```
data exercise;
  input id exertype diet time1 time2 time3;
cards;
1      1          1        85        85        88
2      1          1        90        92        93
3      1          1        97        97        94
4      1          1        80        82        83
5      1          1        91        92        91
6      1          2        83        83        84
7      1          2        87        88        90
8      1          2        92        94        95
9      1          2        97        99        96
10     1          2       100        97       100
11     2          1        86        86        84
12     2          1        93       103       104
13     2          1        90        92        93
14     2          1        95        96       100
15     2          1        89        96        95
16     2          2        84        86        89
17     2          2       103       109        90
18     2          2        92        96       101
19     2          2        97        98       100
20     2          2       102       104       103
21     3          1        93        98       110
22     3          1        98       104       112
23     3          1        98       105        99
24     3          1        87       132       120
25     3          1        94       110       116
26     3          2        95       126       143
27     3          2       100       126       140
28     3          2       103       124       140
29     3          2        94       135       130
30     3          2        99       111       150
;
run;
```

1. Упражнение:

Подредете командите и опишете, какво изпълняват:

```
goptions reset=all;
symbol1 c=blue v=star h=.8 i=j;
symbol2 c=red v=dot h=.8 i=j;
symbol3 c=green v=square h=.8 i=j;
axis1 order=(60 to 150 by 30) label=(a=90 'Means');
axis2 label=('Time') value=('1' '2' '3');
proc gplot data=means;
  plot lsmean*_name_=exertype / vaxis=axis1 haxis=axis2;
run;
quit;
proc glm data=exercise;
  class diet;
  model time1 time2 time3 = diet;
  repeated time 3 / printe;
run;
quit;
proc glm data=exercise;
  class exertype;
  model time1 time2 time3 = exertype;
  repeated time 3 ;
```

```
  lsmeans exertype / out=means;
run;
quit;
proc print data=means;
run;
proc glm data=exercise;
  class exertype;
  model time1 time2 time3 = exertype;
  repeated time 3 ;
run;
quit;
```

2.Упражнение

Опишете вида на анализа, който извършваме чрез програмата. Опишете всяка изпълнена команда.

```
data exercise;
  input id exertype diet time1 time2 time3;
cards;
1      1          1        85        85        88
2      1          1        90        92        93
3      1          1        97        97        94
4      1          1        80        82        83
5      1          1        91        92        91
6      1          2        83        83        84
7      1          2        87        88        90
8      1          2        92        94        95
9      1          2        97        99        96
10     1          2       100        97       100
11     2          1        86        86        84
12     2          1        93       103       104
13     2          1        90        92        93
14     2          1        95        96       100
15     2          1        89        96        95
16     2          2        84        86        89
17     2          2       103       109        90
18     2          2        92        96       101
19     2          2        97        98       100
20     2          2       102       104       103
21     3          1        93        98       110
22     3          1        98       104       112
23     3          1        98       105        99
24     3          1        87       132       120
25     3          1        94       110       116
26     3          2        95       126       143
27     3          2       100       126       140
28     3          2       103       124       140
29     3          2        94       135       130
30     3          2        99       111       150
;
run;
proc corr data=exercise cov;
  var time1 time2 time3;
run;

proc transpose data=exercise out=long;
  by id diet exertype;
```

```
run;
data long;
  set long (rename=(col1=pulse) );
  time = substr(_NAME_, 5, 1 )+0;
  drop _name_;
run;
ods output LSMeans=means1;
proc mixed data=long;
  class exertype time;
  model pulse = exertype time exertype*time;
  repeated time / subject=id type=ar(1);
  lsmeans time*exertype;
run;

goptions reset=all;
symbol1 c=blue v=star h=.8 i=j;
symbol2 c=red v=dot h=.8 i=j;
symbol3 c=green v=square h=.8 i=j;
axis1 order=(60 to 150 by 30) label=(a=90 'Means');
proc gplot data=means1;
  format estimate 8.;
  plot estimate*time=exertype / vaxis=axis1;
run;
quit;
proc glm data=exercise;
 class diet exertype;
 model time1 time2 time3 = diet|exertype;
 repeated time 3 ;
run;
quit;
proc glm data=exercise;
 class diet exertype;
 model time1 time2 time3 = diet|exertype;
 repeated time 3;
 lsmeans diet*exertype / out=means;
run;
quit;

proc print data=means;
run;

proc sort data=means out=sortdiet;
 by diet;
run;

goptions reset=all;
symbol1 c=blue v=star h=.8 i=j;
symbol2 c=red v=dot h=.8 i=j;
symbol3 c=green v=square h=.8 i=j;
axis1 order=(60 to 150 by 30) label=(a=90 'Means');
axis2 label=('Time') value=('1' '2' '3');
proc gplot data=sortdiet;
 by diet;
 plot lsmean*_name_ = exertype / vaxis=axis1 haxis=axis2;
run;
quit;

proc mixed data=long;
```

```
  class exertype diet time;
  model pulse = exertype|diet|time;
  repeated time / subject=id type=arh(1) ;
run;
proc print data=means;
run;
```

