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NOTE: SAS (r) 9.1 (TS1M3)

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NOTE: This session is executing on the XP_PRO platform.

NOTE: SAS initialization used:

real time	2.35 seconds
cpu time	0.82 seconds

```
1  TITLE ;
2
3
4  FOOTNOTE 'Psychology 602 SAS Example' ;
5
6
7  /*
8
9  This command file uses the LINEPRINTER option on the PROC REG command line.
10
11 This option creates low-resolution, line-printer-style plots in response
12 to the PLOT subcommand.
13
14 If you remove this option, requested plots are created on a
15 high-resolution graphics device.
16
17 The LINEPRINTER option is required if plots are requested and SAS/GRAPH
18 software has not been installed on the network or computer as a SAS
18 ! component.
19
20 */
21
22 /*
23
24 Example:
25
26 The example below represents a multi-step execution of SAS, where data are
26 ! both
27 read in during multiple DATA steps, and also created by other SAS procedures.
28
29
30 - PROC REG is employed to conduct a simple and then a multiple regression.
31 The predicted values and residuals are plotted, and saved,
32 along with the predictor and criterion values, in a new data set.
33 These variables are then passed to PROC CORR, which calculates the
34 simple correlations among them.
35
36 - PROC GLM is utilized to conduct a oneway ANOVA, with the ESTIMATE
37 subcommand used to estimate mean differences, the CONTRAST
38 subcommand used to test for mean differences and trend, and the LSMEANS
39 subcommand to estimate cell means, and conduct post hoc tests of
40 simple mean differences. These least squares means are saved to a
41 new data set, and graphed by PROC CHART, and plotted by PROC PLOT.
42
```

```

43 - PROC REG is employed to conduct a oneway ANOVA on the same data
44 PROC GLM analyzed.
45
46 - PROC GLM is used to conduct a randomized blocks ANOVA, first by
47 the 'traditional' ANOVA approach, with the effects tested through both
48 the TEST subcommand and using the residual from a main-effects-only model,
49 and then, by the multivariate approach.
50
51 - PROC GLM is utilized to conduct a twoway ANOVA, with the CONTRAST
52 subcommand used to test simple main effects, treatment-contrast interactions,
53 and contrast-contrast interactions. The LSMEANS subcomand is used in several
54 instances to calculate the cell means, test for simple mean differences among
55 these cell means, and to conduct simple main effect tests. These least
55 ! squares
56 cell means are saved to a new data set, and graphed by PROC CHART, and
56 ! plotted
57 by PROC PLOT.
58
59 - PROC GLM is employed to conduct a nested two-factor ANOVA, and the TEST
60 subcommand is used to test the fixed effect when the nested factor is a
60 ! random
61 effect.
62
63 - PROC GLM is used to conduct a split-plot factorial, first by
64 the 'traditional' mixed-model ANOVA approach, with the effects tested
65 through the TEST subcommand, and then, by the multivariate approach.
66
67 - PROC GLM is utilized to conduct a single-factor ANCOVA with a single
68 covariate.
69
70
71 This example contains a few `wrinkles` not discussed in the
72 SAS Tutorial, such as the use of the * (comment), FOOTNOTE, TITLE,
73 LABEL, and RUN commands, data transformation during the DATA step
74 using the IF, DO, and SELECT commands, and the PROC FORMAT procedure.
75
76 */
77
78
79 TITLE 'Cohen, Cohen, West, & Aiken (2003), Table 2.2.2, p. 27: Simple
79 ! Regression' ;
80
81 /*
82
83     !NOTE! that Table 2.2.2 on p. 27 contains several typographical errors:
84
85         - The (raw) sum of squares for X should be 1175
86         - The variances for X and Y should be 20.95 and 191.07, respectively
87         - The standard deviations for X and Y should be 4.58 and 13.82,
88           respectively
89
90     The variances were apparently calculated by dividing the respective
91     deviation sum of squares by 15 rather than 14. The standard deviations were
92     determined by taking the square root of the respective (uncorrected)
92 ! variances.

```

```

93
94         I cannot explain the error in the (raw) sum of squares for X.
95
96
97         iNOTE! that the variances for X and Y are also incorrect in Table 2.6.2
98 on p. 40.
99
100 */
101
102 DATA  SR ;
103
104         INPUT  X  Y ;
105
106 LABEL  Y = 'Number of Publications'
107         X = 'Number of Years since PhD' ;
108
109 DATALINES ;

```

NOTE: The data set WORK.SR has 15 observations and 2 variables.

