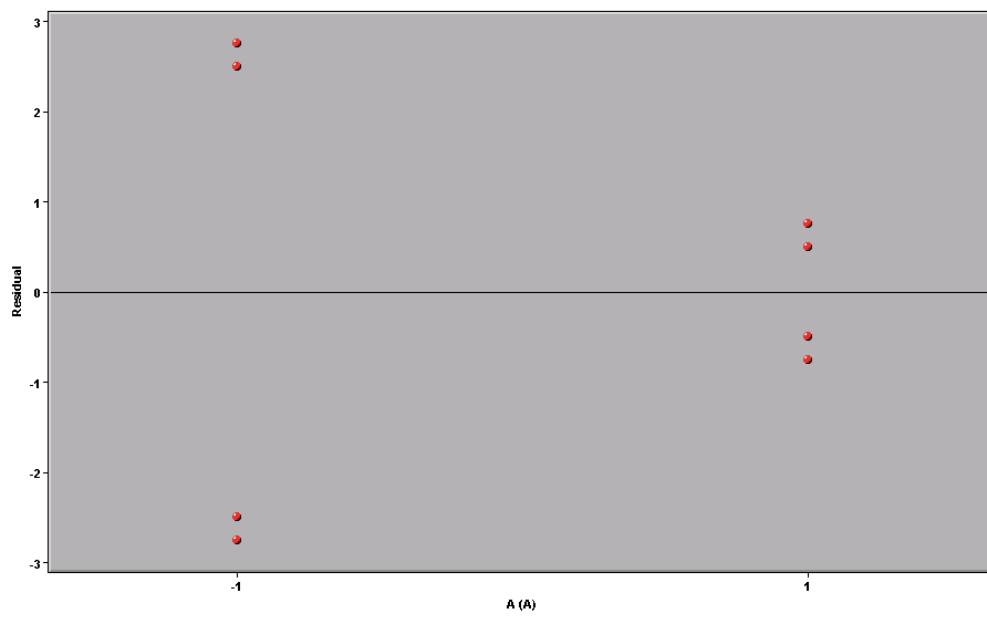
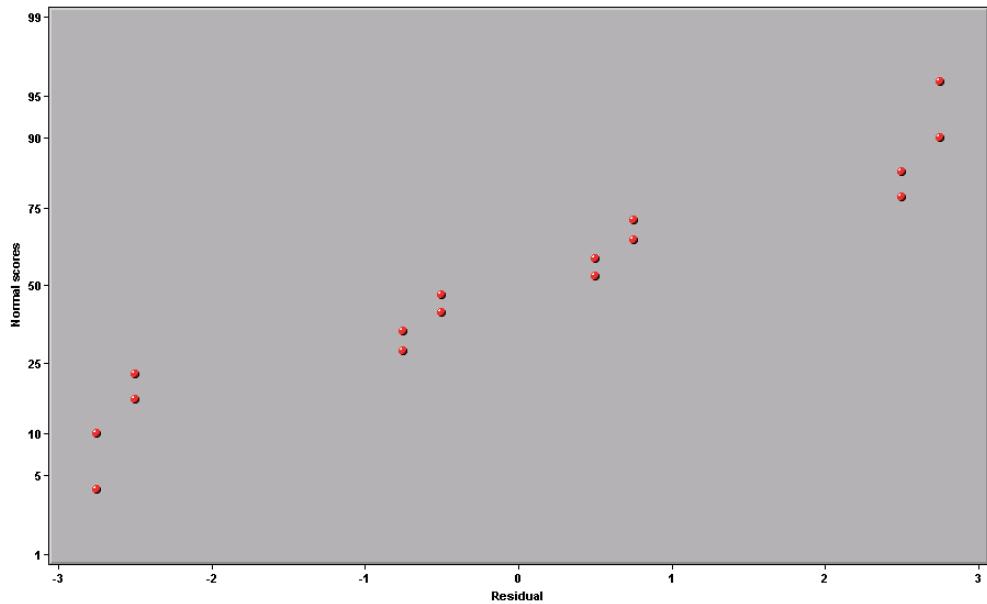
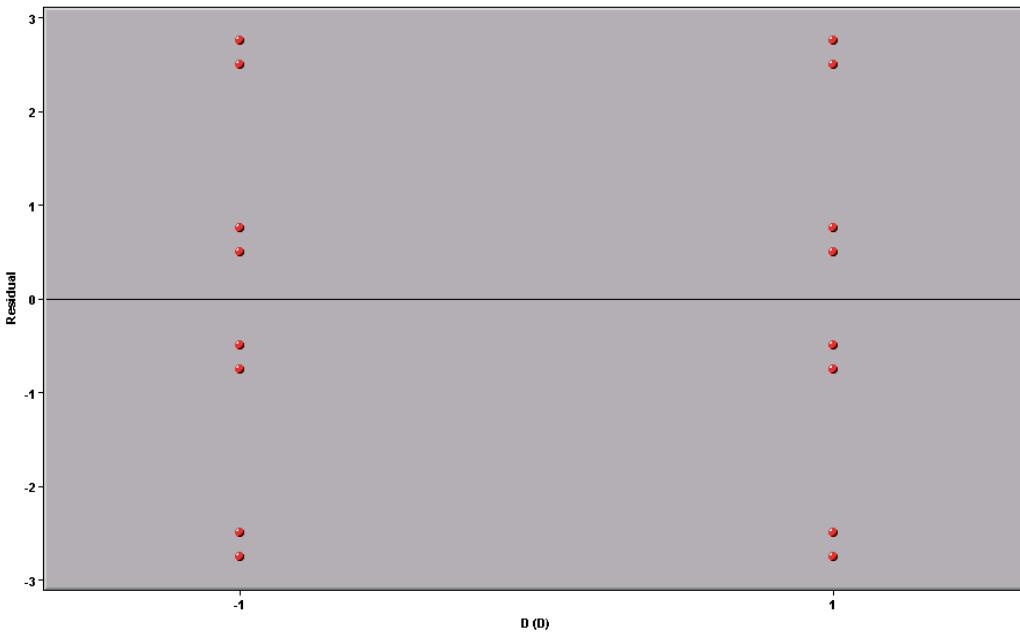
