HW 6

6.2) 2^3 factorial replicated twice

$2^3 \Rightarrow$ 3 factors, each has 2 levels

rep. twice $\Rightarrow 2 \times 2^3 = 16$

Source	df
Main	3
2-Way	3
3-Way	1
Error	8
Total	15

$(16-1) - 3 - 3 - 1$

$= 8$

e)

8 degrees of freedom for Error

6.4) 2^3 factorial replicated three times

Source	df
A	1
B	1
C	1
AB	1
AC	1
BC	1
ABC	1
Error	16
Total	23

Error

$2^3 \times (3-1) = 16$ $\quad 2^k(r-1)$

Total

$2^3 \times 3 - 1 = 23$ $\quad 2^k r - 1$

k = # factors

r = # replicates

$16 + 2$ ← not sig.

$=$ 18 degrees of freedom

f) none of the above

6.5) a)

(1)	22	31	25	78
a	32	43	29	104
b	35	34	50	119
ab	55	47	46	148
c	44	45	38	127
ac	40	37	36	113
bc	60	50	54	164
abc	39	41	47	127

$$A = \frac{(104-78)+(148-119)+(113-127)+(127-164)}{4\times 3} = \frac{26+29-14-37}{12} = \frac{4}{12} \quad (.333)$$

$$B = \frac{(119-78)+(148-104)+(164-127)+(127-113)}{4\times 3} = \frac{41+44+37+14}{12} = \frac{136}{12} \quad (11.33)$$

$$C = \frac{(127+113+164+127-78-104-119-148)}{4\times 3} = \frac{82}{12} = (6.833)$$

$$AB = \frac{(148-104-119+78+127-164-113+127)}{4\times 3} = -\frac{20}{12} = (-1.66)$$

$$AC = \frac{(78-104+119-148-127+113-164+127)}{4\times 3} = -106/12 = -8.833$$

$$BC = \frac{(78+104-119-148-127-113+164+127)}{4\times 3} = -\frac{34}{12} = -2.833$$

$$ABC = \frac{(127-164-113+127-148+119+104-78)}{4\times 3} = \frac{-26}{12} = -2.166$$

The effects of B, C, and AC are significant.

The estimated factor effects are A=4, B=136, C=82
B & C appear to be large.

6.5) b) $SS_A = 4^2/24 = .667$ | $SS_{AB} = -20^2/24 = 16.667$ | $SS_{ABC} = -26^2/24 = 28.167$

$SS_B = 136^2/24 = 770.667$ | $SS_{AC} = -106^2/24 = 468.167$

$SS_C = 82^2/24 = 280.167$ | $SS_{BC} = -34^2/24 = 48.167$

Source	df	SS	MS	F	P	
A	1	.667	.667	.022	<.883	
B	1	770.667	770.667	25.55	<.0001	*
C	1	280.167	280.167	9.29	.0067	*
AB	1	16.667	16.667	.55		
AC	1	468.167	468.167	15.52	.0009	*
BC	1	48.167	48.167	1.6		
ABC	1	28.167	28.167	.93		
Error	16	482.66	30.166			
Total	23	2095.33				

B, C, & AC are significant at 1%

(6.7) $SE_{Effect} = \sqrt{\frac{1}{n2^{k-2}} s^2} = \sqrt{\frac{1}{(3)2^{(3-2)}} (30.17)} = \underline{\underline{2.24}}$

Variable	Effect	
A	.333	
B	11.333	✗
AB	-1.667	
C	6.833	✗
AC	-8.833	✗
BC	-2.833	
ABC	-2.167	

The 95% CI intervals for B, C, & AC do not have zero.

I	II	III	IV		
14.037	16.165	13.972	13.907	58.081	(1)
13.880	13.860	14.032	13.914	55.686	(a)
14.821	14.757	14.843	14.878	59.299	(b)
14.888	14.921	14.415	14.932	59.156	(ab)

6.14) $A = (59.156 + 55.686 - 59.299 - 58.081)/2(4) = -.31725$

$B = (59.156 + 59.299 - 55.686 - 58.081)/2(4) = .586$

$AB = (59.156 + 58.081 - 55.686 - 59.299)/2(4) = .2815$

$SS_A = (ab + a - b - (1))^2/4n = (-2.538)^2/16 = .40259$

$SS_B = (ab + b - a - (1))^2/4n = (4.688)^2/16 = 1.3735$

a) $SS_{AB} = (ab + (1) - a - b)^2/4n = (2.252)^2/16 = .3169$

Est. Factor Effects: A = -2.538, B = 4.688, AB = 2.252

b)

Source	SS	DF	MS	F	P
A	.4023	1	.4023	1.2607	> .1
B	1.3736	1	1.3736	4.3046	.05 < P < .1
AB	.3170	1	.3170	.9934	> .1
Error	3.8287	12	.3191		
Total	5.9216	15			

In this model there are no significant terms.

Table generated through RStudio.