

## JMP Output for Swimming Experiment

A:Shirt	B:Goggles	C:Flipper	D:End	Time	XA	XB	XC	XD
N	N	N	S	22.31	-1	-1	-1	-1
Y	N	N	S	24.29	1	-1	-1	-1
N	Y	N	S	19.96	-1	1	-1	-1
Y	Y	N	S	22.02	1	1	-1	-1
N	N	Y	S	17.30	-1	-1	1	-1
Y	N	Y	S	17.70	1	-1	1	-1
N	Y	Y	S	16.55	-1	1	1	-1
Y	Y	Y	S	17.32	1	1	1	-1
N	N	N	D	22.72	-1	-1	-1	1
Y	N	N	D	24.33	1	-1	-1	1
N	Y	N	D	20.32	-1	1	-1	1
Y	Y	N	D	22.49	1	1	-1	1
N	N	Y	D	16.85	-1	-1	1	1
Y	N	Y	D	17.38	1	-1	1	1
N	Y	Y	D	16.31	-1	1	1	1
Y	Y	Y	D	17.46	1	1	1	1

### Response: Time

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	15	127.41674	8.49445	.
Error	0	0.00000	.	Prob > F
C. Total	15	127.41674	.	.

#### Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
A:Shirt	1	1	7.11556	.	.
B:Goggles	1	1	6.82516	.	.
A:Shirt*B:Goggles	1	1	0.16606	.	.
C:Flippers	1	1	108.00406	.	.
A:Shirt*C:Flippers	1	1	1.54381	.	.
B:Goggles*C:Flippers	1	1	3.30331	.	.
A:Shirt*B:Goggles*C:Flippers	1	1	0.00766	.	.
D:End	1	1	0.01051	.	.
A:Shirt*D:End	1	1	0.00391	.	.
B:Goggles*D:End	1	1	0.06891	.	.
A:Shirt*B:Goggles*D:End	1	1	0.03331	.	.
C:Flippers*D:End	1	1	0.28891	.	.
A:Shirt*C:Flippers*D:End	1	1	0.03706	.	.
B:Goggles*C:Flippers*D:End	1	1	0.00526	.	.
A:Shirt*B:Goggles*C:Flippers*D:End	1	1	0.00331	.	.

**Response: Time**

**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	15	127.41674	8.49445	.
Error	0	0.00000	.	Prob > F
C. Total	15	127.41674	.	.

**Parameter Estimates**

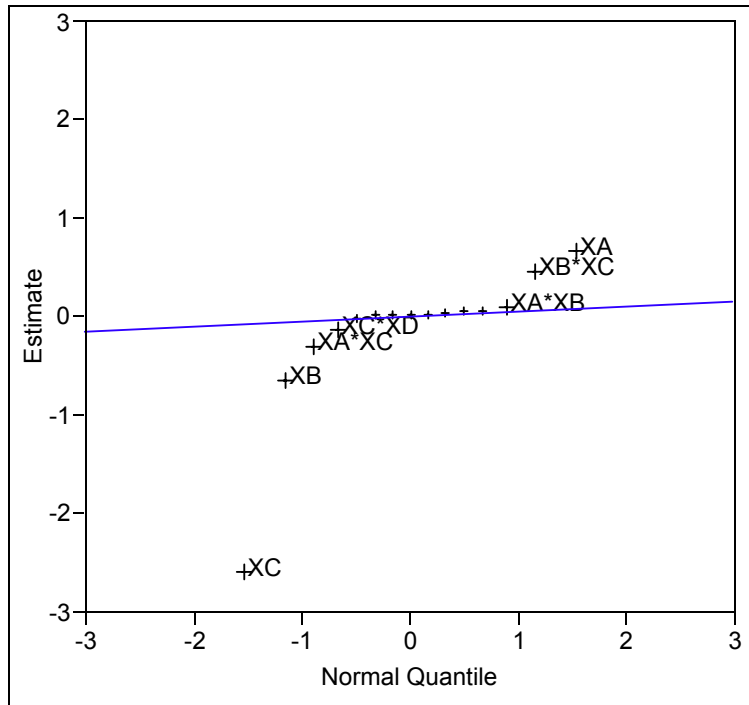
Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	19.706875	.	.	.
XA	0.666875	.	.	.
XB	-0.653125	.	.	.
XA*XB	0.101875	.	.	.
XC	-2.598125	.	.	.
XA*XC	-0.310625	.	.	.
XB*XC	0.454375	.	.	.
XA*XB*XC	0.021875	.	.	.
XD	0.025625	.	.	.
XA*XD	0.015625	.	.	.
XB*XD	0.065625	.	.	.
XA*XB*XD	0.045625	.	.	.
XC*XD	-0.134375	.	.	.
XA*XC*XD	0.048125	.	.	.
XB*XC*XD	0.018125	.	.	.
XA*XB*XC*XD	-0.014375	.	.	.