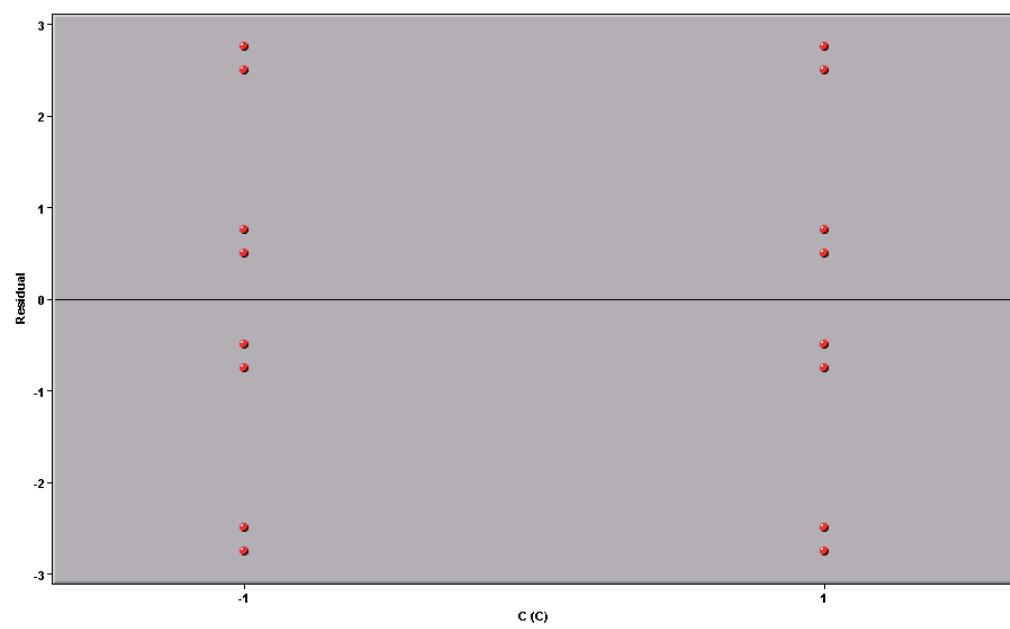
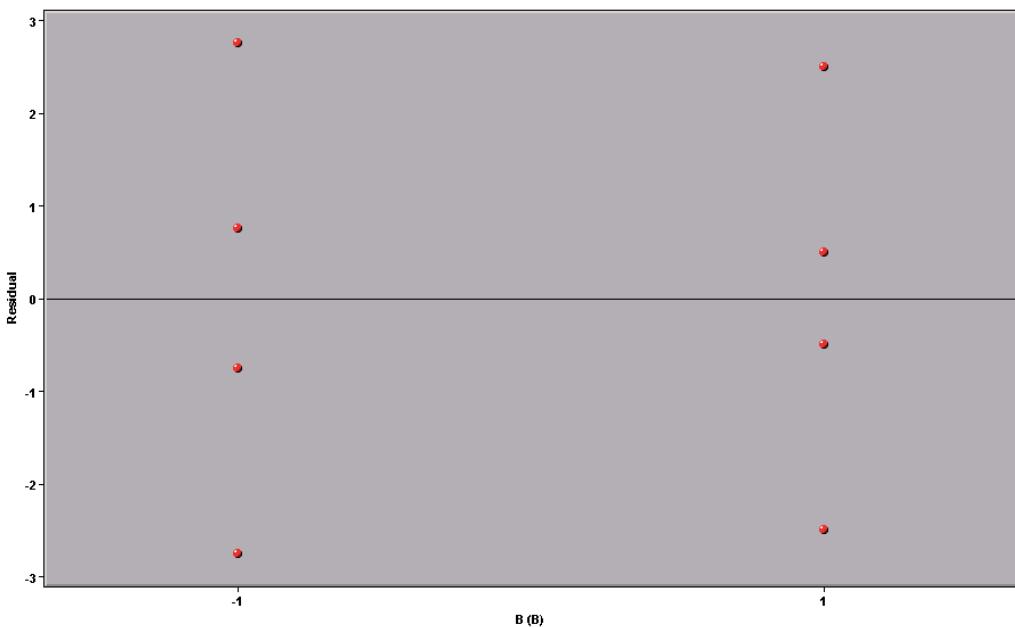


