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Section 1

MANE 6313

Subsection 1

Week 9, Module B

Student Learning Outcome

- Select an appropriate experimental design with one or more factors,
- Select an appropriate model with one or more factors,
- Evaluate statistical analyses of experimental designs,
- Assess the model adequacy of any experimental design, and
- Interpret model results.

Module Learning Outcome

Analyze a one-half fraction factorial design.

Example Problem

20.17 A 2^{4-1} fractional factorial design was conducted on a chemical process by assigning variable 4 to the 123 interaction column.

Variable	*Low Level*	*High Level*
1. Feedrate (liters/min)	5	20
2. Catalyst (%)	A	B
3. Temperature (°C)	200	220
4. Concentration (%)	5	7

The second table summarizes the eight tests that were run, including the levels of each of the four variables and the yield (% reacted) for each test.

Test	*1*	*2*	*3*	*4*	*y (% reacted)*
1	−	−	−	−	33
2	+	−	−	+	51
3	−	+	−	+	44
4	+	+	−	−	40
5	−	−	+	+	35
6	+	−	+	−	82
7	−	+	+	−	46
8	+	+	+	+	69

(a) Write down all of the linear combinations of effects that can be estimated from this experiment (assume that third- and higher-order interactions are negligible).

(b) Calculate numerical values for the effect estimates and determine which effects are significant using a normal probability plot of the effect estimates.

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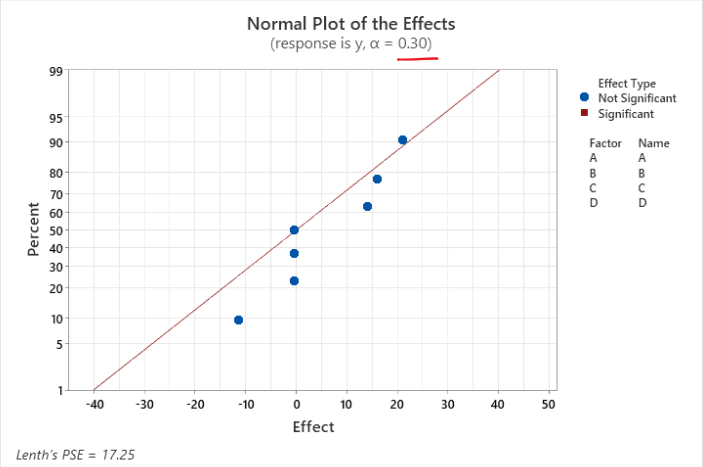

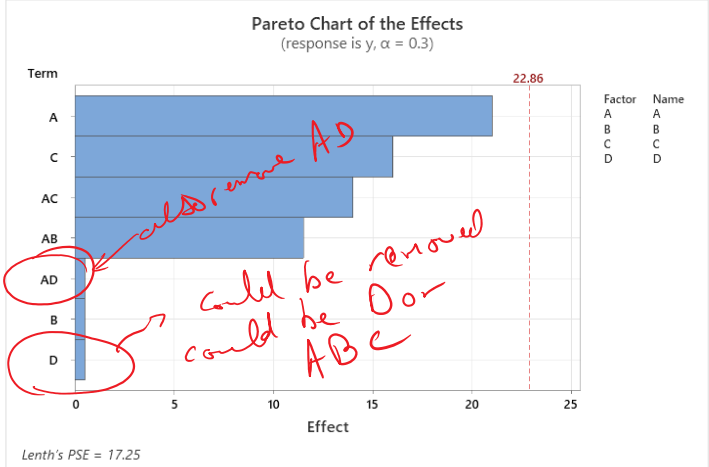

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2nd model

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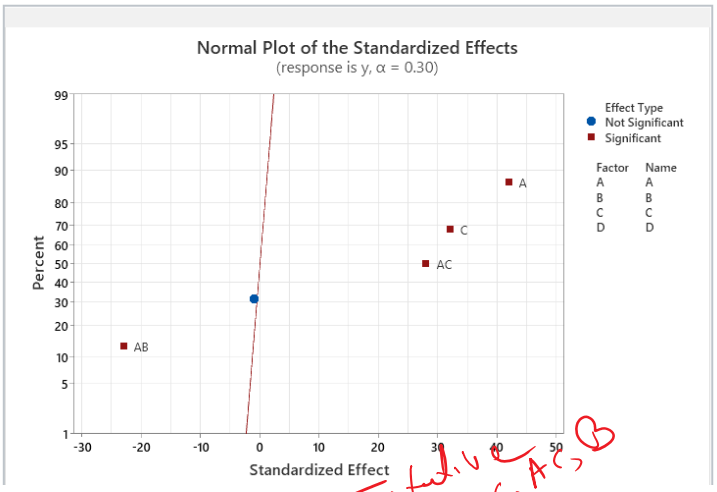

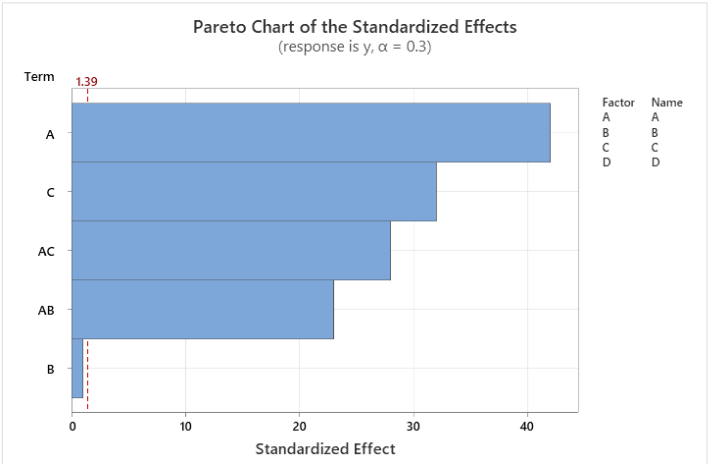

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Tentative A, AB, C, AC, B

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Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Model	5	2051.00	410.200	820.40	0.001
Linear	3	1394.50	464.833	929.67	0.001
A	1	882.00	882.000	1764.00	0.001
B	1	0.50	0.500	1.00	0.423
C	1	512.00	512.000	1024.00	0.001
2-Way Interactions	2	656.50	328.250	656.50	0.002
A*B	1	264.50	264.500	529.00	0.002
A*C	1	392.00	392.000	784.00	0.001
Error	2	1.00	0.500		
Total	7	2052.00			

$\alpha = .05$

- not statistically significant AB but hierarchy

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Paying attention BC interaction

3rd model

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Coded Coefficients

Term	Effect	Coef	SE Coef	T-Value	P-Value	VIF
Constant		50.000	0.250	200.00	0.003	
A	21.000	10.500	0.250	42.00	0.015	1.00
B	-0.500	-0.250	0.250	-1.00	0.500	1.00
C	16.000	8.000	0.250	32.00	0.020	1.00
A*B	-11.500	-5.750	0.250	-23.00	0.028	1.00
A*C	14.000	7.000	0.250	28.00	0.023	1.00
B*C	-0.500	-0.250	0.250	-1.00	0.500	1.00

$\alpha = .05$

should be removed

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