**Effect Tests**

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
XA	1	1	7.11556	.	.
XB	1	1	6.82516	.	.
XA*XB	1	1	0.16606	.	.
XC	1	1	108.00406	.	.
XA*XC	1	1	1.54381	.	.
XB*XC	1	1	3.30331	.	.
XA*XB*XC	1	1	0.00766	.	.
XD	1	1	0.01051	.	.
XA*XD	1	1	0.00391	.	.
XB*XD	1	1	0.06891	.	.
XA*XB*XD	1	1	0.03331	.	.
XC*XD	1	1	0.28891	.	.
XA*XC*XD	1	1	0.03706	.	.
XB*XC*XD	1	1	0.00526	.	.
XA*XB*XC*XD	1	1	0.00331	.	.

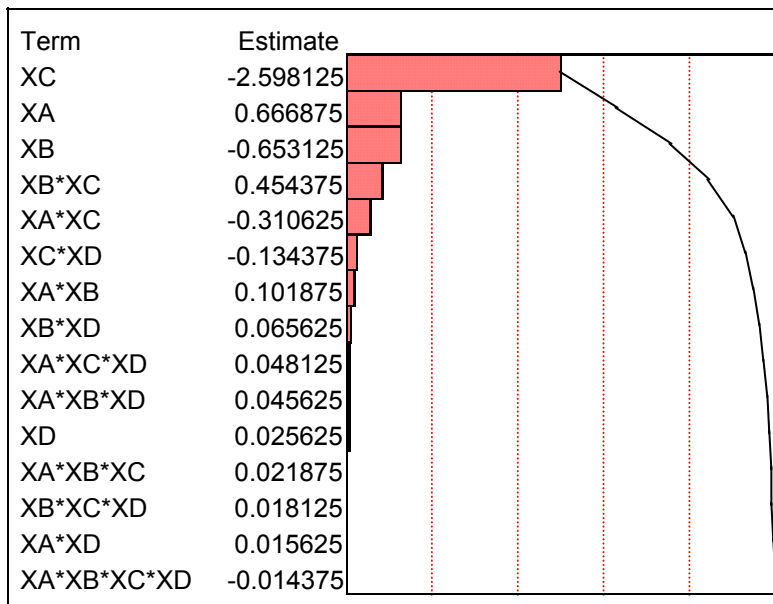
## Effect Screening

### Normal Plot



Blue line is Lenth's PSE, from the estimates population.

### Pareto Plot of Estimates



**Response: Time**

**Summary of Fit (Reduced Model – Full Factorial in XA, XB and XC)**

RSquare	0.996459
RSquare Adj	0.993361
Root Mean Square Error	0.237474
Mean of Response	19.70688
Observations (or Sum Wgts)	16

**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	7	126.96559	18.1379	321.6304
Error	8	0.45115	0.0564	Prob > F
C. Total	15	127.41674		<.0001

**Parameter Estimates**

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	19.706875	0.059368	331.94	<.0001
XA	0.666875	0.059368	11.23	<.0001
XB	-0.653125	0.059368	-11.00	<.0001
XA*XB	0.101875	0.059368	1.72	0.1245
XC	-2.598125	0.059368	-43.76	<.0001
XA*XC	-0.310625	0.059368	-5.23	0.0008
XB*XC	0.454375	0.059368	7.65	<.0001
XA*XB*XC	0.021875	0.059368	0.37	0.7221

**Effect Tests**

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
XA	1	1	7.11556	126.1763	<.0001
XB	1	1	6.82516	121.0268	<.0001
XA*XB	1	1	0.16606	2.9446	0.1245
XC	1	1	108.00406	1915.178	<.0001
XA*XC	1	1	1.54381	27.3755	0.0008
XB*XC	1	1	3.30331	58.5758	<.0001
XA*XB*XC	1	1	0.00766	0.1358	0.7221

**Response: Time****Summary of Fit (Reduced Model – Main Effects and 2-way Interactions)**

RSquare	0.99932
RSquare Adj	0.997961
Root Mean Square Error	0.131591
Mean of Response	19.70688
Observations (or Sum Wgts)	16

**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	10	127.33016	12.7330	735.3218
Error	5	0.08658	0.0173	Prob > F
C. Total	15	127.41674		<.0001

**Parameter Estimates**

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	19.706875	0.032898	599.03	<.0001
XA	0.666875	0.032898	20.27	<.0001
XB	-0.653125	0.032898	-19.85	<.0001
XA*XB	0.101875	0.032898	3.10	0.0270
XC	-2.598125	0.032898	-78.98	<.0001
XA*XC	-0.310625	0.032898	-9.44	0.0002
XB*XC	0.454375	0.032898	13.81	<.0001
XD	0.025625	0.032898	0.78	0.4713
XA*XD	0.015625	0.032898	0.47	0.6548
XB*XD	0.065625	0.032898	1.99	0.1026
XC*XD	-0.134375	0.032898	-4.08	0.0095

**Effect Tests**

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
XA	1	1	7.11556	410.9179	<.0001
XB	1	1	6.82516	394.1475	<.0001
XA*XB	1	1	0.16606	9.5896	0.0270
XC	1	1	108.00406	6237.15	<.0001
XA*XC	1	1	1.54381	89.1536	0.0002
XB*XC	1	1	3.30331	190.7634	<.0001
XD	1	1	0.01051	0.6067	0.4713
XA*XD	1	1	0.00391	0.2256	0.6548
XB*XD	1	1	0.06891	3.9793	0.1026
XC*XD	1	1	0.28891	16.6841	0.0095