

Bijesh Mishra

STAT 5023 Statistics for Experimenters II

SAS Assignment #1

SAS CODE:

*** Filename: STAT 5023: Assignment 1.sas ***

TITLE 'STAT 5023: Assignment 1';

DM 'LOG; CLEAR; ODSRESULTS; CLEAR;';

OPTIONS LS = 80 PAGENO = 1;

DATA metal;

INPUT supplier tenstren @@;

CARDS;

1 21.1 1 24.6 1 26.2 1 22.9

2 27.3 2 30.3 2 24.2 2 29.9

3 31.8 3 30.0 3 21.9 3 25.1

4 26.9 4 26.9 4 12.7 4 15.5

5 8.08 5 18.9 5 31.4 5 27.1

;

* PROC PRINT DATA = metal;

TITLE 'ANOVA, HOVS (LEVENE AND BARTLETT), MEANS, STANDARD DEVIATIONS, PLOTS';

PROC GLM DATA = metal ALPHA = 0.02 PLOTS = (BOXPLOT RESIDUALS DIAGNOSTICS);

CLASS supplier;

MODEL tenstren = supplier;

MEANS supplier / HOVTEST = LEVENE (TYPE = ABS)HOVTEST = BARTLETT ALPHA = 0.02;

PROC MIXED DATA = metal PLOTS = RESIDUALPANEL;

CLASS supplier;

MODEL tenstren = supplier /DDFM = SATTERTH;

```

REPEATED / GROUP = supplier;

LSMEANS supplier;

TITLE MIXED Procedure When the Variances are Unequal;

;

RUN;

QUIT;

```

SAS Assignment II

```

SAS CODE:

DM 'LOG; CLEAR; ODSRESULTS; CLEAR; ';
DATA sas2; INPUT coating wear @@;
LABEL coating ='Layers of Coating' wear='Wear';
DATALINES;
0 21.0434 1 17.0270 2 13.2604 3 13.2798 4 13.9394
0 23.7164 1 15.1824 2 16.0983 3 14.6028 4 09.0165
0 26.3993 1 16.1865 2 15.1277 3 12.7176 4 15.5906
0 25.5745 1 15.2647 2 14.3230 3 11.7969 4 11.2414
0 23.2901 1 14.7997 2 14.5364 3 10.6507 4 10.0621
0 26.6883 1 16.0777 2 16.0863 3 14.3297 4 10.4367
0 24.8230 1 14.5333 2 13.7632 3 09.4774 4 13.6440
;
TITLE "ANOVA, Control Vs Rest, Tukey Comparison, Trend Analysis, CI: 0.02";
PROC GLM DATA = sas2 PLOTS = NONE;
CLASS coating;
MODEL wear = coating;
/* Simultaneous Contrast: Method 1.1: SS != SSH0*/
CONTRAST '1 = 2' coating 0 1 -1 0 0;
CONTRAST '1 + 2 = 2*3' coating 0 1 0 -1 0;
CONTRAST '1 + 2 + 3 = 3*4' coating 0 1 0 0 -1;
/* Simultaneous Contrast: Method 1.2 (~ Method 1.1)*/
CONTRAST 'M1.2: 1 = 2 = 3 = 4 ' coating 0 1 -1 0 0,
coating 0 1 0 -1 0,
coating 0 1 0 0 -1;

/* Simultaneous Contrast: Method 2.1: SS = SSH0*/
CONTRAST '1 = 2' coating 0 1 -1 0 0;
CONTRAST '1 + 2 = 2*3' coating 0 1 1 -2 0;
CONTRAST '1 + 2 + 3 = 3*4' coating 0 1 1 1 -3;
/* Simultaneous Contrast: Method 2.2 (~ Method 2.1)*/
CONTRAST ' M2.2: 1 = 2 = 3 = 4 ' coating 0 1 -1 0 0,
coating 0 1 1 -2 0,
coating 0 1 1 1 -3;
TITLE3 'Simultaneous Contrast: Single Test, mean difference, Non Control
Trts';
RUN; QUIT;
PROC GLM DATA = sas2 PLOTS = (BOXPLOT);
CLASS coating;
MODEL wear = coating;
/* Tukey Comparison of the Means */

