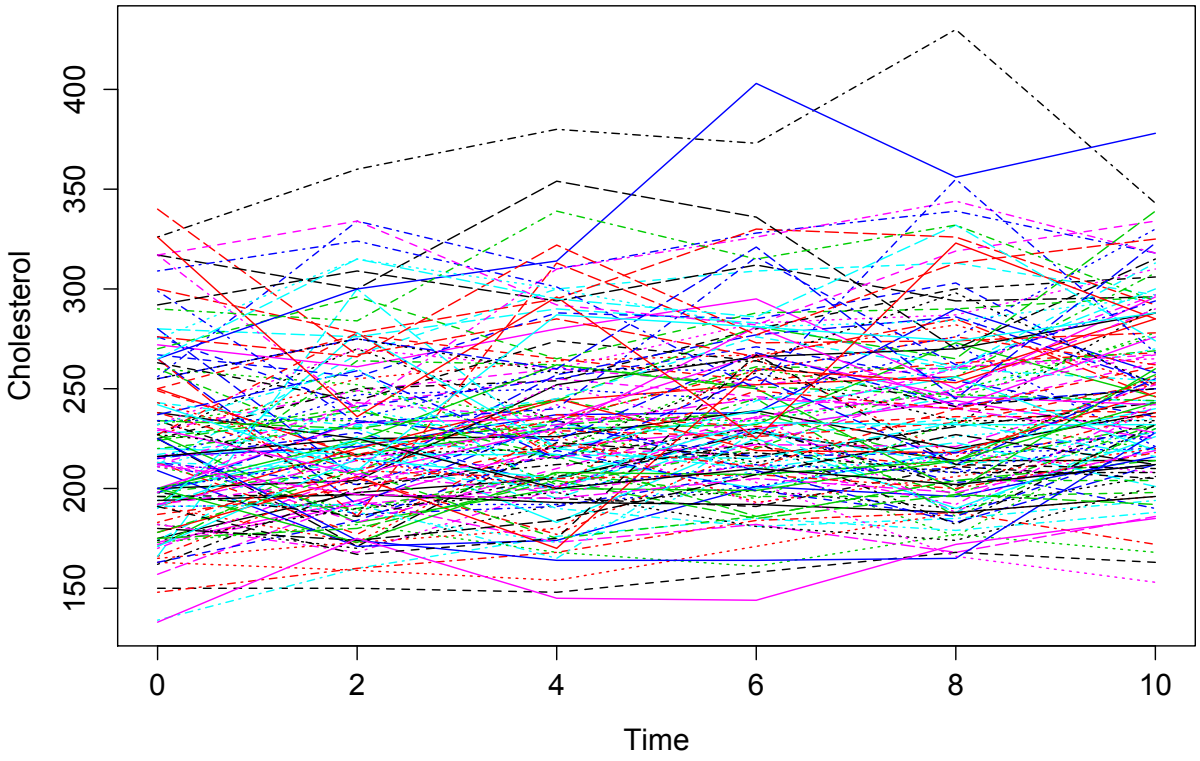
- In the Framingham study, each of 2634 participants was examined every 2 years for a 10 year period for his/her cholesterol level.
- Study objectives:
    - How does cholesterol level change over time on average as people get older?
    - How is the change of cholesterol level associated with sex and baseline age?
- A subset of 200 subjects' data is used for illustrative purpose.
- Below is the spaghetti plot of the 200 subjects.




```
data cholst;
input ID  cholst    sex  age  time;
datalines;
1     175  1     32    0
1     198  1     32    2
200   252  0     46    10
;
run;
```

```
proc mixed data=cholst;
class ID;
model cholst = / s;
random intercept/subject=ID g gcorr v vcorr;
run;
```

Model Information	
Data Set	WORK.CHOLST
Dependent Variable	cholst
Covariance Structure	Unstructured
Subject Effect	ID
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Dimensions	
Covariance Parameters	2
Columns in X	1
Columns in Z per Subject	1
Subjects	200
Max Obs per Subject	6

Iteration History			
Iteration	**Evaluations**	**-2 Res Log Like**	**Criterion**
0	1	10813.99587154	
1	2	9925.13211020	0.00000001
2	1	9925.13205318	0.00000000