NOTE: DATA statement used (Total process time):

```

      real time          0.03 seconds
      cpu time           0.01 seconds

```

```

125 ;
126
127 PROC REG DATA=SR CORR SIMPLE LINEPRINTER ;
128     Y_ON_X : MODEL Y = X / SS2 SCORR2 PCORR2 STB ;
129 RUN ;

130 TITLE3 'Plot of y by Observation Number' ;
131         PLOT  Y*OBS. = 'y' ;
132 RUN ;

133 TITLE3 'Plot of e by Observation Number' ;
134         PLOT  R.*OBS. = 'e' ;
135 RUN ;

136 TITLE3 'Plot of y by X' ;
137         PLOT  Y*X = '.' ;
138 RUN ;

139 TITLE3 'Plot of y by y-hat' ;
140         PLOT  Y*P. = '.' ;
141 RUN ;

142 TITLE3 'Plot of y by e' ;
143         PLOT  Y*R. = '.' ;
144 RUN ;

145 TITLE3 'Plot of y-hat by X' ;
146         PLOT  P.*X = '* ' ;
147 RUN ;

148 TITLE3 'Plot of e by X' ;

```

```
149          PLOT R.*X = '*' ;
150 RUN ;

151 TITLE3 'Plot of y-hat by e' ;
152          PLOT P.*R. = '+' ;
153 RUN ;

154          OUTPUT OUT=CORRDATA P=YHAT R=E ;
155 RUN ;

156 QUIT ;
```

NOTE: The data set WORK.CORRDATA has 15 observations and 4 variables.

NOTE: PROCEDURE REG used (Total process time):

```
real time      2.45 seconds
cpu time       0.17 seconds
```

```
157
158
159 PROC PRINT DATA=CORRDATA LABEL N ;
160 TITLE3 'Data Listing' ;
161
162 LABEL YHAT = 'Predicted Y'
163        E   = 'Error in Prediction' ;
164
165        VAR X Y YHAT E ;
166
167 RUN ;
```

NOTE: There were 15 observations read from the data set WORK.CORRDATA.

NOTE: PROCEDURE PRINT used (Total process time):

```
real time      0.01 seconds
cpu time       0.01 seconds
```

```
168
169 PROC CORR DATA=CORRDATA ;
170 TITLE3 'Simple Pearson product-moment correlations' ;
171
172 LABEL YHAT = 'Predicted Y'
173        E   = 'Error in Prediction' ;
174
175        VAR Y YHAT X E ;
176
177 RUN ;
```

NOTE: PROCEDURE CORR used (Total process time):

```
real time      0.01 seconds
cpu time       0.01 seconds
```

```
178
179
180
```

```

181 TITLE 'Cohen, Cohen, West, & Aiken (2003), Table 3.5.1, pp. 81-82: Multiple
181! Regression' ;
182
183 /*
184
185     !NOTE! that Table 3.5.1 on p. 82 contains a typographical error:
186
187     - The mean for X3 should be .44, not .56
188
189
190     !NOTE! that the data below are the same as found on the CD that
190! accompanies
191 the book, in example CH03EX02, but the variables are labeled differently in
192 this program, and are in a different column order.
193
194 */
195
196 DATA WORK ;
197
198     INPUT  X1  X2  X3  X4  Y ;
199
200 LABEL  X1 = 'Time since Ph.D.'
201        X2 = 'No. of Publications'
202        X3 = 'Sex: Female=1, Male=0'
203        X4 = 'No. of Citations'
204        Y  = 'Salary' ;
205
206 DATALINES ;

```

NOTE: The data set WORK.WORK has 62 observations and 5 variables.

NOTE: DATA statement used (Total process time):

```

real time          0.00 seconds
cpu time           0.00 seconds

```

```

269 ;
270 PROC REG DATA=WORK CORR SIMPLE LINEPRINTER ;
271     FULL_MODEL : MODEL Y = X1 X2 X3 X4 / P SS2 SCORR2 PCORR2 STB ;
272 RUN ;

273 TITLE3 'TESTs of Submodels within the Full Model' ;
274     X1_X4      : TEST X1=0, X4=0 ;
275 RUN ;

276     X2_X3      : TEST X2=0, X3=0 ;
277 RUN ;

278     X1_X4_X2   : TEST X1=0, X4=0, X2=0 ;
279 RUN ;

280     X1_X4_X3   : TEST X1=0, X4=0, X3=0 ;
281 RUN ;

282 TITLE3 'Plot of y by Observation Number' ;
283     PLOT Y*OBS. = 'y' ;

```

```

284 RUN ;

285 TITLE3 'Plot of e by Observation Number' ;
286         PLOT R.*OBS. = 'e' ;
287 RUN ;

288 TITLE3 'Plot of y by y-hat' ;
289         PLOT Y*P. = '.' ;
290 RUN ;

291 TITLE3 'Plot of y by e' ;
292         PLOT Y*R. = '.' ;
293 RUN ;

294 TITLE3 'Plot of y-hat by e' ;
295         PLOT P.*R. = '+' ;
296 RUN ;

297         OUTPUT OUT=CORRDATA P=YHAT R=E ;
298 RUN ;

299 QUIT ;

```

NOTE: The data set WORK.CORRDATA has 62 observations and 7 variables.

