Syam Evani, Project 1

Part 1

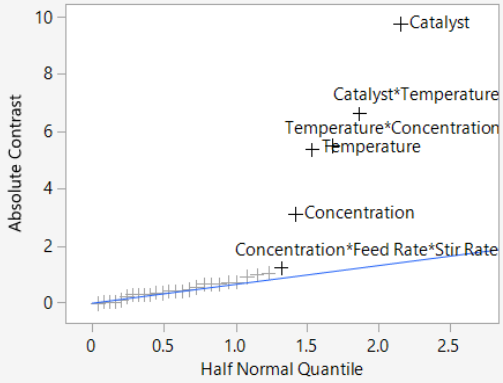
Recreating the JMP analysis for the reactor runs, I generated the screening report and half normal plot below

Screening for Percent Reacted

Contrasts

Term	Contrast	Lenth t-Ratio	Individual p-Value	Simultaneous p-Value
Catalyst	9.75000	14.86	<.0001*	<.0001*
Temperature	5.37500	8.19	<.0001*	0.0007*
Concentration	-3.12500	-4.76	0.0012*	0.0186*
Feed Rate	-0.68750	-1.05	0.2902	0.9999
Stir Rate	-0.31250	-0.48	0.6482	1.0000
Catalyst*Temperature	6.62500	10.10	<.0001*	0.0002*
Catalyst*Concentration	1.00000	1.52	0.1330	0.9541
Temperature*Concentration	-5.50000	-8.38	<.0001*	0.0007*
Catalyst*Feed Rate	0.68750	1.05	0.2902	0.9999
Temperature*Feed Rate	-0.43750	-0.67	0.5032	1.0000
Concentration*Feed Rate	0.06250	0.10	0.9277	1.0000
Catalyst*Stir Rate	0.43750	0.67	0.5256	1.0000
Temperature*Stir Rate	1.06250	1.62	0.1115	0.9211
Concentration*Stir Rate	0.43750	0.67	0.5032	1.0000
Feed Rate*Stir Rate	0.37500	0.57	0.5881	1.0000
Catalyst*Temperature*Concentration	-0.12500	-0.19	0.8585	1.0000
Catalyst*Temperature*Feed Rate	0.68750	1.05	0.2902	0.9999
Catalyst*Concentration*Feed Rate	-0.93750	-1.43	0.1593	0.9757
Temperature*Concentration*Feed Rate	0.31250	0.48	0.6482	1.0000
Catalyst*Temperature*Stir Rate	0.56250	0.86	0.3845	1.0000
Catalyst*Concentration*Stir Rate	0.06250	0.10	0.9277	1.0000
Temperature*Concentration*Stir Rate	0.06250	0.10	0.9277	1.0000
Catalyst*Feed Rate*Stir Rate	0.75000	1.14	0.2531	0.9990
Temperature*Feed Rate*Stir Rate	-0.37500	-0.57	0.5881	1.0000
Concentration*Feed Rate*Stir Rate	-1.25000	-1.90	0.0676	0.7619
Catalyst*Temperature*Concentration*Feed Rate	0.31250	0.48	0.6482	1.0000
Catalyst*Temperature*Concentration*Stir Rate	-0.31250	-0.48	0.6482	1.0000
Catalyst*Temperature*Feed Rate*Stir Rate	0.00000	0.00	1.0000	1.0000
Catalyst*Concentration*Feed Rate*Stir Rate	0.75000	1.14	0.2531	0.9990
Temperature*Concentration*Feed Rate*Stir Rate	0.50000	0.76	0.4401	1.0000
Catalyst*Temperature*Concentration*Feed Rate*Stir Rate	-0.25000	-0.38	0.7160	1.0000

Half Normal Plot



Lenth PSE=0.65625

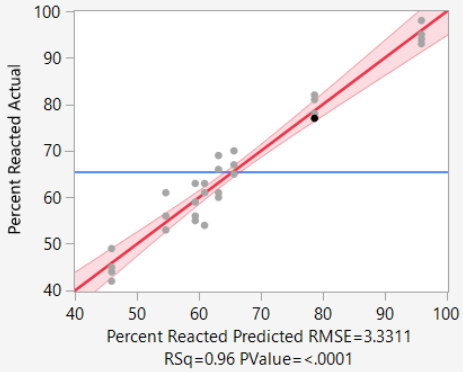
P-Values derived from a simulation of 10000 Lenth t ratios.

