Assignment 11

(1) (a) The cases are people.
(b) 4 observations per student.
(c) The factors are gender and year
(d) Gender is between and year is within.
(e) i. $\bar{y} = (y_1 + y_2 + y_3 + y_4)/4$ or drop the 4
ii. $E(y|x) = \beta_0 + \beta_1 g$ where $g = \begin{cases} 1 & \text{if Female} \\ -1 & \text{if Male} \end{cases}$
iii. $H_0 : \beta_1 = 0$

(f) i. $d_1 = y_2 - y_1$, $d_2 = y_3 - y_2$, $d_3 = y_4 - y_3$

ii. $E(d_1) = \beta_{01} + \beta_{11} g$

$E(d_2) = \beta_{02} + \beta_{12} g$

$E(d_3) = \beta_{03} + \beta_{13} g$

iii. For main effect of year, $H_0 : \beta_{01} = \beta_{02} = \beta_{03} = 0$

iv. For gender by year $H_0 : \beta_{11} = \beta_{12} = \beta_{13} = 0$

The y variables should have double subscripts, as in the question. y1 should be y11, y2 should be y12, y3 should be y21 and y4 should be y22.

(2) (a) Cases are patients

(b) Drug A and Drug B

(c) Both factors are within cases.

(d)

A \ B	ν_0	yes
ν_0	$E(y_1) = \mu_{11}$	$E(y_2) = \mu_{12}$
yes	$E(y_3) = \mu_{21}$	$E(y_4) = \mu_{22}$

(e) i. A $\quad d_1 = y_1 + y_2 - (y_3 + y_4)$

ii. B $\quad d_2 = y_1 + y_3 - (y_2 + y_4)$.

iii. A x B $\quad d_3 = y_1 - y_2 - (y_3 - y_4)$

(f) i. $E(y|x) = \beta_0 + \beta_1 a_1 + \beta_2 a_2 + \beta_3 a_3 + \beta_4 a_4$

ii.

Age	a_1	a_2	a_3	a_4	$E(y\|x)$
5-12	1	0	0	0	$\beta_0 + \beta_1$
13-18	0	1	0	0	$\beta_0 + \beta_2$
19-29	0	0	1	0	$\beta_0 + \beta_3$
30-64	0	0	0	1	$\beta_0 + \beta_4$
65+	-1	-1	-1	-1	$\beta_0 - \beta_1 - \beta_2 - \beta_3 - \beta_4$

iii. Because the average Expected Value $= \beta_0$

iv. Age group is between

v. Try it yourself before looking at the next page.

(2 f v.)

Effect	Linear Combination	Null Hypothesis
Drug A	$d_1 = \mu_1 + \mu_2 - (\mu_3 + \mu_4)$	$\beta_0 = 0$
Drug B	$d_2 = \mu_1 + \mu_3 - (\mu_2 + \mu_4)$	$\beta_0 = 0$
Age	$l = (\mu_1 + \mu_2 + \mu_3 + \mu_4)/4$	$\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$
A X B	$d_3 = \mu_1 - \mu_2 - (\mu_3 - \mu_4)$	$\beta_0 = 0$
A X Age	d_1	$\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$
B X Age	d_2	$\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$
A X B X Age	d_3	$\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$