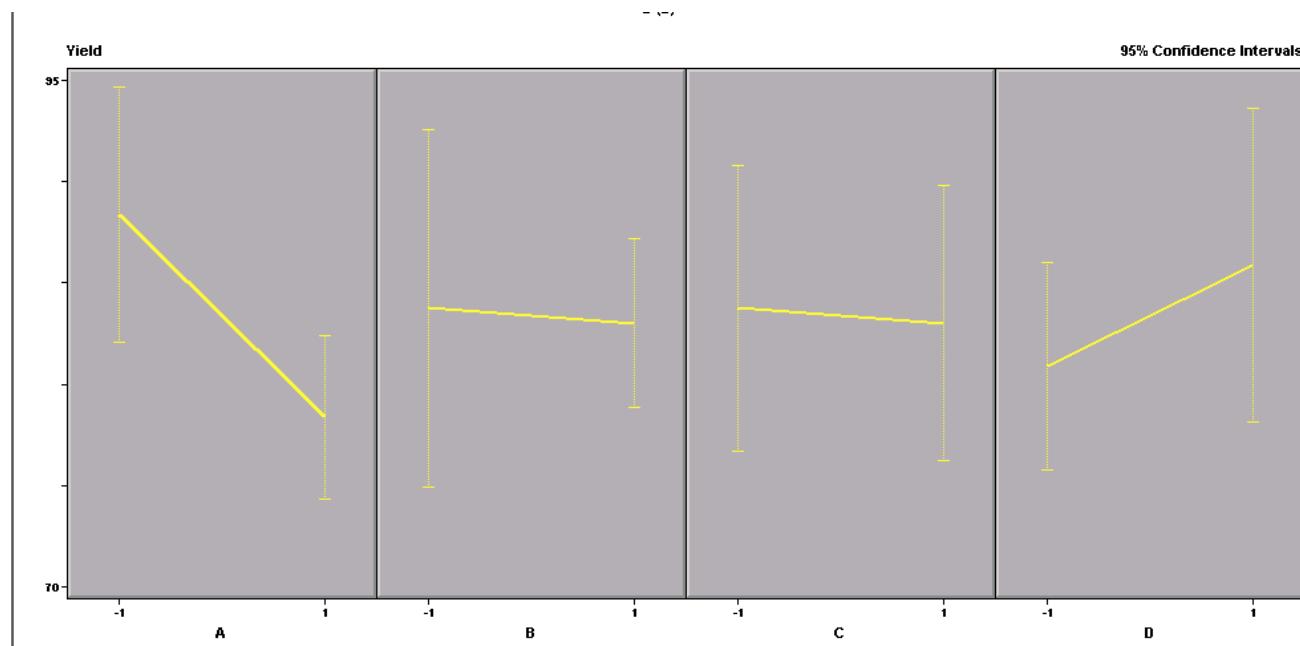
STA4202 Assignment 4

Jeremy Harper
04.05.2011

1. Only the main effect of factor A was significant in the final model. The normal probability plot looks OK (although it is spaced out between the four pairs), and so do the residuals for factors B-D, but the residuals for factor A do not have equal variance between settings (which is an indication that the ANOVA model might not be applicable).







