

Two-Way Analysis of Variance using Multiple Regression

Engine type	Propellant Type			
	1	2	3	4
1	34.0	30.1	29.8	29.0
	32.7	32.8	26.7	28.9
2	32.0	30.2	28.7	27.6
	33.2	29.8	28.1	27.8
3	28.4	27.3	29.7	28.8
	29.3	28.9	27.3	29.1

Fit twoway model using ANOVA command

MTB > c3 contains engine types

DATA> set c3

DATA> 8(1) 8(2) 8(3)

c2 contains propellant type

DATA> set c2

DATA> 6(1 2 3 4)

DATA> end

MTB > twoway c1 c2 c3

Two-way ANOVA: C1 versus C2, C3

Source	DF	SS	MS	F	P
C2	3	40.0817	13.3606	10.75	0.001
C3	2	14.5233	7.2617	5.84	0.017
Interaction	6	22.1633	3.6939	2.97	0.051
Error	12	14.9100	1.2425		
Total	23	91.6783			

GENERATE 3 INDICATOR VARIABLES FOR PROPELLANT

c5-c7 contain indicators for propellant

MTB > indic c2 c5-c8

MTB > erase c8

GENERATE 2 INDICATOR VARIABLES FOR PROPELLANT

c9-c10 contain indicators for engine

MTB > indic c3 c9-c11

MTB > erase c11

GENERATE THE 3x2=6 PRODUCT VARIABLES

c12-c17 contain the products of indicators
for propellant and engine

MTB > let c12=c5*c9

MTB > let c13=c5*c10

MTB > let c14=c6*c9

MTB > let c15=c6*c10

MTB > let c16=c7*c9

MTB > let c17=c7*c10

REGRESSION INCLUDING MAIN EFFECTS OF ENGINE, PROPELLANT and INTERACTION

```
MTB > regress c1 11 c5-c7 c9-c10 c12-c17
```

Source	DF	SS	MS	F	P
Regression	11	76.768	6.979	5.62	0.003
Residual Error	12	14.910	1.243		
Total	23	91.678			

REGRESSION INCLUDING MAIN EFFECTS OF ENGINE, PROPELLANT

```
MTB > regress c1 5 c5-c7 c9 c10
```

Source	DF	SS	MS	F	P
Regression	5	54.605	10.921	5.30	0.004
Residual Error	18	37.073	2.060		
Total	23	91.678			

REGRESSION INCLUDING MAIN EFFECTS OF PROPELLANT

```
MTB > regress c1 3 c5-c7
```

Source	DF	SS	MS	F	P
Regression	3	40.082	13.361	5.18	0.008
Residual Error	20	51.597	2.580		
Total	23	91.678			

MODEL VARIABLES	SSE	Reduction of SSE	regression df	change in regression df	error df
none	91.678		0		23
propellant	51.597	40.082	3	3	20
propellant+engine	37.073	14.524	5	2	18
propellant+engine+interaction	14.910	22.163	11	6	12

Compare to Two-way ANOVA table

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C2	3	40.0817	13.3606	10.75	0.001
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Interaction	6	22.1633	3.6939	2.97	0.051
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