RELATIONSHIPS BETWEEN ONE-WAY AND TWO-WAY DESIGNS

1.   The data below represent the number of errors made by subjects in a paired-associate learning task. There are four groups, with eight subjects per group. The experimenter is interested in the influence of two specific but unnamed drugs on performance. Group A_1 is a control group not given any drug. Groups A_2, A_3, and A_4 are experimental groups; Group A_2 was given one drug, Group A_3 another, and Group A_4 was given both drugs.

	A_1	A_2	A_3	A_4	
	7	13	10	14	
	1	12	12	13	
	8	6	4	14	
	9	10	11	14	
	9	13	7	17	
	7	13	8	11	
	4	6	12	13	
	9	10	5	14	
Total	54	83	69	110	316
Means	6.75	10.38	8.63	13.75	9.88
$\sum Y^2$	422	923	663	1532	
$s^2 =$	8.2143	8.8393	9.6964	2.7857	

2.   Partition of SS for Data

$\sum Y^2 = 3540$
$SS_{mean} = 3120.50$
$SS_{cells} = 212.75$
$SS_{S/cells} = 206.75$ $MS_{S/AB} = 28 = 7.3839$

3.   Analysis of the Data as a Two-way Design

		Drug 1			
		Absent	Present		
	Absent	A_1	A_2	137	
Drug 2		54	83		Entries are
	Present	A_3	A_4	179	totals
		69	110		
		123	193	316	

$[T] = 316^2/32 = 3120.50$ $[Y] = 3540$

$[C] = (123^2 + 193^2)/16 = 3273.63$ $[R] = (137^2 + 179^2)/16 = 3175.63$

$[RC] = (54^2 + 83^2 + 69^2 + 110^2)/8 = 3333.25$

$SS_M = [T] = 3120.50$

$SS_C = [C] - [T] = 3273.63 - 3120.50 = 153.13$

$SS_R = [R] - [T] = 55.13$

$SS_{RC} = [RC] - [C] - [R] + [T] = 3333.25 - 3273.63 - 3175.63 + 3120.50 = 4.49$

$SS_{S/AB} = [Y] - [RC] = 3540 - 3333.25 = 206.75$

Note that SS_{cells} from homework problem (212.75) is equal to the <u>sum</u> of

SS_C	153.13
SS_R	55.13
SS_{RC}	4.49
	212.75

4. Analysis of the Data as a Set of Orthogonal Contrasts

	A_1	A_2	A_3	A_4	
C_1	-1	-1	+1	+1	Main effect of Drug 2
C_2	+1	-1	+1	-1	Main effect of Drug 1
C_3	-1	+1	+1	-1	Interaction

$C_1 = \dfrac{8[-6.75 - 10.38 + 8.63 + 13.75]^2}{4} = 55.13 = SS_{ROW}$

$C_2 = \dfrac{8[6.75 - 10.38 + 8.63 - 13.75]^2}{4} = 153.13 = SS_{COL}$

$C_3 = \dfrac{8[-6.75 + 10.38 + 8.63 - 13.75]^2}{4} = 4.44 = SS_{RC}$

Total $212.70 = SS_{CELLS}$ (within rounding error)