

STAT 362 HMWK 13

PROBLEM 7.11

SAS PROGRAM

```

***Problem 7-11;
***a;
DATA PROB7_11;
    DO GROUP = 'A', 'B', 'C';
        INPUT M_SCORE AGE @;
        OUTPUT;
    END;
DATALINES;
90 16 92 18 97 18
88 15 88 13 92 17
72 12 76 12 88 16
82 14 78 14 92 17
65 12 90 17 99 17
74 13 68 12 82 14
;
PROC ANOVA DATA=PROB7_11;
    CLASS GROUP;
    MODEL M_SCORE AGE = GROUP;
    MEANS GROUP / SNK;
RUN;
***b;
PROC GLM DATA=PROB7_11;
    TITLE "Testing Assumption of Homogeneity of Slope";
    CLASS GROUP;
    MODEL M_SCORE = AGE GROUP AGE*GROUP;
RUN;

/* Interaction term not significant. OK to do analysis of covariance */

***c;
PROC GLM DATA=PROB7_11;
    TITLE "Analysis of Covariance";
    CLASS GROUP;
    MODEL M_SCORE = AGE GROUP;
    LSMEANS GROUP / PDIFF;
RUN;

/*****
    In the unadjusted analysis, the groups are significantly different
    (p = .0479) and the ages are nearly significant (p = .0559). The null
    hypothesis that the slopes are equal among the three groups is not rejected
    (AGE*GROUP interaction p = .1790). Adjusting for age, the group differences
    on math scores disappears completely (p = .7606).
*****/

```

SAS LOG

```
44 DATA PROB7_11;
45     DO GROUP = 'A','B','C';
46         INPUT M_SCORE AGE @;
47         OUTPUT;
48     END;
49 DATALINES;
```

NOTE: The data set WORK.PROB7_11 has 18 observations and 3 variables.

NOTE: DATA statement used (Total process time):

| | |
|-----------|--------------|
| real time | 0.03 seconds |
| cpu time | 0.03 seconds |

```
56 ;
57 PROC ANOVA DATA=PROB7_11;
58     CLASS GROUP;
59     MODEL M_SCORE AGE = GROUP;
60     MEANS GROUP / SNK;
61 RUN;
```

NOTE: Writing HTML Body file: sashtml.htm

```
62 ***b;
```

NOTE: PROCEDURE ANOVA used (Total process time):

| | |
|-----------|---------------|
| real time | 14.85 seconds |
| cpu time | 0.95 seconds |

```
63 PROC GLM DATA=PROB7_11;
64     TITLE "Testing Assumption of Homogeneity of Slope";
65     CLASS GROUP;
66     MODEL M_SCORE = AGE GROUP AGE*GROUP;
67 RUN;
```

```
68
69 /* Interaction term not significant. OK to do analysis of covariance */
70
71 ***c;
```

NOTE: PROCEDURE GLM used (Total process time):

| | |
|-----------|--------------|
| real time | 0.40 seconds |
| cpu time | 0.15 seconds |

```
72 PROC GLM DATA=PROB7_11;
73     TITLE "Analysis of Covariance";
74     CLASS GROUP;
75     MODEL M_SCORE = AGE GROUP;
76     LSMEANS GROUP / PDIFF;
77 RUN;
```

```
78
79 /*****
80     In the unadjusted analysis, the groups are significantly different
81     (p = .0479) and the ages are nearly significant (p = .0559). The null hypothesis that the
81 ! slopes are equal among the three groups is not rejected (AGE*GROUP interaction p = .1790).
81 ! Adjusting for age, the group differences on math scores disappears completely (p = .7606).
82 *****/
```

SAS OUTPUT

Analysis of Covariance

The ANOVA Procedure

M_SCORE

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|----|----------------|-------------|---------|--------|
| Model | 2 | 558.111111 | 279.055556 | 3.75 | 0.0479 |
| Error | 15 | 1116.833333 | 74.455556 | | |
| Corrected Total | 17 | 1674.944444 | | | |

| R-Square | Coeff Var | Root MSE | M_SCORE Mean |
|----------|-----------|----------|--------------|
| 0.333212 | 10.26555 | 8.628763 | 84.05556 |

| Source | DF | Anova SS | Mean Square | F Value | Pr > F |
|--------|----|------------|-------------|---------|--------|
| GROUP | 2 | 558.111111 | 279.055556 | 3.75 | 0.0479 |

