Additional EXERCISES CHAP 4

Box Hunter and Hunter, Wiley, Prob 4.2 and Prob. 4.3

BHH Problem 4.2

(g) Do you

2. Six burn treatments A, B, C, D, E, F were tested on six subjects (volunteers). Each subject has six sites on which a burn could be applied for testing (each arm with two below the elbow and one above). A standard burn was administered at each site and the six treatments were arranged so that each treatment occurred once with every subject once in every position. After treatment each burn was covered by a clean gauze; treatment C was a control with clean gauze but without other treatment. The data are the number of hours for a clearly defined degree of partial healing to occur.

	Subjects					
Positions on arm	1	2	3	4	5	6
I	A 32	B 40	C 72	D 43	E 35	F 50
II	B 29	A 37	F 59	E 53	D 32	C 53
III	C 40	D 56	A 53	B 48	F 37	E 43
IV	D 29	F 59	E 67	A 56	C 38	B 42
V	E 28	C 50	B 100	F 46	A 29	D 56
VI	F 37	E 42	D 67	C 50	B 33	A 48

a) What is this Design called ?
b) How can such design be randomized ?
c) Conduct an ANOVA with JMP
d) State any assumptions that you make.
e) Analyse the residuals.

Solution: See JMP file BHH_prob_4.2

a) Latin square (6x6)

b) Assign randomly the letters to the treatments. All subjects receive all treatments and all treatments are performed in all the positions.

c)

Summary of Fit

RSquare	0.774783
RSquare Adj	0.60587
Root Mean Square Error	9.243015
Mean of Response	46.91667
Observations (or Sum Wgts)	36

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	15	5878.0833	391.872	4.5869
Error	20	1708.6667	85.433	Prob > F
C. Total	35	7586.7500		0.0010*

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
position	5	5	219.9167	0.5148	0.7619
subject	5	5	5407.9167	12.6600	<.0001*
treatment	5	5	250.2500	0.5858	0.7107

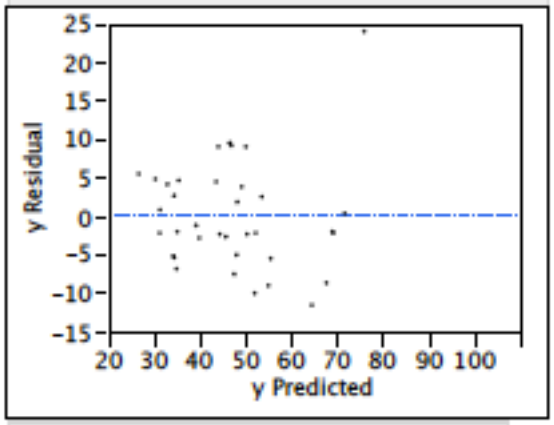
d) Equal variance in the data set, normal distribution of errors, no interaction between factors.

e)