Effect Estimate Std Error t Ratio P Value

A	-10	2.2079	-4.5291	0.0201
B	-0.75	2.2079	-0.33968	0.7565
C	-0.75	2.2079	-0.33968	0.7565
D	5	2.2079	2.2646	0.1085
A*B	4.5	2.2079	2.0381	0.1343
A*C	0.5	2.2079	0.22646	0.8354
A*D	-3.75	2.2079	-1.6984	0.1880
B*C	-1.25	2.2079	-0.56614	0.6109
B*D	-1.5	2.2079	-0.67937	0.5456

ANOVA for YIELD

Predictive Model					
Source	DF	SS	MS	F	Pr > F
BLOCK	3	243.25	81.08333	2.818062	0.0884
A	1	400	400	13.90205	0.0033
Model	4	643.25	160.8125	5.58906	0.0105
Error	11	316.5	28.77273		
(Lack of fit)	3	15.5	5.166667	0.13732	0.9349
(Pure Error)	8	301	37.625		
Total	15	959.75			

Fit Statistics for YIELD

Master Model	Predictive Model
--------------	------------------

Mean	83.375	83.375
R-square	93.90%	67.02%
Adj. R-square	69.52%	55.03%
RMSE	4.41588	5.364022
CV	5.296408	6.433609

Effect Estimates for YIELD

Term	Predictive Model			
	Estimate	Std Err	t	Pr > t
A	-10	2.682011	-3.72855	0.0033

2.a. and 2.b. The design generators were ACE and BDE. The aliases are presented below in both SAS output and longhand.

2.a		I	A(CE)	B(DE)	C	D	E	Jeremy Hayes	
	+	-		+	+	-	-	b	✓
	+	+	-		-	+	-	ad	✓
	+	-	-	-	-	-	+	e	✓
	+	+	+		+	+	+	abcde	✓
	+	-	-		+	+	-	cd	✓
	+	+	-		+	-	+	acc	✓
	+	-	+		-	+	+	bde	✓
	+	+	+		---	---	---	ab	✓

2.b		I = ACE = BDE = ABCD		
	2.c.	A ∈ CE = AODE = BCD		
		B = ABCE = DE = ACD		
		C = AE = BCDE = ABD		
		D = ACDE = BE = ABC		
		E = AC = BD = ABCDE		
		AD = BCE = ADE = CD		
		AD = DCE = ABE = BC		

2.d.

The

CONDENA + MATERIAL*SOLVENT*TIME + SOLVENT*MATERIAL2 + CONDENSA*MATERIAL*TIME*MATERIAL2
 MATERIAL + CONDENSA*MATERIAL*SOLVENT*MATERIAL2 + CONDENSA*SOLVENT*TIME + TIME*MATERIAL2
 SOLVENT + MATERIAL*SOLVENT*TIME*MATERIAL2 + CONDENSA*MATERIAL*TIME + CONDENSA*MATERIAL2
 TIME + CONDENSA*MATERIAL*SOLVENT + MATERIAL*MATERIAL2 + CONDENSA*SOLVENT*TIME*MATERIAL2
 MATERIAL2 + MATERIAL*TIME + CONDENSA*SOLVENT
 MATERIAL*SOLVENT*MATERIAL2 + CONDENSA*MATERIAL + SOLVENT*TIME + CONDENSA*TIME*MATERIAL2
 MATERIAL*SOLVENT + CONDENSA*MATERIAL*MATERIAL2 + SOLVENT*TIME*MATERIAL2 + CONDENSA*TIME

only significant main effect or interaction was material1, and the final model for material is significant. From the master model, you can see that the condensation*material1 and condensation*time interactions are non-significant.

Effect	Estimate	Std Error	t Ratio	P Value
MATERIAL + ...	-5.175	1.0201	-5.073	0.0367
SOLVENT + ...	2.275	1.0201	2.2302	0.1555
MATERIA2 + ...	2.275	1.0201	2.2302	0.1555
SOLVENT*TIME	1.825	1.0201	1.789	0.2155
SOLVENT*MATERIA2	-1.525	1.0201	-1.4949	0.2736

