An anesthesiologist made a comparative study of the effects of acupuncture and codeine on postoperative dental pain in male subjects. The four treatments were: (1) placebo treatment, (2) codeine treatment only, (3) acupuncture treatment only, and (4) codeine and acupuncture treatment. 32 subjects were grouped into eight blocks of four according to an initial evaluation of their level of pain tolerance. The subjects in each block were then randomly assigned to the four treatments. Pain relief scores were obtained for all the subjects two hours after dental treatment. Data were collected on a double-blind basis – the higher the pain relief score, the more effective the treatment.

```
title1 'Randomized Complete Block With Two Factors';
options nodate nonumber;
data PainRelief;
input PainLevel Codeine  Acupuncture  Relief @@;
datalines;
1 1 1 0.0  1 2 1 0.5  1 1 2 0.6  1 2 2 1.2
2 1 1 0.3  2 2 1 0.6  2 1 2 0.7  2 2 2 1.3
3 1 1 0.4  3 2 1 0.8  3 1 2 0.8  3 2 2 1.6
4 1 1 0.4  4 2 1 0.7  4 1 2 0.9  4 2 2 1.5
5 1 1 0.6  5 2 1 1.0  5 1 2 1.5  5 2 2 1.9
6 1 1 0.9  6 2 1 1.4  6 1 2 1.6  6 2 2 2.3
7 1 1 1.0  7 2 1 1.8  7 1 2 1.7  7 2 2 2.1
8 1 1 1.2  8 2 1 1.7  8 1 2 1.6  8 2 2 2.4
;

proc glm data=PainRelief;
class PainLevel Codeine Acupuncture;
model Relief = PainLevel Codeine|Acupuncture;
lsmeans Codeine*Acupuncture / out=abmeans;
lsmeans Codeine / out=ameans;
lsmeans Acupuncture /out=bmeans;
lsmeans Codeine Acupuncture / pdiff cl;
run;

title2 "Profile/Interaction Plots";

symbol1 i=join l=1 v=star c=blue; *draw lines between joint means;
symbol2 i=join l=3 v=plus c=red; *draw lines between joint means;

proc gplot data=abmeans;
plot lsmean*Codeine=Acupuncture;
plot lsmean*Acupuncture=Codeine;
run;

title2 "Main Effects Plots";

proc gplot data=ameans;
plot lsmean*Codeine;
run;

proc gplot data=bmeans;
plot lsmean*Acupuncture;
run;
```

Randomized Complete Block With Two Factors

The GLM Procedure

Class Level Information

Class	Levels	Values
PainLevel	8	1 2 3 4 5 6 7 8
Codeine	2	1 2
Acupuncture	2	1 2

Number of Observations Read	32
Number of Observations Used	32

Randomized Complete Block With Two Factors

The GLM Procedure

Dependent Variable: Relief

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	10	11.33500000	1.13350000	78.37	<.0001
Error	21	0.30375000	0.01446429		
Corrected Total	31	11.63875000			

R-Square	Coeff Var	Root MSE	Relief Mean
0.973902	10.40152	0.120268	1.156250

Source	DF	Type I SS	Mean Square	F Value	Pr > F
PainLevel	7	5.59875000	0.79982143	55.30	<.0001
Codeine	1	2.31125000	2.31125000	159.79	<.0001
Acupuncture	1	3.38000000	3.38000000	233.68	<.0001
Codeine*Acupuncture	1	0.04500000	0.04500000	3.11	0.0923

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PainLevel	7	5.59875000	0.79982143	55.30	<.0001
Codeine	1	2.31125000	2.31125000	159.79	<.0001
Acupuncture	1	3.38000000	3.38000000	233.68	<.0001
Codeine*Acupuncture	1	0.04500000	0.04500000	3.11	0.0923

Randomized Complete Block With Two Factors
The GLM Procedure
Least Squares Means

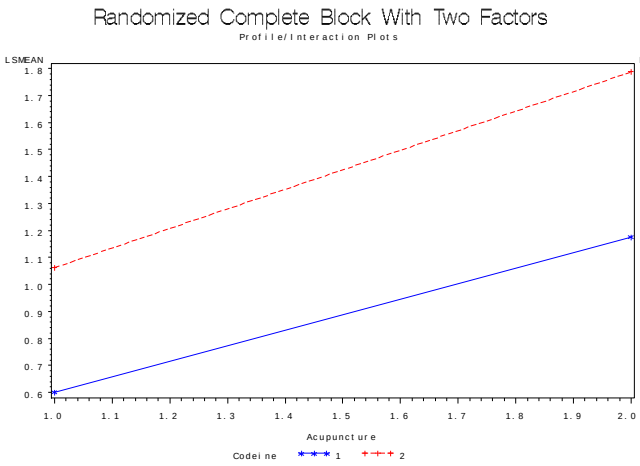
Codeine	Acupuncture	Relief LSMEAN
1	1	0.60000000
1	2	1.17500000
2	1	1.06250000
2	2	1.78750000