```

```

MEANS coating / ALPHA = 0.02 LINES TUKEY CLDIFF;
/* Trend Values from Book Page 740. t = 5 */
CONTRAST "Linear Trend (x1)"          coating      -2 -1 0 1 2;
CONTRAST "Quadratic Trend (x2)"       coating      2 -1 -2 -1 2;
CONTRAST "Cubic Trend (x3)"          coating      -1 2 0 -2 1;
CONTRAST "Quartic Trend/LoF (x4)"     coating      1 -4 6 -4 1;
LSMEANS coating /STDERR;
TITLE3 ' Tukey Comparison of Mean and Trend Analysis'; RUN; QUIT;
PROC GPLOT DATA = sas2;
PLOT wear*coating / VAXIS = 8 12 16 20 24 28 HAXIS = 0 1 2 3 4;
SYMBOL1 VALUE = # CV = RED I = NONE;
TITLE2 ' Trend Analysis Using GPLOT'; RUN; QUIT;

PROC SGPLOT DATA = sas2;
SCATTER Y = wear X = coating;
TITLE2 "SGPLOT option for Statistical Graphing"; RUN; QUIT;

```

SAS LOG:

```

747 DM 'LOG; CLEAR; ODSRESULTS; CLEAR; ';
748 DATA sas2; INPUT coating wear @@;
749 LABEL coating ='Layers of Coating' wear='Wear';
750 DATALINES;

```

NOTE: SAS went to a new line when INPUT statement reached past the end of a line.

NOTE: The data set WORK.SAS2 has 35 observations and 2 variables.

NOTE: DATA statement used (Total process time):

```

      real time      0.01 seconds
      cpu time       0.01 seconds

```

```

758 ;
759 TITLE "ANOVA, Control Vs Rest, Tukey Comparison, Trend Analysis, CI: 0.02";
760 PROC GLM DATA = sas2 PLOTS = NONE;
761 CLASS coating;
762 MODEL wear = coating;
763 /* Simultaneous Contrast: Method 1.1: SS != SSH0*/
764 CONTRAST '1 = 2'          coating 0 1 -1 0 0;
765 CONTRAST '1 + 2 = 2*3'    coating 0 1 0 -1 0;
766 CONTRAST '1 + 2 + 3 = 3*4' coating 0 1 0 0 -1;
767 /* Simultaneous Contrast: Method 1.2 (~ Method 1.1)*/
768 CONTRAST 'M1.2: 1 = 2 = 3 = 4 ' coating 0 1 -1 0 0,
769          coating 0 1 0 -1 0,
770          coating 0 1 0 0 -1;
771
772 /* Simultaneous Contrast: Method 2.1: SS = SSH0*/
773 CONTRAST '1 = 2'          coating 0 1 -1 0 0;
774 CONTRAST '1 + 2 = 2*3'    coating 0 1 1 -2 0;
775 CONTRAST '1 + 2 + 3 = 3*4' coating 0 1 1 1 -3;
776 /* Simultaneous Contrast: Method 2.2 (~ Method 2.1)*/
777 CONTRAST 'M2.2: 1 = 2 = 3 = 4 ' coating 0 1 -1 0 0,
778          coating 0 1 1 -2 0,
779          coating 0 1 1 1 -3;
780 TITLE3 'Simultaneous Contrast: Single Test, mean difference, Non Control Trts';
781 RUN;

```

NOTE: Writing HTML Body file: sashtml15.htm

```
781! QUIT;
```

NOTE: PROCEDURE GLM used (Total process time):

```

      real time      1.08 seconds
      cpu time       0.45 seconds

```

```

782 PROC GLM DATA = sas2 PLOTS = (BOXPLOT);
783 CLASS coating;
784 MODEL wear = coating;
785 /* Tukey Comparison of the Means */
786 MEANS coating / ALPHA = 0.02 LINES TUKEY CLDIFF;
787 /* Trend Values from Book Page 740. t = 5 */
788 CONTRAST "Linear Trend (x1)"      coating  -2 -1 0 1 2;
789 CONTRAST "Quadratic Trend (x2)"   coating   2 -1 -2 -1 2;
790 CONTRAST "Cubic Trend (x3)"       coating  -1 2 0 -2 1;
791 CONTRAST "Quartic Trend/LoF (x4)" coating   1 -4 6 -4 1;
792 LSMEANS coating /STDERR;
793 TITLE3 ' Tukey Comparison of Mean and Trend Analysis'; RUN;

```

```

793!                               QUIT;

```

NOTE: PROCEDURE GLM used (Total process time):

```

    real time      2.27 seconds
    cpu time       0.87 seconds

```

```

794 PROC GPLOT DATA = sas2;
795 PLOT wear*coating / VAXIS = 8 12 16 20 24 28 HAXIS = 0 1 2 3 4;
796 SYMBOL1 VALUE = # CV = RED I = NONE;
797 TITLE2 ' Trend Analysis Using Gplot'; RUN;

```

NOTE: 18542 bytes written to C:\Users\bmishra\AppData\Local\Temp\SAS Temporary
Files_TD93932_NREM-9HTXG02_gplot15.png.

```

797!                               QUIT;

```

NOTE: There were 35 observations read from the data set WORK.SAS2.

