrac{\mu_1 + \mu_2 + \mu_3}{3} \neq$ "grand mean" since unequal cell sizes,

$\alpha_i = \mu_i - \mu =$ "effect" of drug i,
$E_{ij} = Y_{ij} - \mu - \alpha_i =$ error term for j-th pt. using drug i

e) State precisely, using dummy-variables, the regression model that corresponds to the fixed-effects model in (d).

Using effect coding,

$$Y = \mu + \beta_1 X_1 + \beta_2 X_2 + E$$

where

$$X_i = \begin{cases} 1 & \text{if pt. uses drug } i \\ -1 & \text{if pt. uses drug 3} \\ 0 & \text{otherwise} \end{cases} \qquad i = 1, 2$$

$Y_{ij} = j$-th patient using drug i,

$\mu = \dfrac{\mu_1 + \mu_2 + \mu_3}{3} \neq$ "grand mean" since unequal cell sizes,

$$\begin{aligned} \beta_1 &= \mu_1 - \mu = \alpha_1 \\ \beta_2 &= \mu_2 - \mu = \alpha_2 \\ -(\beta_1 + \beta_2) &= \mu_3 - \mu = \alpha_3 \end{aligned}$$

f) Using the t distribution, find a 90% C.I. for the true difference between the effects of drugs 1 and 2 (making sure to use the best estimate of σ^2 provided by the data)

We want a 90% C.I. for

$$\alpha_1 - \alpha_2 = (\mu_1 - \mu) - (\mu_2 - \mu) = \mu_1 - \mu_2$$

It is

$$(\overline{Y}_1 - \overline{Y}_2) \pm t_{n-k,1-\alpha/2}\sqrt{\widehat{\sigma}\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}$$

$$= (.11 - .15) \pm t_{10-3,1-.10/2}\sqrt{.00137\left(\frac{1}{4}+\frac{1}{3}\right)}$$

$$= -.04 \pm (1.895)(.0283)$$

$$= (-.0936, .0136)$$

KKM Ch.20 #5

A questionnaire was administered to a stratified random sample of 40 city residents, from which was obtained data on # times victimized, a measure of social class status, and a measure of the respondent's confidence in law enforcement and in the legal system.

a) Determine the table of sample means and comment on any patterns noted.

$\overline{Y}_{ij}$	SLCS		
# Times Victimized	LO	MED	HI
0	14.57	12	13.5
1	12.33	12.25	7.4
2+	8	2.33	5.75

Give an appropriate regression model for this dataset.

$$Y = \mu + \alpha_1 X_1 + \alpha_2 X_2 + \beta_1 Z_1 + \beta_2 Z_2 + \gamma_{11} X_1 Z_1 +$$

$$\gamma_{12} X_1 Z_2 + \gamma_{21} X_2 Z_1 + \gamma_{22} X_2 Z_2 + E$$

Test for interactions: H_0: $\gamma_{11} = \gamma_{12} = \gamma_{21} = \gamma_{22} = 0$
using the test statistic

$$F(X_1 Z_1, X_1 Z_2, X_2 Z_1, X_2 Z_2 | X_1, X_2, Z_1, Z_2)$$

with 4 numerator and 31 denominator d.f.

Here,

$$F = \frac{(1.69 + 3.32 + 0.40 + 94.59)/4}{22.71} = 1.10 \text{ n.s.}$$