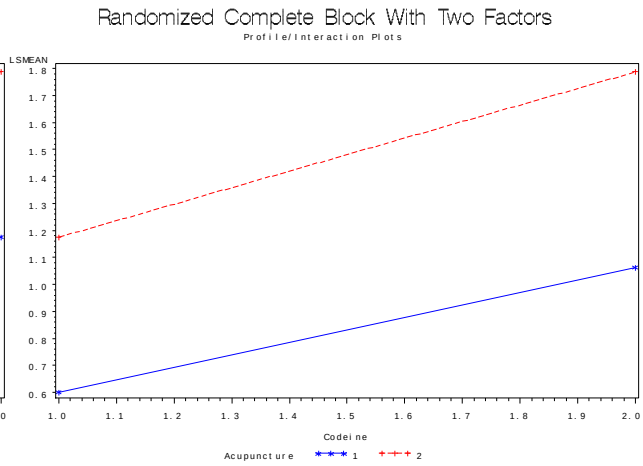
Randomized Complete Block With Two Factors
The GLM Procedure
Least Squares Means

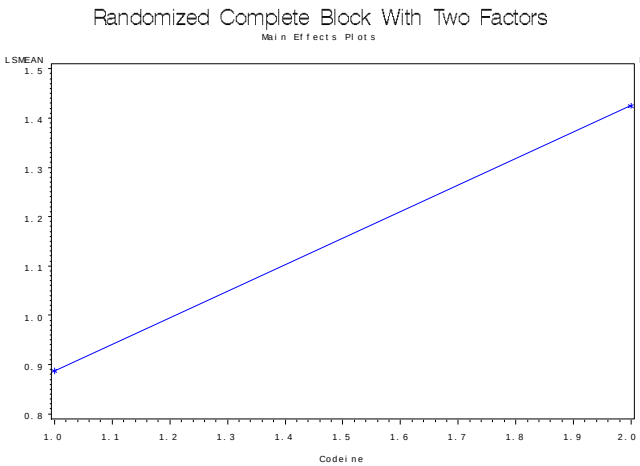
Codeine	Relief LSMEAN
1	0.88750000
2	1.42500000

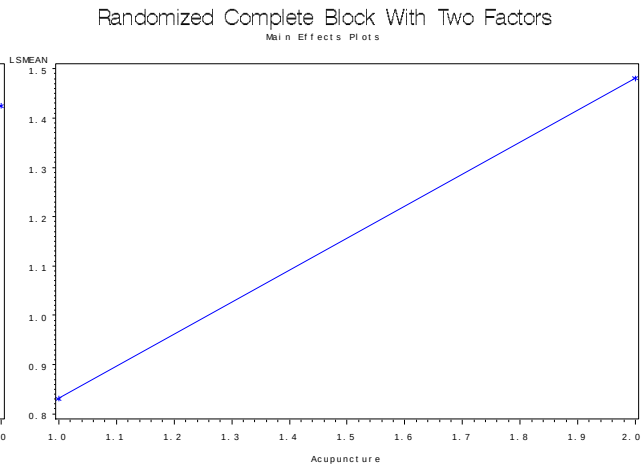
Randomized Complete Block With Two Factors
The GLM Procedure
Least Squares Means

Acupuncture	Relief LSMEAN
1	0.83125000
2	1.48125000









Randomized Complete Block With Two Factors
The GLM Procedure
Least Squares Means

Codeine	Relief LSMEAN	H0:LSMean1= LSMean2 Pr > |t|
1	0.88750000	<.0001
2	1.42500000	

Codeine	Relief LSMEAN	95% Confidence Limits	
1	0.887500	0.824972	0.950028
2	1.425000	1.362472	1.487528

Least Squares Means for Effect Codeine

i	j	Difference Between Means	95% Confidence Limits for LSMean(i)-LSMean(j)	
1	2	-0.537500	-0.625927	-0.449073

Acupuncture	Relief LSMEAN	H0:LSMean1= LSMean2 Pr > |t|
1	0.83125000	<.0001
2	1.48125000	

Acupuncture	Relief LSMEAN	95% Confidence Limits	
1	0.831250	0.768722	0.893778
2	1.481250	1.418722	1.543778

Least Squares Means for Effect Acupuncture

i	j	Difference Between Means	95% Confidence Limits for LSMean(i)-LSMean(j)	
1	2	-0.650000	-0.738427	-0.561573