

The Mixed Procedure

Model Information

Data Set	WORK.CAKE
Dependent Variable	break
Covariance Structure	Variance Components
Estimation Method	Type 3
Residual Variance Method	Factor
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Satterthwaite

Class Level Information

Class	Levels	Values
recipe	3	1 2 3
replicat	15	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
baketemp	6	1 2 3 4 5 6

Dimensions

Covariance Parameters	2
Columns in X	28
Columns in Z	45
Subjects	1
Max Obs Per Subject	270

Number of Observations

Number of Observations Read	270
Number of Observations Used	270
Number of Observations Not Used	0

Type 3 Analysis of Variance

Source	DF	Sum of Squares	Mean Square	Expected Mean Square
recipe	2	135.088889	67.544444	Var(Residual) + 6 Var(replicat(recipe)) + Q(recipe,recipe*baketemp)
baketemp	5	2100.300000	420.060000	Var(Residual) + Q(baketemp,recipe*baketemp)
recipe*baketemp	10	205.977778	20.597778	Var(Residual) + Q(recipe*baketemp)
replicat(recipe)	42	11403	271.493122	Var(Residual) + 6 Var(replicat(recipe))
Residual	210	4298.888889	20.470899	Var(Residual)

The Mixed Procedure

Type 3 Analysis of Variance

Source	Error Term	Error		
		DF	F Value	Pr > F
recipe	MS(replicat(recipe))	42	0.25	0.7809
baketemp	MS(Residual)	210	20.52	<.0001
recipe*baketemp	MS(Residual)	210	1.01	0.4393
replicat(recipe)	MS(Residual)	210	13.26	<.0001
Residual

Covariance Parameter Estimates

Cov Parm	Estimate
replicat(recipe)	41.8370
Residual	20.4709

Fit Statistics

-2 Res Log Likelihood	1633.2
AIC (smaller is better)	1637.2
AICC (smaller is better)	1637.3
BIC (smaller is better)	1640.9

Type 3 Tests of Fixed Effects

Effect	Num	Den	F Value	Pr > F
	DF	DF		
recipe	2	42	0.25	0.7809
baketemp	5	210	20.52	<.0001
recipe*baketemp	10	210	1.01	0.4393

Estimates

Label	Estimate	Standard	DF	t Value	Pr > t	Alpha	Lower	Upper
		Error						
recipe 1 - recipe 2	1.4778	2.4563	42	0.60	0.5506	0.05	-3.4791	6.4347
temp 1 - temp2	-1.9778	0.9538	210	-2.07	0.0393	0.05	-3.8581	-0.09744
mu11 - mu12	-2.4000	1.6521	210	-1.45	0.1478	0.05	-5.6568	0.8568
mu11 - mu21	2.2667	2.8823	77.4	0.79	0.4340	0.05	-3.4722	8.0056