NOTE: PROCEDURE REG used (Total process time):

```

real time      0.35 seconds
cpu time       0.12 seconds

```

```

300
301 PROC PRINT DATA=CORRDATA LABEL N ;
302 TITLE3 'Data Listing' ;
303
304 LABEL YHAT = 'Predicted Y'
305        E   = 'Error in Prediction' ;
306
307        VAR X1 X2 X3 X4 Y YHAT E ;
308
309 RUN ;

```

NOTE: There were 62 observations read from the data set WORK.CORRDATA.

NOTE: PROCEDURE PRINT used (Total process time):

```

real time      0.00 seconds
cpu time       0.00 seconds

```

```

310
311 PROC CORR DATA=CORRDATA ;
312 TITLE3 'Simple Pearson product-moment correlations' ;
313
314 LABEL YHAT = 'Predicted Y'
315        E   = 'Error in Prediction' ;
316
317        VAR Y YHAT X1 X2 X3 X4 E ;
318

```

319 RUN ;

NOTE: PROCEDURE CORR used (Total process time):

real time 0.01 seconds
cpu time 0.01 seconds

320

321

322

323 TITLE 'Kirk (1995), p. 167: CR-4 ANOVA' ;

324

325 DATA CR4 ;

326

327 INPUT Y A ;

328

329 LABEL Y = 'Hand-Steadiness'

330 A = 'Sleep Deprivation' ;

331

332 DATALINES ;

NOTE: The data set WORK.CR4 has 32 observations and 2 variables.

NOTE: DATA statement used (Total process time):

real time 0.00 seconds
cpu time 0.00 seconds

365 ;

366

367 PROC FORMAT ;

368 VALUE FA 1 = '12 Hours'

369 2 = '18 Hours'

370 3 = '24 Hours'

371 4 = '30 Hours' ;

NOTE: Format FA has been output.

372 RUN ;

NOTE: PROCEDURE FORMAT used (Total process time):

real time 0.06 seconds
cpu time 0.01 seconds

373

374 PROC GLM DATA=CR4 ORDER=INTERNAL ;

375 FORMAT A FA. ;

376 CLASS A ;

377 MODEL Y = A / SS3 ;

378

379 * Orthogonal polynomial coding defines the set of contrasts:

380 ;

381 CONTRAST '(1) A Main Effect' A -3 -1 1 3 ,

382 A 1 -1 -1 1 ,

383 A -1 3 -3 1 ;

384

385 * Nonsense coding defines the set of contrasts:

```

386 ;
387     CONTRAST  '(2) A Main Effect'      A   10  -3  -7   0 ,
388                                     A    0   0  -9   9 ,
389                                     A   -4  -4  -4  12 ;
390
391     ESTIMATE   'A[1] v. A[2]'           A    1  -1   0   0 ;
392     ESTIMATE   'A[3] v. A[4]'           A    0   0   1  -1 ;
393     ESTIMATE   '(A[1]+A[2])/2 v. (A[3]+A[4])/2'  A   .5  .5  -.5  -.5 ;
394
395     ESTIMATE   'Linear'                  A   -3  -1   1   3 /
395! DIVISOR=20 ;
396     ESTIMATE   'Quadratic'              A    1  -1  -1   1 /
396! DIVISOR=4 ;
397     ESTIMATE   'Cubic'                  A   -1   3  -3   1 /
397! DIVISOR=20 ;
398
399     CONTRAST   'Linear'                  A   -3  -1   1   3 ;
400     CONTRAST   'Quadratic'              A    1  -1  -1   1 ;
401     CONTRAST   'Cubic'                  A   -1   3  -3   1 ;
402     CONTRAST   'Deviations'            A    1  -1  -1   1 ,
403                                     A   -1   3  -3   1 ;
404
405     LSMEANS   A / ADJUST=BON      ALPHA=.05  CL  STDERR  TDIFF
405! ;
406     LSMEANS   A / ADJUST=SCHEFFE  ALPHA=.05  CL  STDERR  TDIFF  OUT=AMEANS
406! ;
407
408     OUTPUT    OUT=CORRDATA  P=YHAT  R=E ;
409
410 RUN ;

411 QUIT ;

```

NOTE: The data set WORK.AMEANS has 4 observations and 4 variables.

NOTE: The data set WORK.CORRDATA has 32 observations and 4 variables.