NOTE: PROCEDURE Gplot used (Total process time):

```

    real time      0.30 seconds
    cpu time       0.14 seconds

```

```

798
799 PROC SGplot DATA = sas2;
800 SCATTER Y = wear X = coating;
801 TITLE2 "SGplot option for Statistical Graphing"; RUN;

```

```

801!                               QUIT;

```

NOTE: PROCEDURE SGplot used (Total process time):

```

    real time      0.55 seconds
    cpu time       0.04 seconds

```

NOTE: There were 35 observations read from the data set WORK.SAS2.

Complete SAS Code:

```

DM 'LOG; CLEAR; ODSRESULTS; CLEAR; ';
DATA sas2; INPUT coating wear @@;
LABEL coating ='Layers of Coating' wear='Wear';
DATALINES;
0 21.0434 1 17.0270 2 13.2604 3 13.2798 4 13.9394
0 23.7164 1 15.1824 2 16.0983 3 14.6028 4 09.0165
0 26.3993 1 16.1865 2 15.1277 3 12.7176 4 15.5906
0 25.5745 1 15.2647 2 14.3230 3 11.7969 4 11.2414
0 23.2901 1 14.7997 2 14.5364 3 10.6507 4 10.0621
0 26.6883 1 16.0777 2 16.0863 3 14.3297 4 10.4367
0 24.8230 1 14.5333 2 13.7632 3 09.4774 4 13.6440
;
TITLE "ANOVA, Tukey Comparison, Trend Analysis: Control Vs Rest, CI: 0.02";

```

```

PROC PRINT DATA = sas2;
TITLE2 'Data Set';

PROC GLM DATA = sas2 PLOTS = NONE;
CLASS coating;
MODEL wear = coating;
/* Single Test of differences of non-zero layer coating */
/* Simultaneous Contrast: Method 1.1: SS != SSH0*/
CONTRAST '1 = 2' coating 0 1 -1 0 0;
CONTRAST '1 + 2 = 2*3' coating 0 1 0 -1 0;
CONTRAST '1 + 2 + 3 = 3*4' coating 0 1 0 0 -1;
/* Simultaneous Contrast: Method 1.2 (~ Method 1.1)*/
CONTRAST 'M1.2: 1 = 2 = 3 = 4 ' coating 0 1 -1 0 0,
coating 0 1 0 -1 0,
coating 0 1 0 0 -1;

/* Simultaneous Contrast: Method 2.1: SS = SSH0*/
CONTRAST '1 = 2' coating 0 1 -1 0 0;
CONTRAST '1 + 2 = 2*3' coating 0 1 1 -2 0;
CONTRAST '1 + 2 + 3 = 3*4' coating 0 1 1 1 -3;
/* Simultaneous Contrast: Method 2.2 (~ Method 2.1)*/
CONTRAST ' M2.2: 1 = 2 = 3 = 4 ' coating 0 1 -1 0 0,
coating 0 1 1 -2 0,
coating 0 1 1 1 -3;

TITLE3 'Simultaneous Contrast: Single Test, mean difference, Non Control
Trts'; RUN; QUIT;

PROC GLM DATA = sas2 PLOTS = (RESIDUALS DIAGNOSTICS RESIDUALS);
CLASS coating;
MODEL wear = coating;
/* Tukey Comparison of the Means */
LSMEANS coating / STDERR ADJUST = TUKEY LINES ALPHA = 0.02;
MEANS coating / HOVTEST = LEVENE (TYPE = ABS) HOVTEST = BARTLETT ALPHA =
0.02 LINES LSD SCHEFFÉ TUKEY CLM CLDIFF;
TITLE2 'Mean Statements, Tukey Comparison, HOV Tests';

/* Trend Values from Book Page 740. t = 5 */
CONTRAST "Linear Trend (x1)" coating -2 -1 0 1 2;
CONTRAST "Quadratic Trend (x2)" coating 2 -1 -2 -1 2;
CONTRAST "Cubic Trend (x3)" coating -1 2 0 -2 1;
CONTRAST "Quartic Trend/LoF (x4)" coating 1 -4 6 -4 1;
LSMEANS coating / STDERR;
TITLE2 'Trend Analysis using Various Degree Trend'; RUN; QUIT;

PROC GPLOT DATA = sas2;
PLOT wear*coating / VAXIS = 8 12 16 20 24 28 HAXIS = 0 1 2 3 4;
SYMBOL1 VALUE = # CV = RED I = NONE;
TITLE2 ' Trend Analysis Using GPLOT'; RUN; QUIT;

PROC SGLOT DATA = sas2;
SCATTER Y = wear X = coating;
TITLE2 "SGPLOT option for Statistical Graphing"; RUN; QUIT;

