**Bijesh Mishra**

STAT 5023 Statistics for Experimenters II

SAS Assignment #1

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| 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

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| 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. |

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

SAS Assignment III

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| 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 / PDIFF 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 / PDIFF CL ALPHA = **0.01**; /\* Default ADJUST is F-LSD \*/  **RUN**; **QUIT**; |