Estimated G Matrix			
Row	**Effect**	**ID**	**Col1**
1	Intercept	1	1394.48

Estimated G Correlation Matrix			
Row	Effect	ID	Col1
1	Intercept	1	1.0000

Estimated V Matrix for ID 1						
Row	Col1	Col2	Col3	Col4	Col5	Col6
1	1862.71	1394.48	1394.48	1394.48	1394.48	1394.48
2	1394.48	1862.71	1394.48	1394.48	1394.48	1394.48
3	1394.48	1394.48	1862.71	1394.48	1394.48	1394.48
4	1394.48	1394.48	1394.48	1862.71	1394.48	1394.48
5	1394.48	1394.48	1394.48	1394.48	1862.71	1394.48
6	1394.48	1394.48	1394.48	1394.48	1394.48	1862.71

Estimated V Correlation Matrix for ID 1						
Row	Col1	Col2	Col3	Col4	Col5	Col6
1	1.0000	0.7486	0.7486	0.7486	0.7486	0.7486
2	0.7486	1.0000	0.7486	0.7486	0.7486	0.7486
3	0.7486	0.7486	1.0000	0.7486	0.7486	0.7486
4	0.7486	0.7486	0.7486	1.0000	0.7486	0.7486
5	0.7486	0.7486	0.7486	0.7486	1.0000	0.7486
6	0.7486	0.7486	0.7486	0.7486	0.7486	1.0000

Covariance Parameter Estimates		
Cov Parm	Subject	Estimate
UN(1,1)	ID	1394.48
Residual		468.23

Fit Statistics	
-2 Res Log Likelihood	9925.1
AIC (Smaller is Better)	9929.1
AICC (Smaller is Better)	9929.1
BIC (Smaller is Better)	9935.7

Solution for Fixed Effects					
Effect	Estimate	Standard Error	DF	t Value	Pr > |t|
Intercept	138.47	15.9220	197	8.70	<.0001

Now let's do the same analysis using a compound symmetric covariance matrix.

```
proc mixed data=cholst;
class ID;
model cholst = / s;
repeated /type=CS subject=ID r rcorr;
run;
```

Model Information	
Data Set	WORK.CHOLST
Dependent Variable	cholst
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

Class Level Information		
Class	Levels	Values
ID	200	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200

Dimensions	
Covariance Parameters	2
Columns in X	1
Columns in Z	0
Subjects	200
Max Obs per Subject	6

Number of Observations	
Number of Observations Read	1044
Number of Observations Used	1044
Number of Observations Not Used	0

Iteration History			
Iteration	Evaluations	-2 Res Log Like	Criterion
0	1	10813.99587154	
1	2	9925.13211020	0.00000001
2	1	9925.13205318	0.00000000

Estimated R Matrix for ID 1						
Row	Col1	Col2	Col3	Col4	Col5	Col6
1	1862.71	1394.48	1394.48	1394.48	1394.48	1394.48
2	1394.48	1862.71	1394.48	1394.48	1394.48	1394.48
3	1394.48	1394.48	1862.71	1394.48	1394.48	1394.48
4	1394.48	1394.48	1394.48	1862.71	1394.48	1394.48
5	1394.48	1394.48	1394.48	1394.48	1862.71	1394.48
6	1394.48	1394.48	1394.48	1394.48	1394.48	1862.71

Estimated R Correlation Matrix for ID 1						
Row	Col1	Col2	Col3	Col4	Col5	Col6
1	1.0000	0.7486	0.7486	0.7486	0.7486	0.7486
2	0.7486	1.0000	0.7486	0.7486	0.7486	0.7486
3	0.7486	0.7486	1.0000	0.7486	0.7486	0.7486
4	0.7486	0.7486	0.7486	1.0000	0.7486	0.7486
5	0.7486	0.7486	0.7486	0.7486	1.0000	0.7486
6	0.7486	0.7486	0.7486	0.7486	0.7486	1.0000

Covariance Parameter Estimates		
Cov Parm	**Subject**	**Estimate**
CS	ID	1394.48
Residual		468.23

Fit Statistics	
-2 Res Log Likelihood	9925.1
AIC (Smaller is Better)	9929.1
AICC (Smaller is Better)	9929.1
BIC (Smaller is Better)	9935.7

Solution for Fixed Effects					
Effect	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
Intercept	138.47	15.9220	197	8.70	<.0001

As we can see the compound symmetry analysis is equivalent to the random intercept model.