ANOVA for YIELD

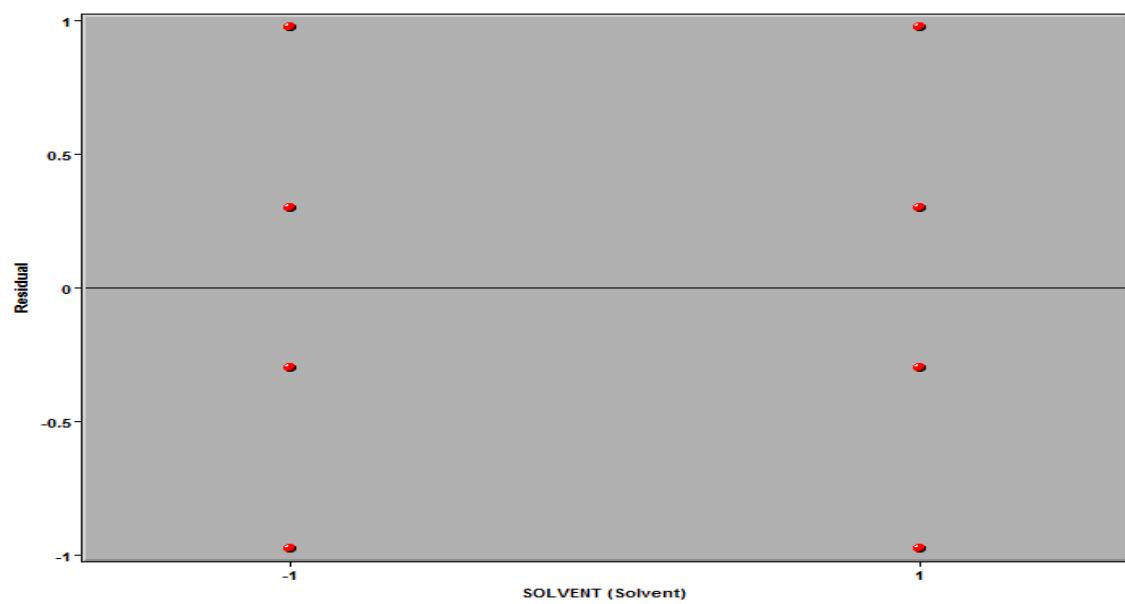
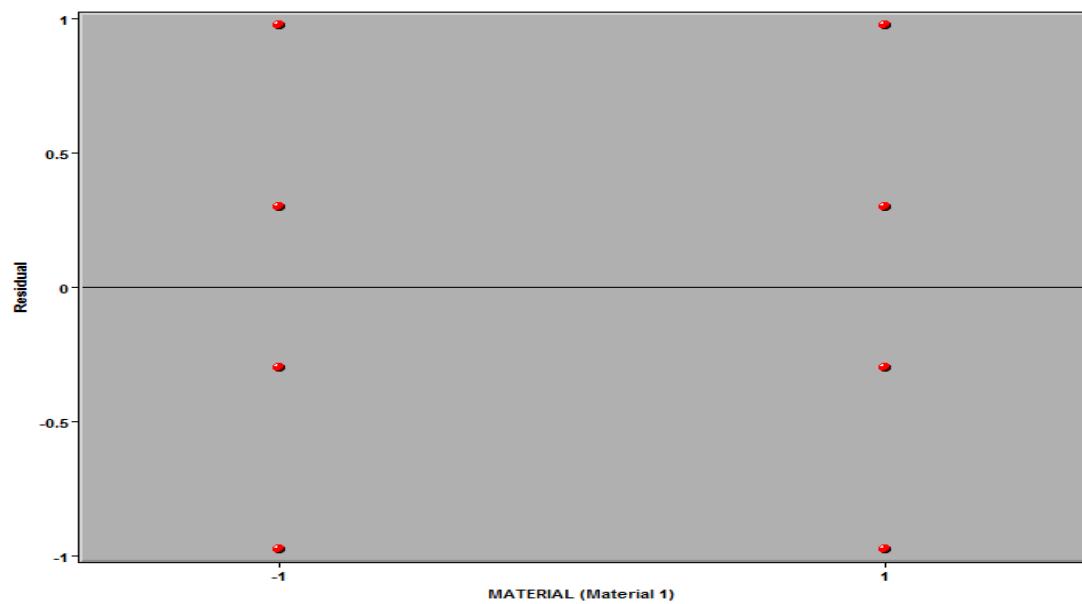
Effect	Estimate
CONDENSA + ...	-1.525
MATERIAL + ...	-5.175
SOLVENT + ...	2.275
TIME + ...	-0.675
MATERIA2 + ...	2.275
CONDENSA*MATERIAL + ...	1.825
CONDENSA*TIME + ...	-1.275