```

```

DM 'LOG; CLEAR; ODSRESULTS; CLEAR; ';
DATA sas3;
INPUT center program gender $ subject wtloss @@;
DATALINES;
1 1 F 1 17.2299 5 1 F 1 11.6695 1 1 F 2 15.7648 5 1 F 2 12.1876
1 2 F 1 19.2342 5 2 F 1 11.6978 1 2 F 2 18.0468 5 2 F 2 10.0957
1 3 F 1 9.1973 5 3 F 1 7.4432 1 3 F 2 8.6906 5 3 F 2 5.9384
1 1 M 1 17.4656 5 1 M 1 10.9597 1 1 M 2 15.9233 5 1 M 2 11.2989
1 2 M 1 24.2613 5 2 M 1 18.3452 1 2 M 2 25.3422 5 2 M 2 18.1953
1 3 M 1 19.6999 5 3 M 1 17.3051 1 3 M 2 18.3468 5 3 M 2 17.2238
2 1 F 1 14.9102 6 1 F 1 16.4390 2 1 F 2 15.5265 6 1 F 2 16.9725
2 2 F 1 24.5785 6 2 F 1 26.3404 2 2 F 2 22.9297 6 2 F 2 25.6193
2 3 F 1 21.4465 6 3 F 1 23.5122 2 3 F 2 19.4496 6 3 F 2 20.7551
2 1 M 1 17.7488 6 1 M 1 19.4338 2 1 M 2 18.6772 6 1 M 2 16.2848
2 2 M 1 18.6206 6 2 M 1 19.9519 2 2 M 2 19.6741 6 2 M 2 22.5633
2 3 M 1 16.2433 6 3 M 1 17.4446 2 3 M 2 16.9580 6 3 M 2 19.0843
3 1 F 1 9.4561 7 1 F 1 10.1201 3 1 F 2 10.0818 7 1 F 2 10.9801
3 2 F 1 19.9627 7 2 F 1 15.4252 3 2 F 2 21.6687 7 2 F 2 14.9049
3 3 F 1 20.5674 7 3 F 1 16.3866 3 3 F 2 20.1926 7 3 F 2 17.3304
3 1 M 1 14.5206 7 1 M 1 13.9226 3 1 M 2 15.4205 7 1 M 2 14.7064
3 2 M 1 16.1217 7 2 M 1 25.6431 3 2 M 2 16.7883 7 2 M 2 25.9734
3 3 M 1 11.7393 7 3 M 1 20.9447 3 3 M 2 11.8407 7 3 M 2 21.4765
4 1 F 1 18.4680 8 1 F 1 11.4767 4 1 F 2 17.8540 8 1 F 2 12.4374
4 2 F 1 25.7911 8 2 F 1 34.4723 4 2 F 2 24.0275 8 2 F 2 34.6249
4 3 F 1 15.1685 8 3 F 1 20.8010 4 3 F 2 16.4565 8 3 F 2 20.3882
4 1 M 1 15.0173 8 1 M 1 25.4748 4 1 M 2 15.0015 8 1 M 2 25.3372
4 2 M 1 23.0530 8 2 M 1 25.1632 4 2 M 2 23.3327 8 2 M 2 25.9337
4 3 M 1 20.8105 8 3 M 1 19.9659 4 3 M 2 20.9137 8 3 M 2 20.9266
;
/* USING MIXED PROCEDURE METHOD =TYPE3 PRODUCES EXPECTED MEAN SQUARES */
TITLE3 "USING METHOD = TYPE3 PRODUCES EXPECTED MEAN SQUARES";
PROC MIXED DATA = sas3 METHOD = TYPE3; /* TYPE3 = Method of Moments */
CLASS center program gender subject; /* All Treatments */
MODEL wtloss = program | gender | subject ; /* Only Fixed Effects; DDFM = KR
*/
RANDOM center center*program center*gender center*subject; /* Random
Statement */
LSMEANS program / PDIF CL ALPHA = 0.01; /* Default ADJUST is F-LSD */
RUN; QUIT;

/* USING MIXED PROCEDURE, REML METHOD */
TITLE3 "USING MIXED PROCEDURE, METHOD = REML";
PROC MIXED DATA = sas3 METHOD = REML PLOT = RESIDUALPANEL; /* DEFAULT METHOD
IS REML */
CLASS center program gender subject; /* All Treatments */
MODEL wtloss = program | gender | subject / DDFM = SATTERTH; /* Only Fixed
Effects; DDFM = KR */
RANDOM center center*program center*gender center*subject; /* Random
Component */
LSMEANS program / PDIF CL ALPHA = 0.01; /* Default ADJUST is F-LSD */
RUN; QUIT;

```

