

**SAS Lab 5 For Statistics 514**

**Topics:**

Chapter 23. Multifactor Studies

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*Attendance 5, 23.1 means for three factor ANOVA I;
data miceroc;
  do gender = 1 to 2;
    do temp = 1 to 4;
      do noise = 1 to 3;
        do case = 1 to 2;
          input roc @;
          output;
        end;
      end;
    end;
  end;
datalines;
10.3 7.2 9.1 5.4 6.1 2.1
1.8 9.8 12.1 4.2 5.1 6.2
1.2 8.1 6.5 4.1 1.2 2.1
12.4 15.1 16.1 17.2 18.1 19.1
9.3 6.2 8.1 5.4 8.1 7.1
2.8 9.8 10.1 4.2 5.1 6.2
4.2 5.1 7.5 4.1 6.2 7.1
5.4 5.1 11.1 12.2 8.1 9.1
;
data micerocm1;
  set miceroc;
  if gender=1;
run;
data micerocm2;
  set miceroc;
  if gender=2;
run;
proc sort data=micerocm1;
  by temp noise;
run;
proc means data=micerocm1 noprint;
  title 'treatment means plot, gender=1';
  var roc;
  by temp noise;
  output out=micerocm1 mean=mnroc;
run;
proc gplot data=micerocm1;
  title 'treatment means plot, noise/temp, gender=1';
  plot mnroc*noise=temp;
run;
proc sort data=micerocm2;
  by temp noise;
run;
proc means data=micerocm2 noprint;
  title 'treatment means plot, gender=2';
  var roc;
  by temp noise;
  output out=micerocm2 mean=mnroc;
run;
proc gplot data=micerocm2;
  title 'treatment means plot, noise/temp, gender=2';
  plot mnroc*noise=temp;
run;
PROC glm DATA=miceroc;
  title '23.1 three factor ANOVA, mice roc';
  class gender temp noise;
  model roc = gender | temp | noise;
  means gender | temp | noise;
  output out=micerocout p=pred r=resid;
RUN;
proc print;
  var gender temp noise roc pred resid;
run;
QUIT;

