```
data wide lead;
input ID TRT $ PB1 - PB4;
datalines;
       P 30.8 26.9 25.8 23.8
 1
                  14.8
                         19.5
       Α
            26.5
                                 21.0
......
100 A 20.7 8.1 25.7 12.3
run;
data long lead;
 set wide lead;
 array APB(1:4) PB1-PB4;
 array Aweek(1:4) (0 1 4 6);
 do i=1 to 4;
  PB = APB[i];
  week = Aweek[i];
  output;
 end;
 drop PB1-PB4 Aweek1 - Aweek4 i;
run;
proc mixed data=long lead;
class ID TRT week;
model PB = TRT week week*TRT/s;
repeated week/type=VC subject=ID r rcorr;
run;
```

Model Information				
Data Set	WORK.LONG_LEAD			
Dependent Variable PB				
Covariance Structure	Variance Components			
Subject Effect	ID			
Estimation Method	REML			
Residual Variance Method Parameter				
Fixed Effects SE Method	Model-Based			
Degrees of Freedom Method	Between-Within			

Class Level Information				
Class	Levels Values			
TRT	2	A P		
week	4	0146		

Dimensions			
Covariance Parameters	1		
Columns in X	15		
Columns in Z	0		
Subjects	100		
Max Obs per Subject	4		

Number of Observations			
Number of Observations Read	400		
Number of Observations Used	400		
Number of Observations Not Used	0		

Iteration History					
Iteration	Criterion				
0	1	2626.25517748			
1	1	2626.25517748	0.00000000		

Estimated R Matrix for Subject 1							
Row	Col1	Col4					
1	43.9001						
2		43.9001					
3			43.9001				
4				43.9001			

Estima	Estimated R Correlation Matrix for Subject 1						
Row	Col1 Col2 Col3 Col4						
1	1.0000						
2		1.0000					
3			1.0000				
4				1.0000			

Covariance Parameter Estimates			
Cov Parm	Subject	Estimate	
week	ID	43.9001	

Fit Statistics				
-2 Res Log Likelihood	2626.3			
AIC (Smaller is Better)	2628.3			
AICC (Smaller is Better)	2628.3			
BIC (Smaller is Better)	2630.9			

Null	Null Model Likelihood Ratio Test						
DF	DF Chi-Square Pr > ChiSq						
0	0.00	1.0000					

Solution for Fixed Effects							
Effect	TRT	week	Estimate	Standard Error	DF	t Value	Pr > t
Intercept			23.6460	0.9370	98	25.24	<.0001
TRT	A		-2.8840	1.3251	98	-2.18	0.0319
TRT	P		0				
week		0	2.6260	1.3251	294	1.98	0.0484
week		1	1.0140	1.3251	294	0.77	0.4448
week		4	0.4240	1.3251	294	0.32	0.7492
week		6	0				
TRT*week	A	0	3.1520	1.8740	294	1.68	0.0936
TRT*week	A	1	-8.2540	1.8740	294	-4.40	<.0001
TRT*week	A	4	-5.6720	1.8740	294	-3.03	0.0027
TRT*week	A	6	0				
TRT*week	P	0	0				
TRT*week	P	1	0				•
TRT*week	P	4	0				
TRT*week	P	6	0				

Type 3 Tests of Fixed Effects								
Effect Num Den DF F Value Pr >								
TRT	1	98	70.86	<.0001				
week	3	294	24.85	<.0001				
TRT*week	3	294	15.42	<.0001				

```
proc mixed data=long_lead;
class TRT week;
model PB = TRT week week*TRT/ s;
repeated week/type=UN subject=ID r rcorr;
run;
```

Model Information					
Data Set	WORK.LONG_LEAD				
Dependent Variable	РВ				
Covariance Structure	Unstructured				
Subject Effect	ID				
Estimation Method	REML				
Residual Variance Method	None				
Fixed Effects SE Method	Model-Based				
Degrees of Freedom Method	Between-Within				

Dimensions				
Covariance Parameters	10			
Columns in X	15			
Columns in Z	0			
Subjects	100			
Max Obs per Subject	4			

Estimated R Matrix for Subject 1							
Row	Col1 Col2 Col3						
1	25.2257	19.1074	19.6995	22.2016			
2	19.1074	44.3458	35.5351	29.6750			
3	19.6995	35.5351	47.3778	30.6205			
4	22.2016	29.6750	30.6205	58.6510			

