Stat465/865 Assignment 4  
Due by 4pm Nov 30, 2016

- The assignment is to be completely individually.
- Provide any code used to help determine your answer.

**Question 1 (/8)**
The following output was obtained from a computer program that performed a two-factor ANOVA on a factorial experiment.

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>DF</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>9.999</td>
<td>1</td>
<td>9.999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>180.378</td>
<td>3</td>
<td>60.126</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td>8.479</td>
<td>3</td>
<td>2.826</td>
<td>0.932</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>158.797</td>
<td>8</td>
<td>19.849</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>357.653</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a) Fill in the blanks in the ANOVA table. Approximate p values are acceptable.
b) How many levels were used for factor B?  
c) How many replicates of the experiment were performed?  
d) What conclusions would you draw about this experiment and/or its factors?  
Show/justify your work.

**Question 2 (/8)**
A $2^4$ factorial design has been run in a pilot plant to investigate the effect of four factors on the molecular weight of a polymer. The data from this experiment are as follows (values are coded by dividing by 10):

(1) = 88  
d = 86  
a = 80  
ad = 81  
b = 89  
bd = 85  
ab = 87  
abd = 86  
c = 86  
cd = 85  
ac = 81  
acd = 79  
bc = 82  
bcd = 84  
abc = 80  
abcd = 81

a) Construct a table showing the signs for effects of this experiment.  
b) Construct a normal probability plot of the effects. Which effects are active?  
c) Construct an appropriate model. Fit this model and test for significant effects.  
d) Analyze the residuals from this model by constructing a normal probability plot of the residuals and plotting the residuals vs the predicted values of $y$.  

**Question 3 (/3)**
Consider the first-order model
\[ \hat{y} = 50 + 2x_1 - 15x_2 + 3x_3 \]
Where \(-1 \leq x_i \leq +1, i = 1,2,3\). Find the direction of steepest ascent.

**Question 4 (/6)**
Draw the type-B OC curve for the single-sampling plan n=100, c=2. Provide calculations of at least 4 points that were used to create the plot of the OC curve.

**Question 5 (/4)**
Find a single sampling plan for which \( p_1 = 0.01, \alpha = 0.05, p_2 = 0.10, \beta = 0.10 \).
Use Figure 1 to help justify your answer.