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*Attendance 5, 23.2 three factor ANOVA I;
data miceroc;
  do gender = 1 to 2;
    do temp = 1 to 4;
      do noise = 1 to 3;
        do case = 1 to 2;
          input roc @;
                                output;
          end;
        end;
      end;
    end;
  end;
datalines;
10.3 7.2 9.1 5.4 6.1 2.1
1.8 9.8 12.1 4.2 5.1 6.2
1.2 8.1 6.5 4.1 1.2 2.1
12.4 15.1 16.1 17.2 18.1 19.1
9.3 6.2 8.1 5.4 8.1 7.1
2.8 9.8 10.1 4.2 5.1 6.2
4.2 5.1 7.5 4.1 6.2 7.1
5.4 5.1 11.1 12.2 8.1 9.1
;
PROC glm DATA=miceroc;
  title '23.1 three factor ANOVA, mice roc';
  class gender temp noise;
  model roc = gender | temp | noise;
RUN;
QUIT;
```

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*Attendance 5, 23.3 three factor ANOVA I, residuals;
data miceroc;
  do gender = 1 to 2;
    do temp = 1 to 4;
      do noise = 1 to 3;
        do case = 1 to 2;
          input roc @;
          output;
        end;
      end;
    end;
  end;
end;
datalines;
10.3 7.2 9.1 5.4 6.1 2.1
1.8 9.8 12.1 4.2 5.1 6.2
1.2 8.1 6.5 4.1 1.2 2.1
12.4 15.1 16.1 17.2 18.1 19.1
9.3 6.2 8.1 5.4 8.1 7.1
2.8 9.8 10.1 4.2 5.1 6.2
4.2 5.1 7.5 4.1 6.2 7.1
5.4 5.1 11.1 12.2 8.1 9.1
;
PROC glm DATA=miceroc;
  title '23.1 three factor ANOVA, mice roc';
  class gender temp noise;
  model roc = gender | temp | noise;
  OUTPUT out=micerocout P=PRED R=RESID;
RUN;
proc gplot data=micerocout;
  title '23.3 residuals vs gender';
  plot resid*gender;
run;
proc gplot data=micerocout;
  title '23.3 residuals vs temp';
  plot resid*temp;
run;
proc gplot data=micerocout;
  title '23.3 residuals vs noise';
  plot resid*noise;
run;
proc gplot data=micerocout;
  title '23.3 residuals vs predicted';
  plot resid*pred;
run;
proc capability data=micerocout noprint graphics;
  title '23.3 normal probability plot for residuals';
  probplot resid;
run;
QUIT;

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```
*Attendance 5, 23.4 three factor ANOVA I, residuals;
data miceroc;
  do gender = 1 to 2;
    do temp = 1 to 4;
      do noise = 1 to 3;
        do case = 1 to 2;
          input roc @;
          output;
        end;
      end;
    end;
  end;
datalines;
10.3 7.2 9.1 5.4 6.1 2.1
1.8 9.8 12.1 4.2 5.1 6.2
1.2 8.1 6.5 4.1 1.2 2.1
12.4 15.1 16.1 17.2 18.1 19.1
9.3 6.2 8.1 5.4 8.1 7.1
2.8 9.8 10.1 4.2 5.1 6.2
4.2 5.1 7.5 4.1 6.2 7.1
5.4 5.1 11.1 12.2 8.1 9.1
;
PROC glm DATA=miceroc;
  title '23.1 three factor ANOVA, mice roc';
  class gender temp noise;
  model roc = gender | temp | noise;
  means gender | temp | noise;
RUN;
QUIT;
```

```
*HOMEWORK 3, 23.4 THREE FACTOR ANOVA I;
data general;
    do i = 1 to 3;
        do k = 1 to 2;
            do j = 1 to 2;
                input response @;
                                output;
            end;
        end;
    end;
datalines;
130 138 140 144
126 130 134 136
122 125 122 131
;
proc glm data=general;
    title 'three factor ANOVA I effects';
    class i j k;
    model response = i | j | k;
    means i | j | k;
    output out=generalout p=pred r=resid;
run;
proc print;
    var i j k response pred resid;
run;
QUIT;
```

```

*HOMEWORK 4, 23.6 THREE FACTOR ANOVA I, CASE HARDENING;
DATA HARDENING;
  INPUT HARDNESS AGENT $ TEMP $ TIME $;
DATALINES;
39.9 1 1 1 1
32.2 1 1 1 2
36.3 1 1 1 3
56 1 1 2 1
56.9 1 1 2 2
56.6 1 1 2 3
53.5 1 2 1 1
50.7 1 2 1 2
52.8 1 2 1 3
70.9 1 2 2 1
73.3 1 2 2 2
71.6 1 2 2 3
45.2 2 1 1 1
48 2 1 1 2
47.5 2 1 1 3
69.4 2 1 2 1
66.6 2 1 2 2
68.8 2 1 2 3
63.3 2 2 1 1
65.5 2 2 1 2
63.6 2 2 1 3
82.9 2 2 2 1
85.2 2 2 2 2
82.3 2 2 2 3
;
PROC GLM DATA=HARDENING noprint;
  TITLE '23.6 three factor ANOVA I';
  CLASS AGENT TEMP TIME;
  MODEL HARDNESS = AGENT | TEMP | TIME;
  OUTPUT out=hardeningout P=PRED R=RESID;
RUN;
PROC PRINT;
  TITLE '23.6(a) case hardening residuals';
  VAR AGENT TEMP TIME HARDNESS PRED RESID;
RUN;
proc gplot data=hardeningout;
  title '23.6(a) agent vs residuals';
  plot agent*resid;
run;
proc gplot data=hardeningout;
  title '23.6(a) temp vs residuals';
  plot temp*resid;
run;
proc gplot data=hardeningout;
  title '23.6(a) time vs residuals';
  plot time*resid;
run;
proc gplot data=hardeningout;
  title '23.6(a) residuals vs predicted';
  plot resid*pred;
run;
proc capability data=hardeningout noprint graphics;
  title '23.6(b) normal probability plot for residuals';
  probplot resid;
run;
QUIT;

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*HOMEWORK 4, 23.7 THREE FACTOR ANOVA I, CASE HARDENING;
DATA HARDENING;
  INPUT HARDNESS AGENT $ TEMP $ TIME $ case;
DATALINES;
39.9 1 1 1 1
32.2 1 1 1 2
36.3 1 1 1 3
56 1 1 2 1
56.9 1 1 2 2
56.6 1 1 2 3
53.5 1 2 1 1
50.7 1 2 1 2
52.8 1 2 1 3
70.9 1 2 2 1
73.3 1 2 2 2
71.6 1 2 2 3
45.2 2 1 1 1
48 2 1 1 2
47.5 2 1 1 3
69.4 2 1 2 1
66.6 2 1 2 2
68.8 2 1 2 3
63.3 2 2 1 1
65.5 2 2 1 2
63.6 2 2 1 3
82.9 2 2 2 1
85.2 2 2 2 2
82.3 2 2 2 3
;
data hardeningk1;
  set hardening;
  if time=1;
run;
data hardeningk2;
  set hardening;
  if time=2;
run;
proc means data=hardeningk1;
  title '23.7(a), treatment means plot, time=1';
  var hardness;
  by agent temp;
  output out=hardeningagentk1 mean=mnagent;
run;
proc gplot data=hardeningagentk1;
  title '23.7(a), treatment means plot, time=1';
  plot mnagent*agent=temp;
run;
proc means data=hardeningk2;
  title '23.7(a), treatment means plot, time=2';
  var hardness;
  by agent temp;
  output out=hardeningagentk2 mean=mnagent;
run;
proc gplot data=hardeningagentk2;
  title '23.7(a), treatment means plot, time=2';
  plot mnagent*agent=temp;
run;
PROC GLM DATA=HARDENING;
  TITLE '23.7(b,c,d,e) three factor ANOVA I';
  CLASS AGENT TEMP TIME;
  MODEL HARDNESS = AGENT | TEMP | TIME;
  OUTPUT out=hardeningout P=PRED R=RESID;
RUN;
QUIT;