Estimated R Correlation Matrix for Subject 1						
Row	Col1	Col2	Col3	Col4		
1	1.0000	0.5713	0.5698	0.5772		
2	0.5713	1.0000	0.7753	0.5819		
3	0.5698	0.7753	1.0000	0.5809		
4	0.5772	0.5819	0.5809	1.0000		
	Fi	t Statisti	cs			
-2 Res	Log Like	lihood		2416.1		
AIC (S		2436.1				
AICC	2436.7					
BIC (S	maller is	Better)		2462.1		

Solution for Fixed Effects							
Effect	TRT	week	Estimate	Standard Error	DF	t Value	Pr > t
Intercept			23.6460	1.0831	98	21.83	<.0001
TRT	A		-2.8840	1.5317	98	-1.88	0.0627
TRT	P		0				
week		0	2.6260	0.8885	98	2.96	0.0039
week		1	1.0140	0.9343	98	1.09	0.2805
week		4	0.4240	0.9464	98	0.45	0.6551
week		6	0				
TRT*week	A	0	3.1520	1.2566	98	2.51	0.0138
TRT*week	A	1	-8.2540	1.3213	98	-6.25	<.0001
TRT*week	A	4	-5.6720	1.3385	98	-4.24	<.0001
TRT*week	A	6	0				
TRT*week	P	0	0				
TRT*week	P	1	0				
TRT*week	P	4	0				
TRT*week	P	6	0				•

Type 3 Tests of Fixed Effects									
Effect Num Den DF F Value Pr > 1									
TRT	1	98	25.43	<.0001					
week	3	98	61.49	<.0001					
TRT*week	3	98	35.93	<.0001					

```
proc mixed data=long_lead;
class TRT week;
model PB = TRT week week*TRT/ s;
repeated week/type=CS subject=ID r rcorr;
run;
```

Model Information					
Data Set	WORK.LONG_LEAD				
Dependent Variable	РВ				
Covariance Structure	Compound Symmetry				
Subject Effect	ID				
Estimation Method	REML				
Residual Variance Method	Profile				
Fixed Effects SE Method	Model-Based				
Degrees of Freedom Method	Between-Within				

Dimensions	
Covariance Parameters	2
Columns in X	15
Columns in Z	0
Subjects	100
Max Obs per Subject	4

	Estimated R Matrix for Subject 1							
Row	Col1	Col2	Col3	Col4				
1	43.9001	26.1399	26.1399	26.1399				
2	26.1399	43.9001	26.1399	26.1399				
3	26.1399	26.1399	43.9001	26.1399				
4	26.1399	26.1399	26.1399	43.9001				

Estimated R Correlation Matrix for Subject 1											
Row	Row Col1 Col2 Col3 Col4										
1	1.0000	0.5954	0.5954	0.5954							
2	0.5954	1.0000	0.5954	0.5954							
3	0.5954	0.5954	1.0000	0.5954							
4	0.5954	0.5954	0.5954	1.0000							

Fit Statistics				
-2 Res Log Likelihood	2460.6			
AIC (Smaller is Better)	2464.6			
AICC (Smaller is Better)	2464.7			
BIC (Smaller is Better)	2469.8			

	Solution for Fixed Effects							
Effect	TRT	week	Estimate	Standard Error	DF	t Value	Pr > t	
Intercept			23.6460	0.9370	98	25.24	<.0001	
TRT	A		-2.8840	1.3251	98	-2.18	0.0319	
TRT	P		0	•				
week		0	2.6260	0.8429	294	3.12	0.0020	
week		1	1.0140	0.8429	294	1.20	0.2299	
week		4	0.4240	0.8429	294	0.50	0.6153	
week		6	0					
TRT*week	A	0	3.1520	1.1920	294	2.64	0.0086	
TRT*week	A	1	-8.2540	1.1920	294	-6.92	<.0001	
TRT*week	A	4	-5.6720	1.1920	294	-4.76	<.0001	
TRT*week	A	6	0	•				
TRT*week	P	0	0					
TRT*week	P	1	0					
TRT*week	P	4	0					
TRT*week	P	6	0		•		•	

repeated week/type=CSH subject=ID r rcorr; run;