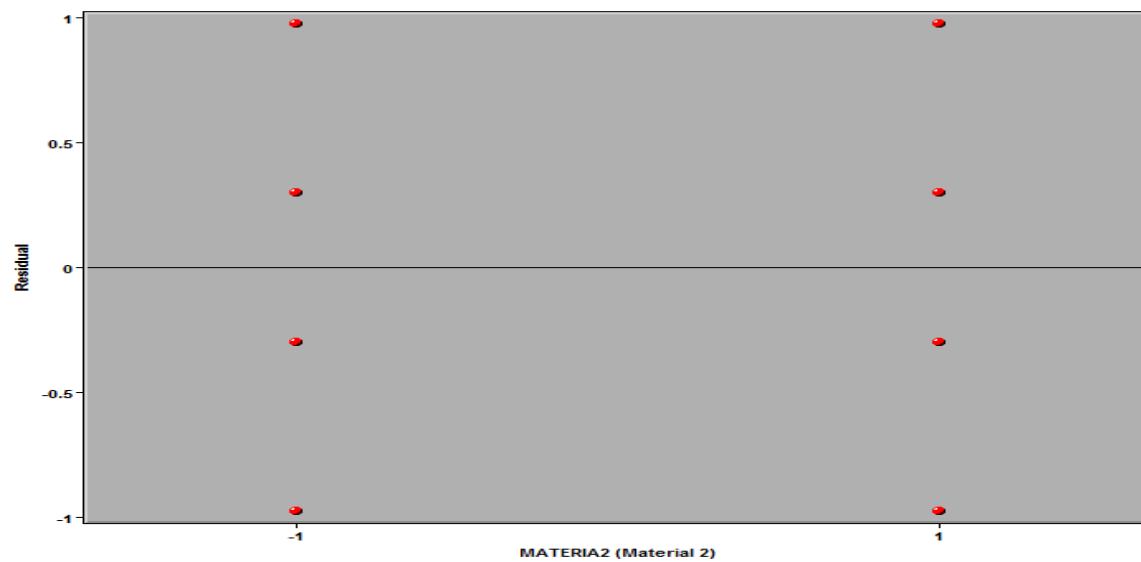
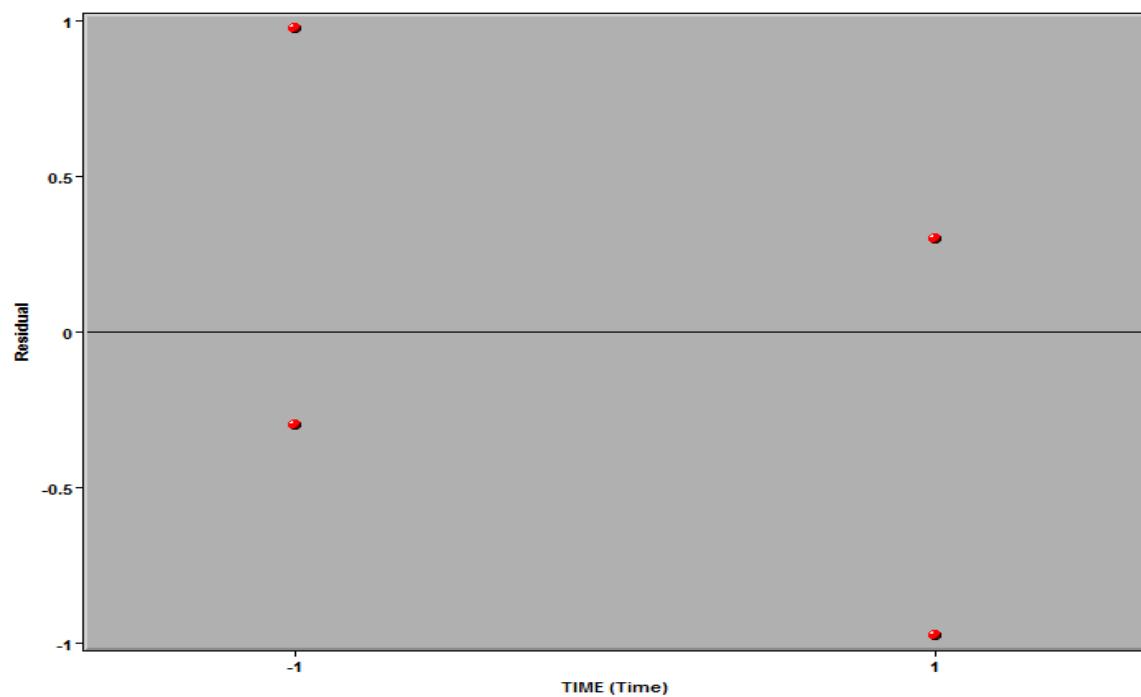
Master Model						Predictive Model					
Source	DF	SS	MS	F	Pr > F	DF	SS	MS	F	Pr > F	
MATERIAL	0	0	.	.	.	1	53.56125	53.56125	8.883076	0.0246	
SOLVENT	0	0	.	.	.						
MATERIA2	0	0	.	.	.						
CONDENSA*SOLVENT	0	0	.	.	.						
CONDENSA*MATERIA2	0	0	.	.	.						
MATERIAL*TIME	0	0	.	.	.						
TIME*MATERIA2	0	0	.	.	.						
CONDENSA*MATERIAL	1	6.66125	6.66125	2.395056	0.2618						
CONDENSA*TIME	1	3.25125	3.25125	1.168989	0.3926						
Model	5	84.17625	16.83525	6.053124	0.1478	1	53.56125	53.56125	8.883076	0.0246	
Error	2	5.5625	2.78125			6	36.1775	6.029583			
Total	7	89.73875				7	89.73875				