The Mixed Procedure

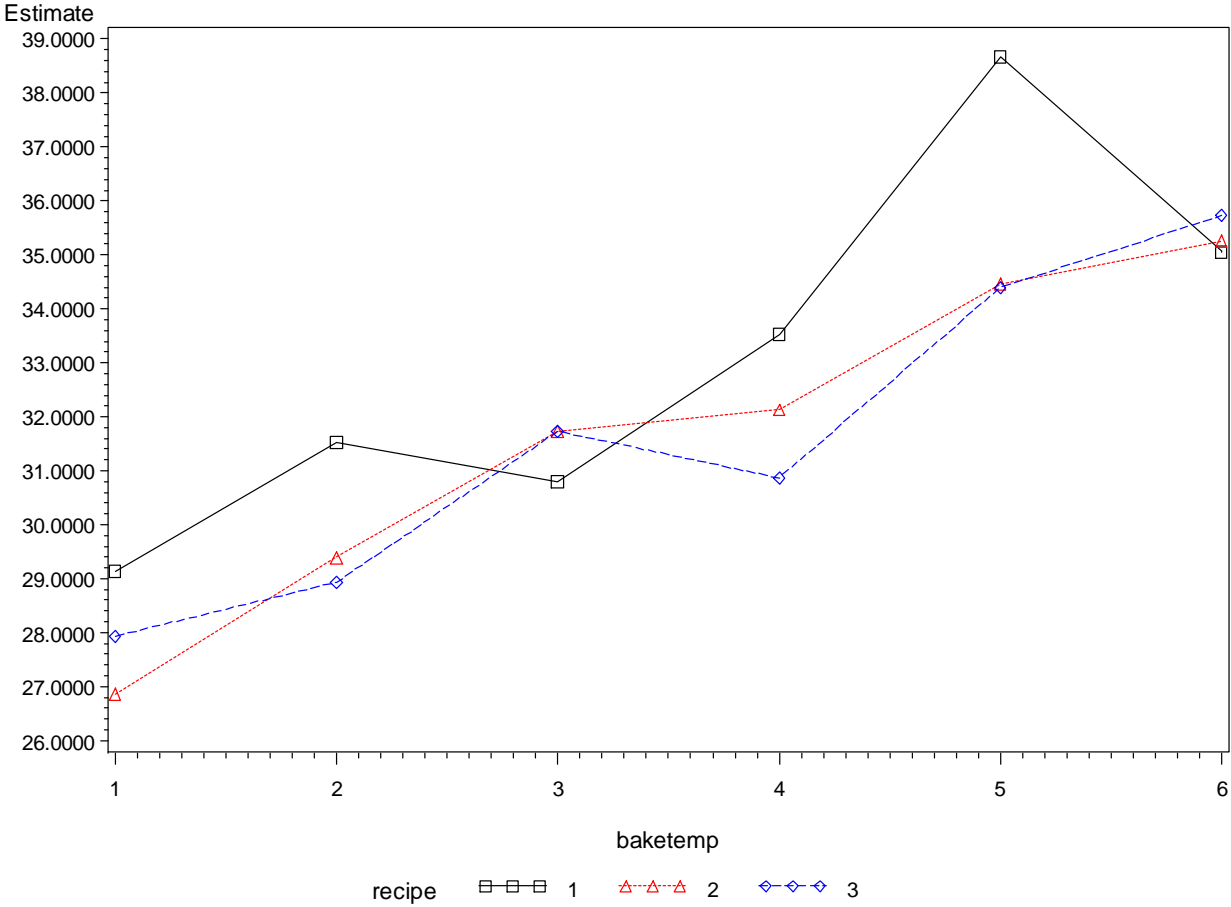
Contrasts

Label	Num DF	Den DF	F Value	Pr > F
normal vs extra sugar	1	42	0.14	0.7145
chocolate temp	1	42	0.36	0.5506
linear baketemp	1	210	96.07	<.0001
nonlinear baketemp	4	210	1.63	0.1675

Least Squares Means

Effect	recipe	baketemp	Estimate	Standard Error	DF	t Value	Pr > t
recipe	1		33.1222	1.7368	42	19.07	<.0001
recipe	2		31.6444	1.7368	42	18.22	<.0001
recipe	3		31.6000	1.7368	42	18.19	<.0001
baketemp		1	27.9778	1.1767	77.4	23.78	<.0001
baketemp		2	29.9556	1.1767	77.4	25.46	<.0001
baketemp		3	31.4222	1.1767	77.4	26.70	<.0001
baketemp		4	32.1778	1.1767	77.4	27.35	<.0001
baketemp		5	35.8444	1.1767	77.4	30.46	<.0001
baketemp		6	35.3556	1.1767	77.4	30.05	<.0001
recipe*baketemp	1	1	29.1333	2.0381	77.4	14.29	<.0001
recipe*baketemp	1	2	31.5333	2.0381	77.4	15.47	<.0001
recipe*baketemp	1	3	30.8000	2.0381	77.4	15.11	<.0001
recipe*baketemp	1	4	33.5333	2.0381	77.4	16.45	<.0001
recipe*baketemp	1	5	38.6667	2.0381	77.4	18.97	<.0001
recipe*baketemp	1	6	35.0667	2.0381	77.4	17.21	<.0001
recipe*baketemp	2	1	26.8667	2.0381	77.4	13.18	<.0001
recipe*baketemp	2	2	29.4000	2.0381	77.4	14.43	<.0001
recipe*baketemp	2	3	31.7333	2.0381	77.4	15.57	<.0001
recipe*baketemp	2	4	32.1333	2.0381	77.4	15.77	<.0001
recipe*baketemp	2	5	34.4667	2.0381	77.4	16.91	<.0001
recipe*baketemp	2	6	35.2667	2.0381	77.4	17.30	<.0001
recipe*baketemp	3	1	27.9333	2.0381	77.4	13.71	<.0001
recipe*baketemp	3	2	28.9333	2.0381	77.4	14.20	<.0001
recipe*baketemp	3	3	31.7333	2.0381	77.4	15.57	<.0001
recipe*baketemp	3	4	30.8667	2.0381	77.4	15.14	<.0001
recipe*baketemp	3	5	34.4000	2.0381	77.4	16.88	<.0001
recipe*baketemp	3	6	35.7333	2.0381	77.4	17.53	<.0001