Model Information				
Data Set	WORK.LONG_LEAD			
Dependent Variable	РВ			
Covariance Structure	Heterogeneous Compound Symmetry			
Subject Effect	ID			
Estimation Method	REML			
Residual Variance Method	None			
Fixed Effects SE Method	Model-Based			
Degrees of Freedom Method	Between-Within			

Dimensions	
Covariance Parameters	5
Columns in X	15
Columns in Z	0
Subjects	100
Max Obs per Subject	4

	Estimated R Matrix for Subject 1					
Row	Col1	Col2	Col3	Col4		
1	26.1923	20.4552	21.1511	24.2840		
2	20.4552	42.8932	27.0669	31.0762		
3	21.1511	27.0669	45.8612	32.1334		
4	24.2840	31.0762	32.1334	60.4537		

Esti	Estimated R Correlation Matrix for Subject 1					
Row	Col1	Col2	Col3	Col4		
1	1.0000	0.6103	0.6103	0.6103		
2	0.6103	1.0000	0.6103	0.6103		
3	0.6103	0.6103	1.0000	0.6103		
4	0.6103	0.6103	0.6103	1.0000		

Fit Statistics		
-2 Res Log Likelihood	2434.0	
AIC (Smaller is Better)	2444.0	
AICC (Smaller is Better)	2444.1	
BIC (Smaller is Better)	2457.0	

Solution for Fixed Effects							
Effect	TRT	week	Estimate	Standard Error	DF	t Value	Pr > t
Intercept			23.6460	1.0996	98	21.50	<.0001
TRT	A		-2.8840	1.5550	98	-1.85	0.0667
TRT	P		0			•	
week		0	2.6260	0.8727	294	3.01	0.0028
week		1	1.0140	0.9077	294	1.12	0.2649
week		4	0.4240	0.9170	294	0.46	0.6442
week		6	0				•
TRT*week	A	0	3.1520	1.2341	294	2.55	0.0112
TRT*week	A	1	-8.2540	1.2837	294	-6.43	<.0001
TRT*week	A	4	-5.6720	1.2969	294	-4.37	<.0001
TRT*week	A	6	0				•
TRT*week	P	0	0			•	
TRT*week	P	1	0			•	
TRT*week	P	4	0				
TRT*week	P	6	0				

```
proc mixed data=long_lead;
class TRT week;
model PB = TRT week week*TRT/ s;
repeated week/type=AR(1) subject=ID r rcorr;
run;
```

Model Information				
Data Set	WORK.LONG_LEAD			
Dependent Variable	РВ			
Covariance Structure	Autoregressive			
Subject Effect	ID			
Estimation Method	REML			
Residual Variance Method Profile				

Model Information				
Fixed Effects SE Method Model-Based				
Degrees of Freedom Method	Between-Within			

Dimensions		
Covariance Parameters	2	
Columns in X	15	
Columns in Z	0	
Subjects	100	
Max Obs per Subject	4	

	Estimated R Matrix for Subject 1					
Row	Col1	Col2	Col3	Col4		
1	43.4126	27.3909	17.2820	10.9040		
2	27.3909	43.4126	27.3909	17.2820		
3	17.2820	27.3909	43.4126	27.3909		
4	10.9040	17.2820	27.3909	43.4126		

Esti	Estimated R Correlation Matrix for Subject 1					
Row	Col1	Col2	Col3	Col4		
1	1.0000	0.6309	0.3981	0.2512		
2	0.6309	1.0000	0.6309	0.3981		
3	0.3981	0.6309	1.0000	0.6309		
4	0.2512	0.3981	0.6309	1.0000		

Fit Statistics		
-2 Res Log Likelihood	2472.6	
AIC (Smaller is Better)	2476.6	
AICC (Smaller is Better)	2476.7	
BIC (Smaller is Better)	2481.8	