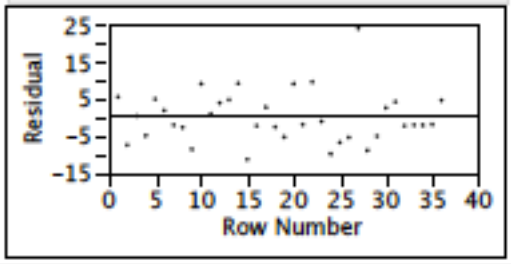
Response y

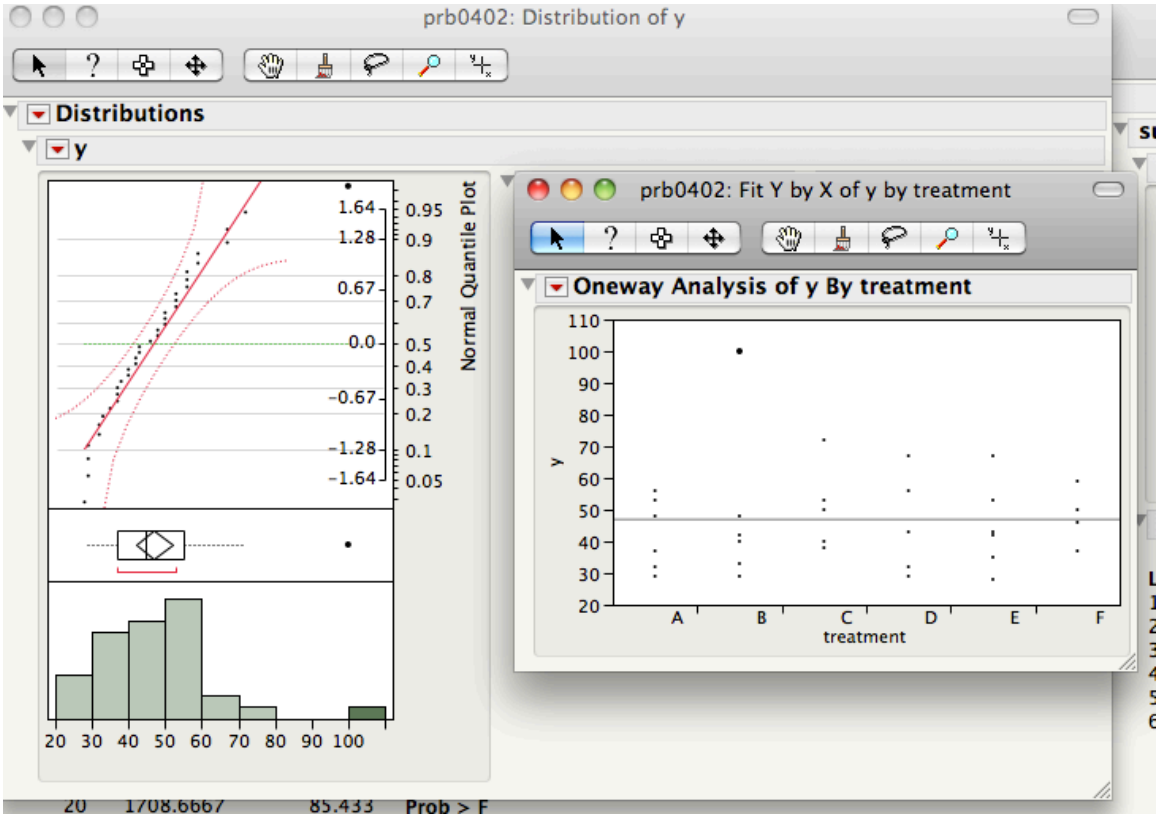
Whole Model

Residual by Predicted Plot



Residual by Row Plot





note: Looks normally distributed but one data point is an outlier and should be checked.

BHH Prob 4.3.

(e) Make an appropriate analysis.

3. Three alternative regimes α, β, and γ involving combinations of certain exercises and drugs are being compared for their efficacy in the reduction of overweight in men. Fifteen volunteers were available for the trial. The trials were carried out by first dividing the subjects into "matched" groups; that is, men in any group were chosen to be as alike as possible. The loss of weight after 3 months for the three regimes was as follows:

		Regimes		
		α	β	γ
Groups	1	15	10	8
	2	24	15	17
	3	31	28	34
	4	37	36	34
	5	33	37	39

(a) Make any analysis you feel is appropriate, including a graphical analysis.

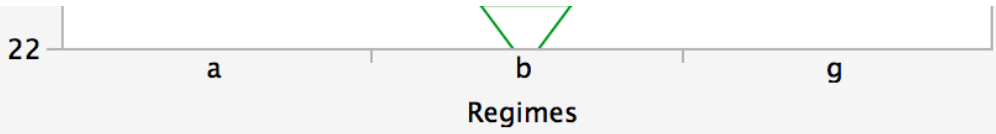
(b) Suppose you are told that the average weight in pounds at the beginning of the trial for members in each group is as follows:

Group	1	2	3	4	5
Weight	250	309	327	356	379

How might this affect your analysis and conclusions?