Testing Assumption of Homogeneity of Slope

The GLM Procedure

M_SCORE

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|----|----------------|-------------|---------|--------|
| Model | 5 | 1442.906111 | 288.581222 | 14.92 | <.0001 |
| Error | 12 | 232.038333 | 19.336528 | | |
| Corrected Total | 17 | 1674.944444 | | | |

| R-Square | Coeff Var | Root MSE | M_SCORE Mean |
|----------|-----------|----------|--------------|
| 0.861465 | 5.231459 | 4.397332 | 84.05556 |

| Source | DF | Type I SS | Mean Square | F Value | Pr > F |
|-----------|----|-------------|-------------|---------|--------|
| AGE | 1 | 1353.543771 | 1353.543771 | 70.00 | <.0001 |
| GROUP | 2 | 12.324017 | 6.162008 | 0.32 | 0.7331 |
| AGE*GROUP | 2 | 77.038323 | 38.519162 | 1.99 | 0.1790 |

| Source | DF | Type III SS | Mean Square | F Value | Pr > F |
|-----------|----|-------------|-------------|---------|--------|
| AGE | 1 | 768.8994431 | 768.8994431 | 39.76 | <.0001 |
| GROUP | 2 | 79.2386314 | 39.6193157 | 2.05 | 0.1716 |
| AGE*GROUP | 2 | 77.0383234 | 38.5191617 | 1.99 | 0.1790 |

PROBLEM 9.2

SAS PROGRAM

```
***Problem 9-1;
DATA TOMATO;
  DO LIGHT = 5,10,15;
    DO WATER = 1,2;
      DO I = 1 TO 3;
        IF LIGHT IN ('5','10','15') THEN DO;
          L_2 = (LIGHT EQ '10');
          L_3 = (LIGHT EQ '15');
        END;
        IF WATER IN ('1','2') THEN DO;
          W_1 = (WATER EQ '1');
        END;
        INPUT YIELD @;
        OUTPUT;
      END;
    END;
  END;
  DROP I;
DATALINES;
12 9 8 13 15 14 16 14 12 20 16 16 18 25 20 25 27 29
;
PROC REG DATA=TOMATO;
  TITLE "Question 9-1";
  MODEL YIELD = L_2 L_3 W_1;
RUN;
```

SAS LOG

NOTE: Copyright (c) 2002-2010 by SAS Institute Inc., Cary, NC, USA.
NOTE: SAS (r) Proprietary Software 9.3 (TS1M1)
Licensed to GEORGE MASON UNIVERSITY-SFA T&R, Site 70008900.
NOTE: This session is executing on the W32_7PRO platform.

NOTE: Updated analytical products:

SAS/STAT 9.3_M1, SAS/ETS 9.3_M1, SAS/OR 9.3_M1

NOTE: SAS initialization used:
real time 12.25 seconds
cpu time 2.06 seconds

```
1
2 ***Problem 9-1;
3 DATA TOMATO;
4   DO LIGHT = 5,10,15;
5     DO WATER = 1,2;
6       DO I = 1 TO 3;
7         IF LIGHT IN ('5','10','15') THEN DO;
8           L_2 = (LIGHT EQ '10');
9           L_3 = (LIGHT EQ '15');
10        END;
11        IF WATER IN ('1','2') THEN DO;
12          W_1 = (WATER EQ '1');
13        END;
14        INPUT YIELD @;
```

```

15          OUTPUT;
16      END;
17  END;
18  END;
19  DROP I;
20  DATALINES;

```

NOTE: Character values have been converted to numeric values at the places given by:
(Line):(Column).

```

7:16      8:32      9:32     11:16     12:32

```

NOTE: The data set WORK.TOMATO has 18 observations and 6 variables.

NOTE: DATA statement used (Total process time):
 real time 0.76 seconds
 cpu time 0.15 seconds

```

22  ;
23  PROC REG DATA=TOMATO;
NOTE: Writing HTML Body file: sashtml.htm
24      TITLE "Question 9-1";
25      MODEL YIELD = L_2 L_3 W_1;
26  RUN;

```

SAS OUTPUT

Question 9-1

The REG Procedure

Model: MODEL1

Dependent Variable: YIELD

| | |
|------------------------------------|--------|
| Number of Observations Read | 1 8 |
|------------------------------------|--------|

| | |
|------------------------------------|--------|
| Number of Observations Used | 1 8 |
|------------------------------------|--------|

| Analysis of Variance | | | | | |
|------------------------|----|----------------|-------------|---------|--------|
| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
| Model | 3 | 557.72222 | 185.90741 | 37.84 | <.0001 |
| Error | 14 | 68.77778 | 4.91270 | | |
| Corrected Total | 17 | 626.50000 | | | |

| | | | |
|-----------------------|----------|-----------------|--------|
| Root MSE | 2.21646 | R-Square | 0.8902 |
| Dependent Mean | 17.16667 | Adj R-Sq | 0.8667 |
| Coeff Var | 12.91142 | | |

Parameter Estimates

| Variable | DF | Parameter Estimate | Standard Error | t Value | Pr > t |
|------------------|-----------|---------------------------|-----------------------|----------------|--------------------|
| Intercept | 1 | 14.11111 | 1.04485 | 13.51 | <.0001 |
| L_2 | 1 | 3.83333 | 1.27967 | 3.00 | 0.0096 |
| L_3 | 1 | 12.16667 | 1.27967 | 9.51 | <.0001 |
| W_1 | 1 | -4.55556 | 1.04485 | -4.36 | 0.0007 |