```



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*HOMEWORK 4, 23.8 THREE FACTOR ANOVA I, CASE HARDENING;
DATA CASEHARDENING;
    INPUT HARDNESS AGENT $ TEMPERATURE $ TIME $;
DATALINES;
39.9 1 1 1 1
32.2 1 1 1 2
36.3 1 1 1 3
56 1 1 2 1
56.9 1 1 2 2
56.6 1 1 2 3
53.5 1 2 1 1
50.7 1 2 1 2
52.8 1 2 1 3
70.9 1 2 2 1
73.3 1 2 2 2
71.6 1 2 2 3
45.2 2 1 1 1
48 2 1 1 2
47.5 2 1 1 3
69.4 2 1 2 1
66.6 2 1 2 2
68.8 2 1 2 3
63.3 2 2 1 1
65.5 2 2 1 2
63.6 2 2 1 3
82.9 2 2 2 1
85.2 2 2 2 2
82.3 2 2 2 3
;
PROC GLM DATA=CASEHARDENING;
    TITLE '23.8 three factor ANOVA I';
    CLASS AGENT TEMPERATURE TIME;
    MODEL HARDNESS = AGENT | TEMPERATURE | TIME;
    means agent;
    ESTIMATE 'CHEMICAL2 - CHEMICAL1' AGENT -1 1;
    ESTIMATE 'TEMPERATURE2 - TEMPERATURE1' TEMPERATURE -1 1;
    ESTIMATE 'TIME2 - TIME1' TIME -1 1;
RUN;
QUIT;

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