Solution:

Check JMP file BHH_Prob_4.3



Block Groups

Oneway Anova

Summary of Fit

Rsquare	0.943036
Adj Rsquare	0.900313
Root Mean Square Error	3.396076
Mean of Response	26.53333
Observations (or Sum Wgts)	15

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Regimes	2	19.7333	9.867	0.8555	0.4606
Groups	4	1507.7333	376.933	32.6821	<.0001*
Error	8	92.2667	11.533		
C. Total	14	1619.7333			

Means for Oneway Anova

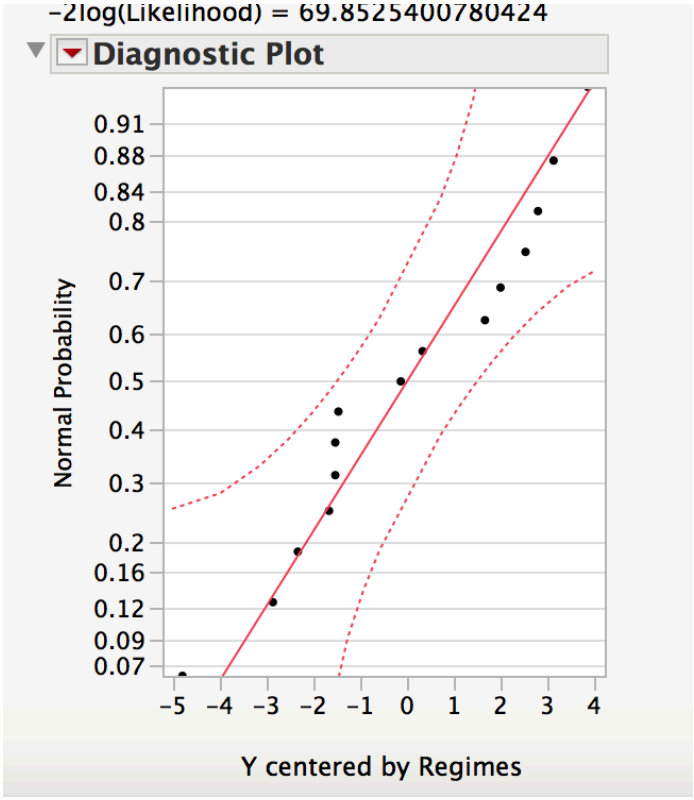
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
a	5	28.0000	1.5188	24.498	31.502
b	5	25.2000	1.5188	21.698	28.702
g	5	26.4000	1.5188	22.898	29.902

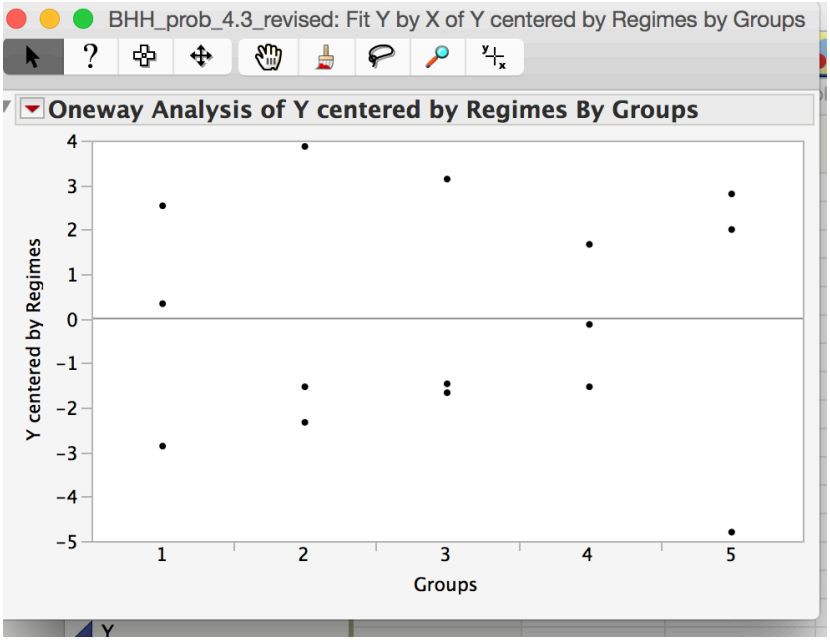
Std Error uses a pooled estimate of error variance