Make Model | Run Model

Examining the predictions I get the following:

Response Percent Reacted

Actual by Predicted Plot



Effect Summary

Source	Logworth	PValue
Catalyst(1,2)	14.602	0.00000
Catalyst*Temperature	10.763	0.00000
Temperature*Concentration	9.065	0.00000
Temperature(140,180)	8.864	0.00000 ^
Concentration(3,6)	4.825	0.00001 ^

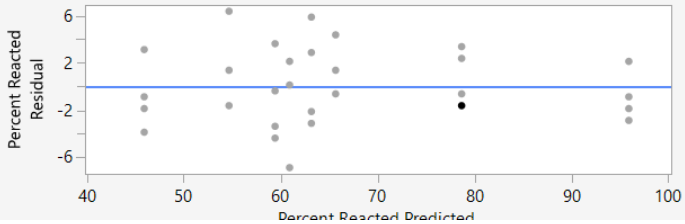
Remove Add Edit Exclude ☐ FDR

('^' denotes effects with containing effects above them)

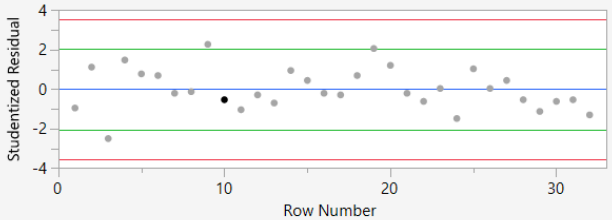
Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	2	32.50000	16.2500	1.5234
Pure Error	24	256.00000	10.6667	**Prob > F**
Total Error	26	288.50000		0.2383
				Max RSq
				0.9631

Residual by Predicted Plot



Studentized Residuals



Externally studentized residuals with 95% simultaneous limits (Bonferroni) in red, individual limits in green.

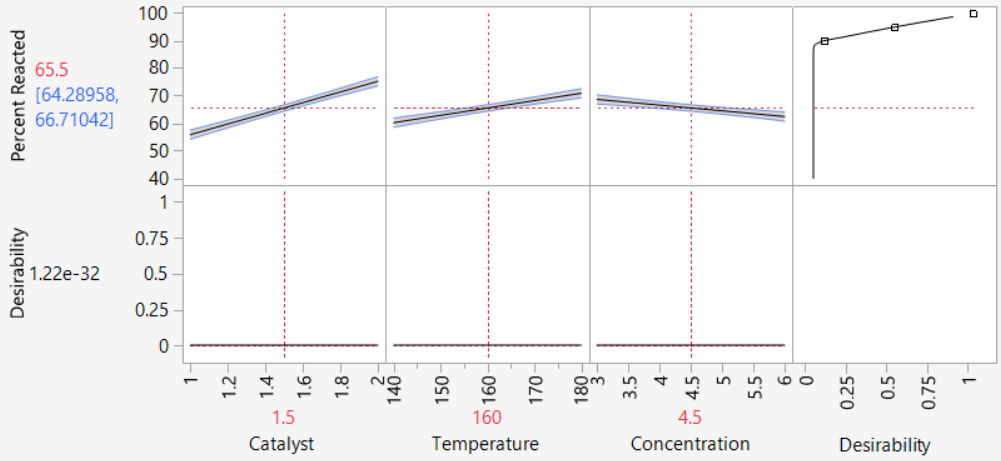
Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|	Uncoded Estimate
Intercept	65.5	0.588859	111.23	<.0001*	29.625
Catalyst(1,2)	9.75	0.588859	16.56	<.0001*	-86.5
Temperature(140,180)	5.375	0.588859	9.13	<.0001*	0.1
Concentration(3,6)	-3.125	0.588859	-5.31	<.0001*	27.25
Catalyst*Temperature	6.625	0.588859	11.25	<.0001*	0.6625
Temperature*Concentration	-5.5	0.588859	-9.34	<.0001*	-0.183333

Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Catalyst(1,2)	1	1	3042.0000	274.1490	<.0001*
Temperature(140,180)	1	1	924.5000	83.3172	<.0001*
Concentration(3,6)	1	1	312.5000	28.1629	<.0001*
Catalyst*Temperature	1	1	1404.5000	126.5754	<.0001*
Temperature*Concentration	1	1	968.0000	87.2374	<.0001*

Prediction Profiler



Finally we can create a reduced order model experiment, then optimize for desirability with the prediction profiler. I get a response like this. This really indicates that maximizing the catalyst, temperature, and minimizing the concentration will maximize desirability.