Profile plot of treatment means, choc cake data



PROC GLM analysis of choc cake data (not recommended)

4

The GLM Procedure

Class Level Information

Class	Levels	Values
recipe	3	1 2 3
replicat	15	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
baketemp	6	1 2 3 4 5 6

Number of Observations Read 270
 Number of Observations Used 270

PROC GLM analysis of choc cake data (not recommended)

5

The GLM Procedure

Dependent Variable: break

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	59	13844.07778	234.64539	11.46	<.0001
Error	210	4298.88889	20.47090		
Corrected Total	269	18142.96667			

R-Square 0.763055
 Coeff Var 14.08520
 Root MSE 4.524478
 break Mean 32.12222

Source	DF	Type III SS	Mean Square	F Value	Pr > F
recipe	2	135.08889	67.54444	3.30	0.0388
replicat(recipe)	42	11402.71111	271.49312	13.26	<.0001
baketemp	5	2100.30000	420.06000	20.52	<.0001
recipe*baketemp	10	205.97778	20.59778	1.01	0.4393

The GLM Procedure

Source	Type III Expected Mean Square
recipe	Var(Error) + 6 Var(replicat(recipe)) + Q(recipe,recipe*baketemp)
replicat(recipe)	Var(Error) + 6 Var(replicat(recipe))
baketemp	Var(Error) + Q(baketemp,recipe*baketemp)
recipe*baketemp	Var(Error) + Q(recipe*baketemp)

The GLM Procedure

Tests of Hypotheses for Mixed Model Analysis of Variance

Dependent Variable: break

Source	DF	Type III SS	Mean Square	F Value	Pr > F
* recipe	2	135.088889	67.544444	0.25	0.7809
Error	42	11403	271.493122		

Error: MS(replicat(recipe))

* This test assumes one or more other fixed effects are zero.

Source	DF	Type III SS	Mean Square	F Value	Pr > F
replicat(recipe)	42	11403	271.493122	13.26	<.0001
* baketemp	5	2100.300000	420.060000	20.52	<.0001
recipe*baketemp	10	205.977778	20.597778	1.01	0.4393

Error: MS(Error)

* This test assumes one or more other fixed effects are zero.

Least Squares Means

Standard Errors and Probabilities Calculated Using the Type III MS for replicat(recipe) as an Error Term

recipe	break LSMEAN	Standard Error	Pr > t
1	33.1222222	1.7368334	<.0001
2	31.6444444	1.7368334	<.0001
3	31.6000000	1.7368334	<.0001

Least Squares Means

	baketemp	break	LSMEAN	Standard Error	Pr > t
	1		27.9777778	0.6744693	<.0001
	2		29.9555556	0.6744693	<.0001
	3		31.4222222	0.6744693	<.0001
	4		32.1777778	0.6744693	<.0001
	5		35.8444444	0.6744693	<.0001
	6		35.3555556	0.6744693	<.0001

recipe	baketemp	break	LSMEAN	Standard Error	Pr > t
1	1		29.1333333	1.1682151	<.0001
1	2		31.5333333	1.1682151	<.0001
1	3		30.8000000	1.1682151	<.0001
1	4		33.5333333	1.1682151	<.0001
1	5		38.6666667	1.1682151	<.0001
1	6		35.0666667	1.1682151	<.0001
2	1		26.8666667	1.1682151	<.0001
2	2		29.4000000	1.1682151	<.0001
2	3		31.7333333	1.1682151	<.0001
2	4		32.1333333	1.1682151	<.0001
2	5		34.4666667	1.1682151	<.0001
2	6		35.2666667	1.1682151	<.0001
3	1		27.9333333	1.1682151	<.0001
3	2		28.9333333	1.1682151	<.0001
3	3		31.7333333	1.1682151	<.0001
3	4		30.8666667	1.1682151	<.0001
3	5		34.4000000	1.1682151	<.0001
3	6		35.7333333	1.1682151	<.0001

Dependent Variable: break

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
linear baketemp	1	1966.705079	1966.705079	96.07	<.0001
nonlinear baketemp	4	133.594921	33.398730	1.63	0.1675

Tests of Hypotheses Using the Type III MS for replicat(recipe) as an Error Term

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
normal vs extra sugar	1	36.816667	36.816667	0.14	0.7145
chocolate temp	1	98.272222	98.272222	0.36	0.5506

Parameter	Estimate	Standard Error	t Value	Pr > t
temp 1 - temp2	-1.9777778	0.95384367	-2.07	0.0393
mu11 - mu12	-2.4000000	1.65210571	-1.45	0.1478
mu11 - mu21	2.2666667	1.65210571	1.37	0.1715