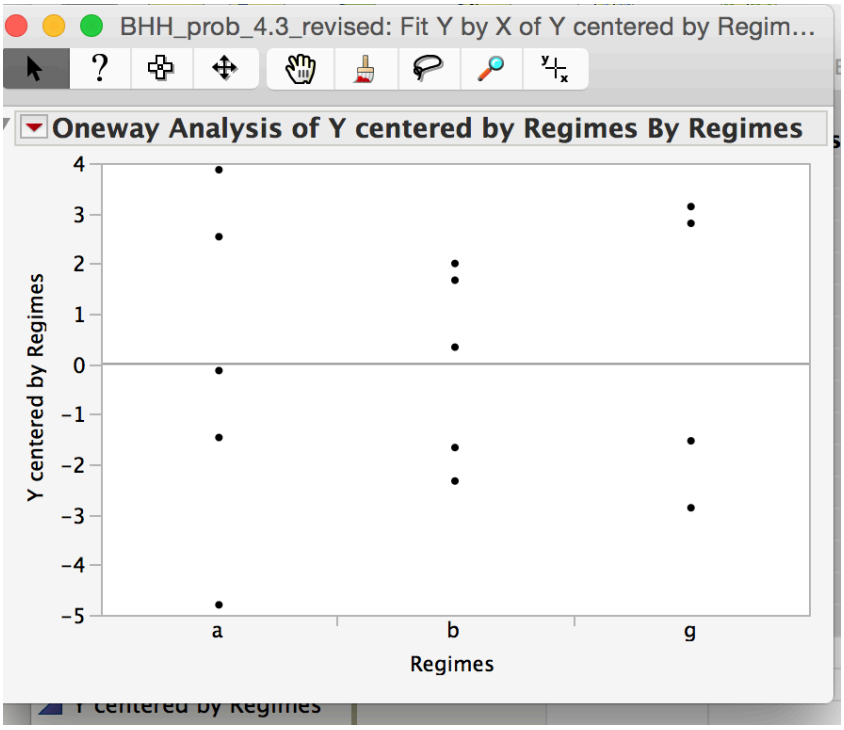
Block Means

Groups	Mean	Number
1	11.0000	3
2	18.6667	3
3	31.0000	3
4	35.6667	3
5	36.3333	3

This was analysed as a RCBE. The analysis indicates that there is no significant difference between the regimes. The groups, as expected, are significantly different. However, the analysis of the residuals raises some concerns since the residuals deviate from the normal distribution. This may be due to an interaction between group weight and regime which may mask the overall effect of the factor regime (question b. Regimes may have different effects depending on the weight). This suggests that a randomized complete block design may not be appropriate to address this question.


-2log(Likelihood) = 69.85254007804 24
Diagnostic Plot
Normal Probability
0.91
0.88
0.84
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.16
0.12
0.09
0.07
-5 -4 -3 -2 -1 0 1 2 3 4
Y centered by Regimes


BHH_prob_4.3_revised: Fit Y by X of Y centered by Regimes by Groups
Oneway Analysis of Y centered by Regimes By Groups
Y centered by Regimes
4
3
2
1
0
-1
-2
-3
-4
-5
1 2 3 4 5
Groups


BHH_prob_4.3_revised: Fit Y by X of Y centered by Regim...
Oneway Analysis of Y centered by Regimes By Regimes
Y centered by Regimes
4
3
2
1
0
−1
−2
−3
−4
−5
a
b
g
Regimes