NOTE: PROCEDURE GLM used (Total process time):

```

real time      0.12 seconds
cpu time       0.04 seconds

```

```

412
413 PROC PRINT  DATA=CORRDATA  LABEL  N ;
414 TITLE3  'Data Listing' ;
415
416 LABEL  YHAT = 'Predicted Y'
417        E    = 'Error in Prediction' ;
418
419        VAR  A Y YHAT E ;
420
421 RUN ;

```

NOTE: There were 32 observations read from the data set WORK.CORRDATA.

NOTE: PROCEDURE PRINT used (Total process time):

```

real time      0.00 seconds
cpu time       0.00 seconds

```

```
422
423 PROC PLOT DATA=CORRDATA ;
424 TITLE3 'Bivariate Plots' ;
425
426 LABEL YHAT = 'Predicted Y'
427        E   = 'Error in Prediction' ;
428
429        PLOT Y*YHAT = 'P' ;
430        PLOT Y*E   = 'E' ;
431        PLOT YHAT*E = '*' ;
432
433 RUN ;
```

434

NOTE: There were 32 observations read from the data set WORK.CORRDATA.

NOTE: PROCEDURE PLOT used (Total process time):

```
real time          0.00 seconds
cpu time           0.00 seconds
```

```
435 PROC CORR DATA=CORRDATA ;
436 TITLE3 'Simple Pearson product-moment correlations' ;
437
438 LABEL YHAT = 'Predicted Y'
439        E   = 'Error in Prediction' ;
440
441        VAR Y YHAT E ;
442
443 RUN ;
```

NOTE: PROCEDURE CORR used (Total process time):

```
real time          0.00 seconds
cpu time           0.00 seconds
```

```
444
445 PROC PRINT DATA=AMEANS LABEL NOOBS ;
446 TITLE3 'Listing of AMEANS Dataset' ;
447 FORMAT A FA. ;
448
449 LABEL LSMEAN = 'Mean of Y' ;
450
451        VAR A LSMEAN ;
452
453 RUN ;
```

NOTE: There were 4 observations read from the data set WORK.AMEANS.

NOTE: PROCEDURE PRINT used (Total process time):

```
real time          0.01 seconds
cpu time           0.01 seconds
```

```

454
455 PROC CHART DATA=AMEANS ;
456 TITLE3 'Bar Graph of A-effect Means' ;
457 FORMAT A FA. ;
458
459 LABEL LSMEAN = 'Y' ;
460
461 HBAR A / DISCRETE TYPE=MEAN SUMVAR=LSMEAN MEAN REF=4.25 ;
462
463 RUN ;

```

NOTE: PROCEDURE CHART used (Total process time):

```

real time          0.01 seconds
cpu time           0.01 seconds

```

```

464
465 PROC PLOT DATA=AMEANS ;
466 TITLE3 'Plot of A-effect Means' ;
467 FORMAT A FA. ;
468
469 LABEL LSMEAN = 'Mean of Y' ;
470
471 PLOT LSMEAN*A='*' ;
472
473 RUN ;

```

```

474
475
476
477 TITLE 'Kirk (1995), p. 230: CR-4 ANOVA, regression approach' ;

```

NOTE: There were 4 observations read from the data set WORK.AMEANS.

NOTE: PROCEDURE PLOT used (Total process time):

```

real time          0.00 seconds
cpu time           0.00 seconds

```

```

478 DATA AV4 ;
479 SET CR4 ;
480
481 * Use effect coding to define the predictor variables X1--X3:
482 ;
483 SELECT (A) ;
484 WHEN (1) DO ;
485 X1 = 1 ; X2 = 0 ; X3 = 0 ;
486 END ;
487 WHEN (2) DO ;
488 X1 = 0 ; X2 = 1 ; X3 = 0 ;
489 END ;
490 WHEN (3) DO ;
491 X1 = 0 ; X2 = 0 ; X3 = 1 ;
492 END ;
493 WHEN (4) DO ;
494 X1 = -1 ; X2 = -1 ; X3 = -1 ;

```

```
495                               END ;
496     END ;
497
```

NOTE: There were 32 observations read from the data set WORK.CR4.

NOTE: The data set WORK.AV4 has 32 observations and 5 variables.

NOTE: DATA statement used (Total process time):

```
    real time          0.01 seconds
    cpu time           0.01 seconds
```

```
498 PROC PRINT  DATA=AV4  LABEL  N ;
499 TITLE3  'Data Listing' ;
500 VAR  Y A X1 X2 X3 ;
501 RUN ;
```

NOTE: There were 32 observations read from the data set WORK.AV4.