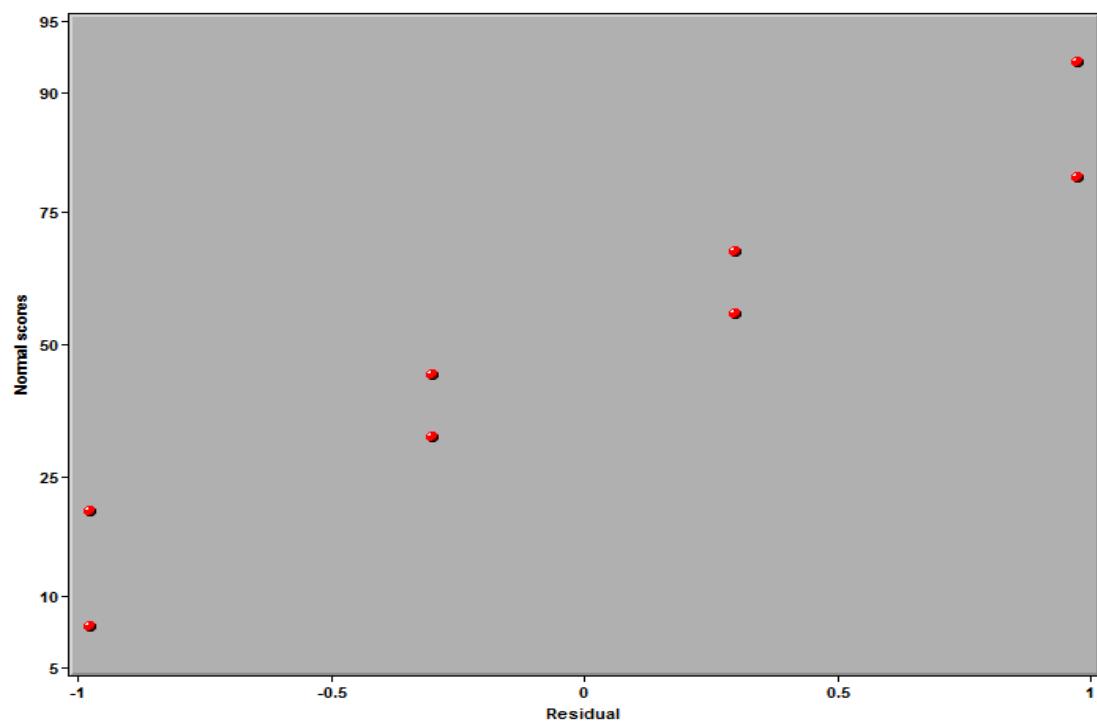
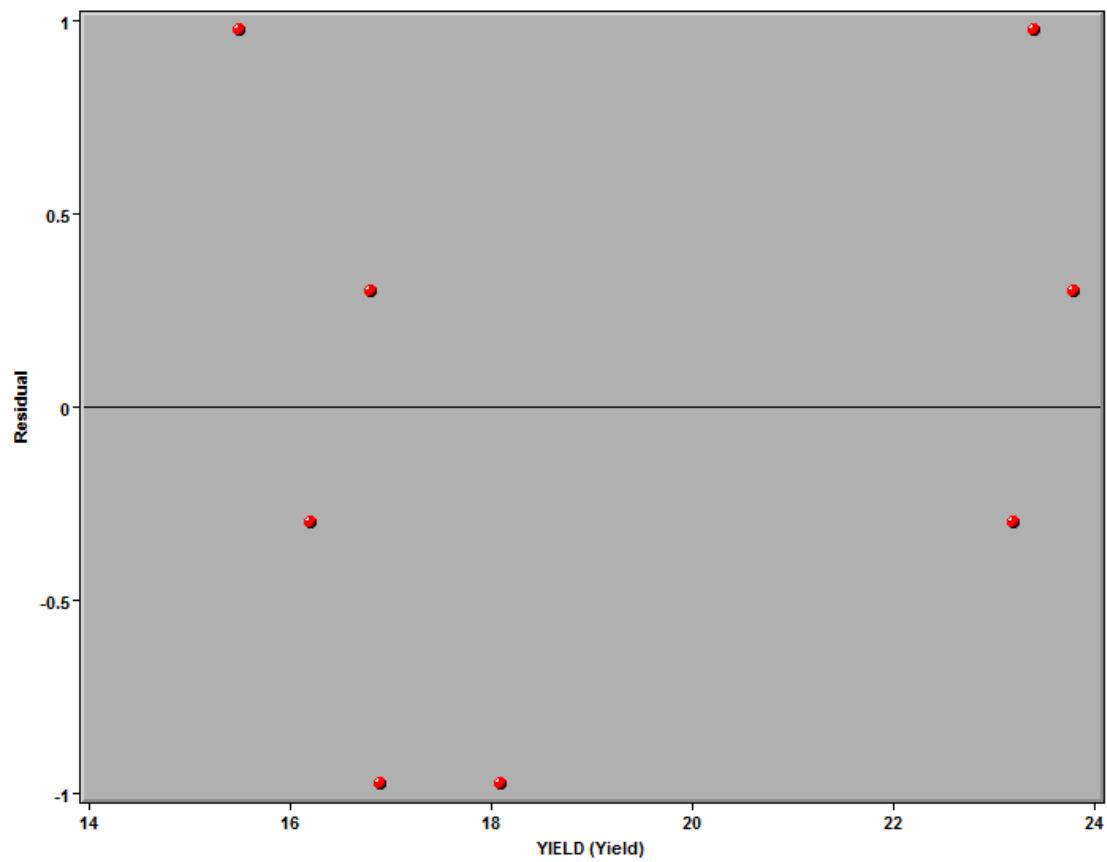
Fit Statistics for YIELD