	Solution for Fixed Effects							
Effect	TRT	week	Estimate	Standard Error	DF	t Value	Pr > t	
Intercept			23.6460	0.9318	98	25.38	<.0001	
TRT	A		-2.8840	1.3178	98	-2.19	0.0310	
TRT	P		0				•	
week		0	2.6260	1.1403	294	2.30	0.0220	
week		1	1.0140	1.0224	294	0.99	0.3221	
week		4	0.4240	0.8005	294	0.53	0.5968	
week		6	0				•	
TRT*week	A	0	3.1520	1.6127	294	1.95	0.0516	
TRT*week	A	1	-8.2540	1.4458	294	-5.71	<.0001	
TRT*week	A	4	-5.6720	1.1321	294	-5.01	<.0001	
TRT*week	A	6	0		٠			
TRT*week	P	0	0					
TRT*week	P	1	0					
TRT*week	P	4	0					
TRT*week	P	6	0		•			

```
proc mixed data=long_lead;
class TRT week;
model PB = TRT week week*TRT/ s;
repeated week/type=ARH(1) subject=ID r rcorr;
run;
```

Model Information				
Data Set	WORK.LONG_LEAD			
Dependent Variable	РВ			
Covariance Structure	Heterogeneous Autoregressive			
Subject Effect	ID			
Estimation Method	REML			
Residual Variance Method	None			
Fixed Effects SE Method	Model-Based			
Degrees of Freedom Method	Between-Within			

Dimensions	
Covariance Parameters	5
Columns in X	15
Columns in Z	0
Subjects	100
Max Obs per Subject	4

Estimated R Matrix for Subject 1							
Row	Col1	Col2	Col3	Col4			
1	26.2573	21.1565	13.8855	10.2959			
2	21.1565	42.0226	27.5805	20.4505			
3	13.8855	27.5805	44.6239	33.0878			
4	10.2959	20.4505	33.0878	60.4805			

Estimated R Correlation Matrix for Subject 1						
Row	Col1	Col2	Cola	Col4		
1	1.0000	0.6369	0.4057	0.2584		
2	0.6369	1.0000	0.6369	0.4057		
3	0.4057	0.6369	1.0000	0.6369		
4	0.2584	0.4057	0.6369	1.0000		
	Fi	it Statisti	cs			
-2 Res	-2 Res Log Likelihood					
AIC (S	2461.6					
AICC	2461.8					
BIC (S	maller is	Better)		2474.7		

Solution for Fixed Effects							
Effect	TRT	week	Estimate	Standard Error	DF	t Value	Pr > t
Intercept			23.6460	1.0998	98	21.50	<.0001
TRT	A		-2.8840	1.5554	98	-1.85	0.0667
TRT	P		0	•	•		
week		0	2.6260	1.1502	294	2.28	0.0231
week		1	1.0140	1.1100	294	0.91	0.3617
week		4	0.4240	0.8824	294	0.48	0.6312

	Solution for Fixed Effects							
Effect	TRT	week	Estimate	Standard Error	DF	t Value	Pr > t	
week		6	0		٠	•		
TRT*week	A	0	3.1520	1.6266	294	1.94	0.0536	
TRT*week	A	1	-8.2540	1.5697	294	-5.26	<.0001	
TRT*week	A	4	-5.6720	1.2479	294	-4.55	<.0001	
TRT*week	A	6	0					
TRT*week	P	0	0	•				
TRT*week	P	1	0			·		
TRT*week	P	4	0			•		
TRT*week	P	6	0				•	

```
proc mixed data=long_lead;
class TRT week;
model PB = TRT week week*TRT/ s;
repeated week/type=SP(EXP) (week) subject=ID r rcorr;
run;
```

Model Information				
Data Set	WORK.LONG_LEAD			
Dependent Variable	PB			
Covariance Structure	Spatial Exponential			
Subject Effect	ID			
Estimation Method	REML			
Residual Variance Method	Profile			
Fixed Effects SE Method	Model-Based			
Degrees of Freedom Method	Between-Within			

Dimensions				
Covariance Parameters	2			
Columns in X	15			
Columns in Z	0			
Subjects	100			
Max Obs per Subject	4			

	Estimated R Matrix for Subject 1						
Row	Col1	Col2	Col3	Col4			
1	45.7620	34.5100	14.8002	8.4168			
2	34.5100	45.7620	19.6258	11.1611			
3	14.8002	19.6258	45.7620	26.0247			
4	8.4168	11.1611	26.0247	45.7620			

Estimated R Correlation Matrix for Subject 1							
Row	Col1	Col2	Col3	Col4			
1	1.0000	0.7541	0.3234	0.1839			
2	0.7541	1.0000	0.4289	0.2439			
3	0.3234	0.4289	1.0000	0.5687			
4	0.1839	0.2439	0.5687	1.0000			