NOTE: PROCEDURE PRINT used (Total process time):

```
    real time          0.01 seconds
    cpu time           0.01 seconds
```

```
502
503 PROC REG  DATA=AV4  CORR  SIMPLE ;
504     A_MODEL : MODEL  Y = X1 X2 X3 / SS2  SCORR2  PCORR2  P ;
505     A_TEST  : TEST   X1 = 0, X2 = 0, X3 = 0 ;
506 RUN ;
507 QUIT ;
```

NOTE: PROCEDURE REG used (Total process time):

```
    real time          0.15 seconds
    cpu time           0.04 seconds
```

```
508
509
510 TITLE  'Kirk (1995), p. 260:  RB-4 ANOVA' ;
511
512 DATA  RB4 ;
513
514     INPUT  Y  A  PI ;
515
516 LABEL  Y = 'Dependent Variable'
517     A = 'Treatment'
518     PI = 'Subject' ;
519
520 DATALINES ;
```

NOTE: The data set WORK.RB4 has 32 observations and 3 variables.

NOTE: DATA statement used (Total process time):

```
    real time          0.01 seconds
    cpu time           0.00 seconds
```

```
553 ;
554
555 PROC FORMAT ;
556     VALUE  FA  1 = '1st Level'
557             2 = '2nd Level'
558             3 = '3rd Level'
559             4 = '4th Level' ;
NOTE: Format FA is already on the library.
NOTE: Format FA has been output.
560 RUN ;
```

```
NOTE: PROCEDURE FORMAT used (Total process time):
      real time          0.00 seconds
      cpu time           0.00 seconds
```

```
561
562 PROC PRINT  DATA=RB4 ;
563 TITLE3  'Data Listing' ;
564 RUN ;
```

```
NOTE: There were 32 observations read from the data set WORK.RB4.
NOTE: PROCEDURE PRINT used (Total process time):
      real time          0.00 seconds
      cpu time           0.00 seconds
```

```
565
566 PROC GLM  DATA=RB4  ORDER=INTERNAL ;
567 TITLE3  'A*PI Interaction Effect Included in the Model' ;
568 FORMAT  A  FA. ;
569     CLASS  A  PI ;
570     MODEL  Y  =  A  PI  A*PI  /  SS3  P ;
571     TEST  H=A  E=A*PI ;
572     LSMEANS  A  /  ADJUST=BON  ALPHA=.05  CL  E=A*PI  STDERR  TDIFF ;
573 RUN ;
```

```
574 QUIT ;
```

```
NOTE: PROCEDURE GLM used (Total process time):
      real time          0.06 seconds
      cpu time           0.06 seconds
```

```
575
576 PROC GLM  DATA=RB4  ORDER=INTERNAL ;
577 TITLE3  'A*PI Interaction Effect Excluded from the Model' ;
578 FORMAT  A  FA. ;
579     CLASS  A  PI ;
580     MODEL  Y  =  A  PI  /  SS3  P ;
581     LSMEANS  A  /  ADJUST=BON  ALPHA=.05  CL          STDERR  TDIFF
581! OUT=AMEANS ;
582     OUTPUT  OUT=CORRDATA  P=YHAT  R=E ;
583 RUN ;
```

584 QUIT ;

NOTE: The data set WORK.AMEANS has 4 observations and 4 variables.

NOTE: The data set WORK.CORRDATA has 32 observations and 5 variables.

NOTE: PROCEDURE GLM used (Total process time):

real time	0.14 seconds
cpu time	0.07 seconds

585

586 PROC PRINT DATA=CORRDATA ;

587 TITLE3 'Data listing' ;

588

589 LABEL YHAT = 'Predicted Y'

590 E = 'Error in Prediction' ;

591

592 VAR A Y YHAT E ;

593

594 RUN ;

NOTE: There were 32 observations read from the data set WORK.CORRDATA.

NOTE: PROCEDURE PRINT used (Total process time):

real time	0.01 seconds
cpu time	0.01 seconds

595

596 PROC CORR DATA=CORRDATA ;

597 TITLE3 'Simple Pearson product-moment correlations' ;

598

599 LABEL YHAT = 'Predicted Y'

600 E = 'Error in Prediction' ;

601

602 VAR Y YHAT E ;

603

604 RUN ;

NOTE: PROCEDURE CORR used (Total process time):

real time	0.01 seconds
cpu time	0.01 seconds

605

606 PROC PRINT DATA=AMEANS ;

607 TITLE3 'Listing of MEANS dataset' ;

608 FORMAT A FA. ;

609

610 LABEL LSMEAN = 'Mean of Y' ;

611

612 VAR A LSMEAN ;

613

614 RUN ;

NOTE: There were 4 observations read from the data set WORK.AMEANS.