3.Упражнение

Опишете вида на анализа, който извършваме чрез програмата. Опишете всяка изпълнена команда.

```
data study2;
  input id exertype diet pulse time;
cards;
1 1 1 90 0
1 1 1 92 228
1 1 1 93 296
1 1 1 93 639
2 1 1 90 0
2 1 1 92 56
2 1 1 93 434
2 1 1 93 538
3 1 1 97 0
3 1 1 97 150
3 1 1 94 295
3 1 1 94 541
4 1 1 80 0
4 1 1 82 121
4 1 1 83 256
4 1 1 83 575
5 1 1 91 0
5 1 1 92 161
5 1 1 91 252
5 1 1 91 526
6 1 2 83 0
6 1 2 83 73
6 1 2 84 320
6 1 2 84 570
7 1 2 87 0
7 1 2 88 40
7 1 2 90 325
7 1 2 90 730
8 1 2 92 0
8 1 2 94 205
8 1 2 95 276
8 1 2 95 761
9 1 2 97 0
9 1 2 99 57
9 1 2 96 244
9 1 2 96 695
10 1 2 100 0
10 1 2 97 143
10 1 2 100 296
10 1 2 100 722
11 2 1 86 0
11 2 1 86 83
11 2 1 84 262
11 2 1 84 566
```