Fit Statistics				
-2 Res Log Likelihood	2501.9			
AIC (Smaller is Better)	2505.9			
AICC (Smaller is Better)	2505.9			
BIC (Smaller is Better)	2511.1			

Solution for Fixed Effects							
Effect	TRT	week	Estimate	Standard Error	DF	t Value	Pr > t
Intercept			23.6460	0.9567	98	24.72	<.0001
TRT	A		-2.8840	1.3530	98	-2.13	0.0355
TRT	P		0				
week		0	2.6260	1.2222	294	2.15	0.0325
week		1	1.0140	1.1764	294	0.86	0.3894
week		4	0.4240	0.8885	294	0.48	0.6336
week		6	0		•		
TRT*week	A	0	3.1520	1.7285	294	1.82	0.0692
TRT*week	A	1	-8.2540	1.6638	294	-4.96	<.0001
TRT*week	A	4	-5.6720	1.2566	294	-4.51	<.0001
TRT*week	A	6	0			•	
TRT*week	P	0	0		٠	•	

Solution for Fixed Effects							
Effect	TRT	week	Estimate	Standard Error	DF	t Value	Pr > t
TRT*week	P	1	0				
TRT*week	P	4	0				
TRT*week	P	6	0		•	•	

Trying some covariance models by treatment.

```
proc mixed data=long_lead;
class ID TRT week;
model PB = TRT week week*TRT/ s ;
repeated week/type=UN subject=ID r=1,2 rcorr=1,2 GROUP=TRT;
run:
```

The Mixed Procedure Model Information

Data Set	WORK.LONG_LEAD
Dependent Variable	PB
Covariance Structure	Unstructured
Subject Effect	ID
Group Effect	TRT
Estimation Method	REML
Residual Variance Method	None
Fixed Effects SE Method	Model-Based

Dimensions

Degrees of Freedom Method Between-Within

Covariance Parameters	20
Columns in X	15
Columns in Z	0
Subjects	100
Max Obs per Subject	4

Number of Observations

Number of Observations Read 400

Number of Observations

Number of Observations Used 400

Number of Observations Not Used (

Estimated R Matrix for ID 1

Row	Col1	Col2	Col3	Col4
1	25.2416	22.7495	24.2610	21.4178

- **2** 22.7495 29.8245 27.0412 23.3841
- **3** 24.2610 27.0412 33.0985 28.2190
- **4** 21.4178 23.3841 28.2190 31.8074

Estimated R Correlation Matrix for ID 1

Row	Col1	Col2	Col3	Col4
1	1.0000	0.8291	0.8394	0.7559
2	0.8291	1.0000	0.8607	0.7592
3	0.8394	0.8607	1.0000	0.8697
4	0.7559	0.7592	0.8697	1.0000

Estimated R Matrix for ID 2

Row	Col1	Col2	Col3	Col4
1	25.2098	15.4654	15.1380	22.9854
2	15.4654	58.8671	44.0291	35.9660
3	15.1380	44.0291	61.6571	33.0220
4	22 9854	35 9660	33 0220	85 4946

Estimated R Correlation Matrix for ID 2

Row	Col1	Col2	Col3	Col4
1	1.0000	0.4015	0.3840	0.4951
2	0.4015	1.0000	0.7308	0.5070
3	0.3840	0.7308	1.0000	0.4548
4	0.4951	0.5070	0.4548	1.0000

Fit Statistics

-2 Res Log Likelihood 2314.3 AIC (Smaller is Better) 2354.3

Fit Statistics

AICC (Smaller is Better) 2356.6

BIC (Smaller is Better) 2406.4

Null Model Likelihood Ratio Test

DF	Chi-Square	Pr > ChiSq
19	311.91	<.0001

Solution for Fixed Effects

Effect	TRT	week	Estimate	Standard Error	DF	t Value	Pr > t
Intercept			23.6460	0.7976	98	29.65	<.0001
TRT	A		-2.8840	1.5317	98	-1.88	0.0627
TRT	P		0				
week		0	2.6260	0.5332	294	4.93	<.0001
week		1	1.0140	0.5452	294	1.86	0.0639
week		4	0.4240	0.4115	294	1.03	0.3037
week		6	0				
TRT*week	A	0	3.1520	1.2566	294	2.51	0.0127
TRT*week	A	1	-8.2540	1.3213	294	-6.25	<.0001
TRT*week	A	4	-5.6720	1.3385	294	-4.24	<.0001
TRT*week	A	6	0			•	
TRT*week	P	0	0				
TRT*week	P	1	0				
TRT*week	P	4	0				
TRT*week	P	6	0				