NOTE: PROCEDURE PRINT used (Total process time):

```
real time          0.01 seconds
cpu time           0.01 seconds
```

```
615
616 PROC PLOT DATA=AMEANS ;
617 TITLE3 'Plot of A means' ;
618 FORMAT A FA. ;
619
620 LABEL LSMEAN = 'Y' ;
621
622 PLOT LSMEAN*A = '*' ;
623
624 RUN ;
```

625

NOTE: There were 4 observations read from the data set WORK.AMEANS.

NOTE: PROCEDURE PLOT used (Total process time):

```
real time          0.01 seconds
cpu time           0.01 seconds
```

```
626 PROC CHART DATA=AMEANS ;
627 TITLE3 'Bar Graph of A-effect Means' ;
628 FORMAT A FA. ;
629
630 LABEL LSMEAN = 'Y' ;
631
632 VBAR A / DISCRETE TYPE=MEAN SUMVAR=LSMEAN MIDPOINTS = 1 2 3 4
632! REF=4.25 ;
633
634 RUN ;
```

NOTE: PROCEDURE CHART used (Total process time):

```
real time          0.01 seconds
cpu time           0.01 seconds
```

635

636

```
637 DATA REPEAT (KEEP = Y1 Y2 Y3 Y4) ;
```

638

```
639 * This DATA step reads the RB4 dataset, which has the observations of each
640 subject on a separate line, and creates a new dataset, named REPEAT,
641 which has the observations of each subject on a single line.
```

642

```
643 See the PROC PRINT listing to see exactly how the REPEAT file is
644 structured.
```

```
645 ;
```

```
646 ARRAY Y1234(4) Y1 Y2 Y3 Y4 ;
```

647

```
648 DO I = 1 TO 4 ;
```

649

```
650 SET RB4 ;
```

```
651
652     Y1234(I) = Y ;
653
654     END ;
655
656     OUTPUT ;
657
658 RUN ;
```

NOTE: There were 32 observations read from the data set WORK.RB4.
NOTE: The data set WORK.REPEAT has 8 observations and 4 variables.
NOTE: DATA statement used (Total process time):
 real time 0.01 seconds
 cpu time 0.01 seconds

```
659
660 PROC PRINT DATA=REPEAT ;
661 TITLE3 'Data listing' ;
662     VAR Y1 Y2 Y3 Y4 ;
663 RUN ;
```

NOTE: There were 8 observations read from the data set WORK.REPEAT.
NOTE: PROCEDURE PRINT used (Total process time):
 real time 0.01 seconds
 cpu time 0.01 seconds

```
664
665 PROC GLM DATA=REPEAT ORDER=INTERNAL ;
666 TITLE3 'MANOVA Approach through the REPEATED subcommand' ;
667     MODEL Y1 Y2 Y3 Y4 = / NOUNI SS3 ;
668     REPEATED A 4 / ;
669 RUN ;

670 QUIT ;
```

NOTE: PROCEDURE GLM used (Total process time):
 real time 0.06 seconds
 cpu time 0.01 seconds

```
671
672
673
674 TITLE 'Kirk (1995), p. 325: LS-4 ANOVA' ;
675
676 DATA LS4 ;
677
678     INPUT Y A B C ;
679
680 LABEL Y = 'Thickness of Tread' ;
681 LABEL A = 'Rubber Compounds' ;
682 LABEL B = 'Wheel Position' ;
683 LABEL C = 'Cars' ;
```

684
685 DATALINES ;

NOTE: The data set WORK.LS4 has 32 observations and 4 variables.

NOTE: DATA statement used (Total process time):

real time 0.00 seconds
cpu time 0.00 seconds

718 ;
719
720 PROC FORMAT ;
721 VALUE FA 1 = 'Compound #1'
722 2 = 'Compound #2'
723 3 = 'Compound #3'
724 4 = 'Compound #4' ;

NOTE: Format FA is already on the library.

NOTE: Format FA has been output.

725 RUN ;

NOTE: PROCEDURE FORMAT used (Total process time):

real time 0.00 seconds
cpu time 0.00 seconds

726
727 PROC PRINT DATA=LS4 ;
728 TITLE3 'Data Listing' ;
729 RUN ;

NOTE: There were 32 observations read from the data set WORK.LS4.

NOTE: PROCEDURE PRINT used (Total process time):

real time 0.00 seconds
cpu time 0.00 seconds

730
731 PROC GLM DATA=LS4 ;
732 TITLE3 'Residual Effect Excluded' ;
733 FORMAT A FA. ;
734 CLASS A B C ;
735 MODEL Y = A B C / SS3 P ;
736 RUN ;

737 QUIT ;

NOTE: PROCEDURE GLM used (Total process time):

real time 0.07 seconds
cpu time 0.04 seconds

738
739 PROC GLM DATA=LS4 ;
740 TITLE4 'Residual Effect Included as the A*B*C effect' ;
741 FORMAT A FA. ;

```
742     CLASS A B C ;
743     MODEL Y = A B C A*B*C / SS3 P ;
744     LSMEANS A / ADJUST=BON ALPHA=.05 CL STDERR TDIFF OUT=AMEANS ;
745     OUTPUT OUT=CORRDATA P=YHAT R=E ;
746 RUN ;

747 QUIT ;
```

NOTE: The data set WORK.AMEANS has 4 observations and 4 variables.