12 2 1 93 0
12 2 1 103 116
12 2 1 104 357
12 2 1 104 479
13 2 1 90 0
13 2 1 92 191
13 2 1 93 280
13 2 1 93 709
14 2 1 95 0
14 2 1 96 112
14 2 1 100 219
14 2 1 100 367
15 2 1 89 0
15 2 1 96 96
15 2 1 95 339
15 2 1 95 639
16 2 2 84 0
16 2 2 86 92
16 2 2 89 351
16 2 2 89 508
17 2 2 103 0
17 2 2 109 196
17 2 2 114 213
17 2 2 120 634
18 2 2 92 0
18 2 2 96 117
18 2 2 101 227
18 2 2 101 614
19 2 2 97 0
19 2 2 98 70
19 2 2 100 295
19 2 2 100 515
20 2 2 102 0
20 2 2 104 165
20 2 2 103 302
20 2 2 103 792
21 3 1 93 0
21 3 1 98 100
21 3 1 110 396
21 3 1 115 498
22 3 1 98 0
22 3 1 104 104
22 3 1 112 310
22 3 1 117 518
23 3 1 98 0
23 3 1 105 148
23 3 1 118 208
23 3 1 121 677
24 3 1 87 0
24 3 1 122 171
24 3 1 127 320
24 3 1 133 633
25 3 1 94 0
25 3 1 110 57
25 3 1 116 268
25 3 1 119 657
26 3 2 95 0
26 3 2 126 163

```
26 3 2 143 382
26 3 2 147 501
27 3 2 100 0
27 3 2 126 70
27 3 2 140 347
27 3 2 148 737
28 3 2 103 0
28 3 2 124 61
28 3 2 140 263
28 3 2 143 588
29 3 2 94 0
29 3 2 135 164
29 3 2 130 353
29 3 2 137 560
30 3 2 99 0
30 3 2 111 114
30 3 2 140 362
30 3 2 148 501
;
run;
proc sort data=study2;
  by id time;
run;
goptions reset=all;
symbol1 c=blue v=star h=.8 i=j r=10;
symbol2 c=red v=dot h=.8 i=j r=10;
symbol3 c=green v=square h=.8 i=j r=10;
axis1 order=(60 to 150 by 30) label=(a=90 'Pulse');
proc gplot data=study2;
  plot pulse*time=id  / vaxis=axis1;
run;

*the linear model ;
proc mixed data=study2 covtest noclprint;
  class id exertype ;
  model pulse = time exertype time*exertype / solution outp=pred1r outpm
= pred1f;
  random intercept time / subject = id;
run;

goptions reset=all;
symbol1 c=blue v=star h=.8 i=j;
symbol2 c=red v=dot h=.8 i=j;
symbol3 c=green v=square h=.8 i=j;
axis1 order=(60 to 150 by 30) label=(a=90 'Predicted Pulse');
proc gplot data=pred1f;
  plot pred*time=exertype  /vaxis=axis1;
run;
quit;

proc sort data=pred1f;
  by time;
run;
goptions reset=all;
symbol1 c=blue  v=star   h=.8 i=j      w=10;
symbol2 c=red   v=dot    h=.8 i=j      w=10;
symbol3 c=green v=square h=.8 i=j      w=10;
symbol4 c=blue  v=star   h=.8 i=j      r=10;
```

```
symbol5 c=red   v=dot    h=.8 i=j      r=10;
symbol6 c=green v=square h=.8 i=j      r=10;
axis1 order=(60 to 150 by 30) label=(a=90 'Predicted and Observed
Pulse');
proc gplot data=pred1f;
  plot pred*time=exertype / vaxis=axis1 ;
  plot2 pulse*time = id   / vaxis=axis1 ;;
run;
quit;
proc mixed data=study2 covtest noclprint;
  class id exertype;
  model pulse = time exertype time*exertype time*time / solution
outp=pred2r outpm=pred2f ;
  random intercept time / subject = id;
run;


* just predicted, fixed ;
proc sort data=pred2f;
  by time;
run;
goptions reset=all;
symbol1 c=blue v=star h=.8 i=j ;
symbol2 c=red v=dot h=.8 i=j ;
symbol3 c=green v=square h=.8 i=j ;
axis1 order=(60 to 150 by 30) label=(a=90 'Predicted Pulse');
proc gplot data=pred2f;
  plot pred*time=exertype      /vaxis=axis1 ;
run;
quit;

proc sort data=pred2f;
  by time;
run;
goptions reset=all;
symbol1 c=blue  v=star   h=.8 i=j      w=10;
symbol2 c=red   v=dot    h=.8 i=j      w=10;
symbol3 c=green v=square h=.8 i=j      w=10;
symbol4 c=blue  v=star   h=.8 i=j      r=10;
symbol5 c=red   v=dot    h=.8 i=j      r=10;
symbol6 c=green v=square h=.8 i=j      r=10;
axis1 order=(60 to 150 by 30) label=(a=90 'Predicted and Observed
Pulse');
proc gplot data=pred2f;
  plot pred*time=exertype / vaxis=axis1 ;
  plot2 pulse*time = id   / vaxis=axis1 ;;
run;
quit;
proc mixed data=study2 covtest noclprint;
  class id exertype;
  model pulse = time exertype time*exertype time*time / solution
outp=pred2r outpm=pred2f ;
  random intercept time / subject = id;
run;


* just predicted, fixed ;
proc sort data=pred2f;
```

```
  by time;
run;
goptions reset=all;
symbol1 c=blue v=star h=.8 i=j ;
symbol2 c=red v=dot h=.8 i=j ;
symbol3 c=green v=square h=.8 i=j ;
axis1 order=(60 to 150 by 30) label=(a=90 'Predicted Pulse');
proc gplot data=pred2f;
  plot pred*time=exertype      /vaxis=axis1 ;
run;
quit;

* predicted vs. actual , fixed ;
proc sort data=pred2f;
  by time;
run;
goptions reset=all;
symbol1 c=blue  v=star   h=.8 i=j      w=10;
symbol2 c=red   v=dot    h=.8 i=j      w=10;
symbol3 c=green v=square h=.8 i=j      w=10;
symbol4 c=blue  v=star   h=.8 i=j      r=10;
symbol5 c=red   v=dot    h=.8 i=j      r=10;
symbol6 c=green v=square h=.8 i=j      r=10;
axis1 order=(60 to 150 by 30) label=(a=90 'Predicted and Observed
Pulse');
proc gplot data=pred2f;
  plot pred*time=exertype / vaxis=axis1 ;
  plot2 pulse*time = id   / vaxis=axis1 ;;
run;
quit;
```

4.Упражнение

Опишете вида на анализа, който извършваме чрез програмата. Опишете всяка изпълнена команда.

```
proc mixed data=study2 covtest noclprint;
  class id exertype;
  model pulse = time exertype time*exertype time*time time*time*exertype
/ solution outp=pred3r outpm=pred3f ;
  random intercept time / subject = id;
run;
* predicted vs. actual , fixed ;
proc sort data=pred3f;
  by time;
run;
goptions reset=all;
symbol1 c=blue  v=star   h=.8 i=j      w=10;
symbol2 c=red   v=dot    h=.8 i=j      w=10;
symbol3 c=green v=square h=.8 i=j      w=10;
symbol4 c=blue  v=star   h=.8 i=j      r=10;
symbol5 c=red   v=dot    h=.8 i=j      r=10;
symbol6 c=green v=square h=.8 i=j      r=10;
axis1 order=(60 to 150 by 30) label=(a=90 'Predicted and Observed
Pulse');
proc gplot data=pred3f;
  plot pred*time=exertype / vaxis=axis1 ;
  plot2 pulse*time = id   / vaxis=axis1 ;;
```

```
run;
quit;
```