	Master Model	Predictive Model
Mean	19.2375	19.2375
R-square	90.18%	59.69%
Adj. R-square	77.08%	52.97%
RMSE	1.714035	2.455521
CV	8.909865	12.76424

2.e. The residuals all look good (time has equal variance between points, so it is OK), and the normal probability plot also looks good. There is a linear pattern and constant variance throughout the plot.







3. The main and folded design with effects is presented below. Output from SAS is also given.

3.	A	B	C	D = AB	E = AC	F = BC	Jeremy Harper
	-	-	-	+	+	+	DEF
	+	-	-	-	-	+	AF
	-	+	-	-	+	-	BE
	+	+	-	+	-	-	ABD
	-	-	+	+	-	-	CD
	+	-	+	-	+	-	ACE
	-	+	+	-	-	+	BCF
	+	+	+	+	+	+	ABCDEF
<hr/>							
Folded							
	+	+	+	-	-	-	ABC
	-	+	+	+	+	-	BCDEF
	+	-	+	+	+	+	ACDF
	-	-	+	-	+	+	CEF
	+	+	-	-	+	+	ABDEF
	-	+	-	+	-	+	BDF
	+	-	-	+	+	-	ADE
	-	-	-	-	-	-	(1)

New Design

	X1	X2	X3	X4	X5	X6
1	-1	-1	-1	1	1	1
2	1	-1	-1	-1	-1	1
3	-1	1	-1	-1	1	-1
4	1	1	-1	1	-1	-1
5	-1	-1	1	1	-1	-1
6	1	-1	1	-1	1	-1
7	-1	1	1	-1	-1	1
8	1	1	1	1	1	1
9	-1	-1	-1	1	1	1
10	1	-1	-1	-1	-1	1
11	-1	1	-1	-1	1	-1
12	1	1	-1	1	-1	-1
13	-1	-1	1	1	-1	-1
14	1	-1	1	-1	1	-1
15	-1	1	1	-1	-1	1
16	1	1	1	1	1	1

4. The combinations are correct, and the effects are presented below.

4.	A	B	C	D(AB)	<i>Terry Hapw</i>
					E(BC)
+	-	-	-	-	+ a e ✓
-	+	-	-	-	- b ✓
-	-	+	+	+	- c d ✓
+	+	+	+	+	+ abcde ✓
+	+	-	+	+	- abd ✓
+	-	+	+	-	- ac ✓
-	+	+	+	-	+ bcd ✓
-	-	-	-	+	+ dc ✓

Effect	Estimate
ORDER_QU + ...	49
RE_ORDER + ...	45
SETUP_CO + ...	10.5
BACKORDE + ...	-18
CARRYING + ...	-14.5
ORDER_QU*SETUP_CO + ...	13.5
ORDER_QU*CARRYING + ...	-14.5

Effect	Estimate
ORDER_QU*RE_ORDER	-18
ORDER_QU*SETUP_CO + ...	
ORDER_QU*BACKORDE + ...	
ORDER_QU*CARRYING + ...	
RE_ORDER*SETUP_CO	
RE_ORDER*BACKORDE	
RE_ORDER*CARRYING	
SETUP_CO*BACKORDE	-14.5
SETUP_CO*CARRYING	45
BACKORDE*CARRYING	13.5