NOTE: The data set WORK.CORRDATA has 32 observations and 6 variables.

NOTE: PROCEDURE GLM used (Total process time):

real time	0.09 seconds
cpu time	0.07 seconds

```
748
749
750 PROC PRINT DATA=CORRDATA ;
751 TITLE3 'Data listing' ;
752     VAR A B C Y YHAT E ;
753 RUN ;
```

NOTE: There were 32 observations read from the data set WORK.CORRDATA.

NOTE: PROCEDURE PRINT used (Total process time):

real time	0.00 seconds
cpu time	0.00 seconds

```
754
755 PROC CORR DATA=CORRDATA ;
756 TITLE3 'Simple Pearson product-moment correlations' ;
757
758 LABEL YHAT = 'Predicted Y'
759     E     = 'Error in Prediction' ;
760
761     VAR Y YHAT E ;
762
763 RUN ;
```

NOTE: PROCEDURE CORR used (Total process time):

real time	0.01 seconds
cpu time	0.01 seconds

```
764
765 PROC PRINT DATA=AMEANS ;
766 TITLE3 'Listing of AMEANS dataset' ;
767 FORMAT A FA. ;
768
769 LABEL LSMEAN = 'Mean of Y' ;
770
771     VAR A LSMEAN ;
772
773 RUN ;
```

NOTE: There were 4 observations read from the data set WORK.AMEANS.

NOTE: PROCEDURE PRINT used (Total process time):

real time	0.00 seconds
cpu time	0.00 seconds

774

```
775 PROC PLOT DATA=AMEANS ;
776 TITLE3 'Plot of A Effect means' ;
777 FORMAT A FA. ;
778
779 LABEL LSMEAN = 'Mean of Y' ;
780
781 PLOT LSMEAN*A = '*' ;
782
783 RUN ;
```

784

NOTE: There were 4 observations read from the data set WORK.AMEANS.

NOTE: PROCEDURE PLOT used (Total process time):

real time	0.00 seconds
cpu time	0.00 seconds

```
785 PROC CHART DATA=AMEANS ;
786 TITLE3 'Bar Chart of A-effect Means' ;
787 FORMAT A FA. ;
788
789 LABEL LSMEAN = 'Y' ;
790
791 HBAR A / DISCRETE TYPE=MEAN SUMVAR=LSMEAN MEAN REF=5.375 ;
792
793 RUN ;
```

NOTE: PROCEDURE CHART used (Total process time):

real time	0.00 seconds
cpu time	0.00 seconds

794

795

796

```
797 TITLE 'Kirk (1995), p. 369: CRF-33 ANOVA' ;
798
799 DATA CRF33 ;
800
801 INPUT Y A B ;
802
803 LABEL Y = 'Attitude towards Minority Groups'
804 A = 'Type of Beat'
805 B = 'Length of Training Course' ;
806
807 DATALINES ;
```

NOTE: The data set WORK.CRF33 has 45 observations and 3 variables.

NOTE: DATA statement used (Total process time):

```
real time          0.00 seconds
cpu time           0.00 seconds
```

```
853 ;
854
855 PROC FORMAT ;
856     VALUE  FA  1 = 'Upperclass Beat'
857             2 = 'Middleclass Beat'
858             3 = 'Innercity Beat' ;
```

NOTE: Format FA is already on the library.

NOTE: Format FA has been output.

```
859     VALUE  FB  1 = '5 hrs. Training'
860             2 = '10 hrs. Training'
861             3 = '15 hrs. Training' ;
```

NOTE: Format FB has been output.

```
862 RUN ;
```

NOTE: PROCEDURE FORMAT used (Total process time):

```
real time          0.00 seconds
cpu time           0.00 seconds
```

```
863
864 PROC PRINT DATA=CRF33 LABEL N ;
865 TITLE3 'Data Listing' ;
866 FORMAT A FA. ;
867 FORMAT B FB. ;
868
869     VAR  Y A B ;
870
871 RUN ;
```

NOTE: There were 45 observations read from the data set WORK.CRF33.