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
TRT	1	98	25.43	<.0001
week	3	294	61.49	<.0001
TRT*week	3	294	35.93	<.0001

```
proc mixed data=long_lead;
class ID TRT week;
model PB = TRT week week*TRT/ s;
repeated week/type=CSH subject=ID r=1,2 rcorr=1,2 GROUP=TRT;
run;
```

The Mixed Procedure Model Information

Data Set WORK.LONG_LEAD

Dependent Variable PB

Covariance Structure Heterogeneous Compound Symmetry

Subject Effect ID

Group Effect TRT

Estimation Method REML

Residual Variance Method None

Fixed Effects SE Method Model-Based

Degrees of Freedom Method Between-Within

Dimensions

Covariance Parameters 10
Columns in X 15
Columns in Z 0
Subjects 100
Max Obs per Subject 4

Number of Observations

Number of Observations Read 400 Number of Observations Used 400 Number of Observations Not Used 0

Convergence criteria met.

Estimated R Matrix for ID 1

Row	Col1	Col2	Col3	Col4
1	25.5844	22.6684	23.3035	23.7269
2	22.6684	29.9149	25.1987	25.6565
3	23.3035	25.1987	31.6147	26.3754
4	23.7269	25.6565	26.3754	32.7740

Estimated R Correlation Matrix for ID 1

Row Col1 Col2 Col3 Col4

Estimated R Correlation Matrix for ID 1

Row	Col1	Col2	Col3	Col4
1	1.0000	0.8194	0.8194	0.8194
2	0.8194	1.0000	0.8194	0.8194
3	0.8194	0.8194	1.0000	0.8194
4	0.8194	0.8194	0.8194	1.0000

Estimated R Matrix for ID 2

Row	Col1	Col2	Col3	Col4
1	26.7958	19.3177	19.9576	23.9109
2	19.3177	56.3599	28.9441	34.6775
3	19.9576	28.9441	60.1558	35.8262
4	23.9109	34.6775	35.8262	86.3480

Estimated R Correlation Matrix for ID 2

Row	Col1	Col2	Col3	Col4
1	1.0000	0.4971	0.4971	0.4971
2	0.4971	1.0000	0.4971	0.4971
3	0.4971	0.4971	1.0000	0.4971
4	0.4971	0.4971	0.4971	1.0000

Fit Statistics

-2 Res Log Likelihood	2340.2
AIC (Smaller is Better)	2360.2
AICC (Smaller is Better)	2360.8
BIC (Smaller is Better)	2386.2

Null Model Likelihood Ratio Test DF Chi-Square Pr > ChiSq 9 286.07 <.0001

Solution for Fixed Effects

Effect	TRT	week	Estimate	Standard Error	DF	t Value	Pr > t
Intercept			23.6460	0.8096	98	29.21	<.0001
TRT	A		-2 8840	1 5435	98	-1 87	0.0647

Solution for Fixed Effects

Effect	TRT	week	Estimate	Standard Error	DF	t Value	Pr > t
TRT	P		0				
week		0	2.6260	0.4670	294	5.62	<.0001
week		1	1.0140	0.4770	294	2.13	0.0344
week		4	0.4240	0.4825	294	0.88	0.3802
week		6	0				
TRT*week	A	0	3.1520	1.2347	294	2.55	0.0112
TRT*week	A	1	-8.2540	1.3018	294	-6.34	<.0001
TRT*week	A	4	-5.6720	1.3152	294	-4.31	<.0001
TRT*week	A	6	0				
TRT*week	P	0	0				
TRT*week	P	1	0				
TRT*week	P	4	0				
TRT*week	P	6	0				

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
TRT	1	98	25.69	<.0001
week	3	294	84.41	<.0001
TRT*week	3	294	48.52	<.0001