NOTE: PROCEDURE PRINT used (Total process time):

```
real time          0.01 seconds
cpu time           0.00 seconds
```

```
872
873 PROC GLM DATA=CRF33 ORDER=INTERNAL ;
874 TITLE3 'A fixed, B fixed' ;
875 FORMAT A FA. ;
876 FORMAT B FB. ;
877     CLASS A B ;
878     MODEL Y = A B A*B / SS3 ;
879     CONTRAST 'A within B[1]'      A    1  0 -1
880                                     A*B  1  0  0  0  0  0 -1  0  0 ,
881                                     A    1 -2  1
882                                     A*B  1  0  0 -2  0  0  1  0  0 ;
883     CONTRAST 'B within A[3]'      B    1  1 -2
884                                     A*B  0  0  0  0  0  0  1  1 -2 ,
885                                     B    1 -1  0
```

```

886             A*B 0 0 0 0 0 0 1 -1 0 ;
887
888 * Where A = [ 1 -1 0 , .5 .5 -1] and B{1} = [ 1 -1 0] (see p. 385),
889 then Kronecker product A @ B{1} defines the contrast:
890 ;
891     CONTRAST 'Psi[1(B)]'           A*B 1 -1 0 -1 1 0 0 0 0 ,
892                                     A*B .5 -.5 0 .5 -.5 0 -1 1 0 ;
893
894 * Where A{2} = [ .5 .5 -1] and B{3} = [ 0 1 -1] (see p. 385),
895 then Kronecker product A{2} @ B{3} defines the contrast:
896 ;
897     CONTRAST 'Psi[2(A)]Psi[3(B)]' A*B 0 .5 -.5 0 .5 -.5 0 -1 1 ;
898
899     LSMEANS A /
899! OUT=AMEANS ;
900     LSMEANS B /
900! OUT=BMEANS ;
901     LSMEANS A*B / ADJUST=SCHEFFE ALPHA=.0166667 CL STDERR TDIFF
901! OUT=ABMEANS ;
902     LSMEANS A*B /
902! SLICE=A ;
903     LSMEANS A*B /
903! SLICE=B ;
904 RUN ;

905 TITLE3 'A fixed, B random: Test of the A main effect' ;
906     TEST H=A E=A*B ;
907 RUN ;

908 TITLE3 'A random, B fixed: Test of the B main effect' ;
909     TEST H=B E=A*B ;
910 RUN ;

911 TITLE3 'A random, B random: Test of the A and B main effects' ;
912     TEST H=A E=A*B ;
913     TEST H=B E=A*B ;
914 RUN ;

915 QUIT ;

NOTE: The data set WORK.AMEANS has 3 observations and 4 variables.
NOTE: The data set WORK.BMEANS has 3 observations and 4 variables.
NOTE: The data set WORK.ABMEANS has 9 observations and 5 variables.
NOTE: PROCEDURE GLM used (Total process time):
      real time          0.20 seconds
      cpu time           0.11 seconds

916
917 PROC PRINT DATA=AMEANS LABEL NOOBS ;
918 TITLE3 'Listing of AMEANS Dataset' ;
919 FORMAT A FA. ;
920
921 LABEL LSMEAN = 'Mean of Y' ;
922

```

```
923     VAR A LSMEAN ;
924
925 RUN ;
```

NOTE: There were 3 observations read from the data set WORK.AMEANS.

NOTE: PROCEDURE PRINT used (Total process time):

```
    real time          0.00 seconds
    cpu time           0.00 seconds
```

```
926
927 PROC CHART DATA=AMEANS ;
928 TITLE3 'Bar Graph of A main-effect Means' ;
929 FORMAT A FA. ;
930 LABEL LSMEAN = 'Y' ;
931     HBAR A / TYPE=MEAN SUMVAR=LSMEAN MIDPOINTS = 1 2 3 MEAN REF=35 ;
932 RUN ;
```

NOTE: PROCEDURE CHART used (Total process time):

```
    real time          0.00 seconds
    cpu time           0.00 seconds
```

```
933
934 PROC PRINT DATA=BMEANS LABEL NOOBS ;
935 TITLE3 'Listing of BMEANS Dataset' ;
936 FORMAT B FB. ;
937
938 LABEL LSMEAN = 'Mean of Y' ;
939
940     VAR B LSMEAN ;
941
942 RUN ;
```

NOTE: There were 3 observations read from the data set WORK.BMEANS.

NOTE: PROCEDURE PRINT used (Total process time):

```
    real time          0.00 seconds
    cpu time           0.00 seconds
```

```
943
944 PROC CHART DATA=ABMEANS ;
945 TITLE3 'Bar Graph of B main-effect Means' ;
946 FORMAT B FB. ;
947 LABEL LSMEAN = 'Y' ;
948     VBAR B / TYPE=MEAN SUMVAR=LSMEAN MIDPOINTS = 1 2 3 REF=35 ;
949 RUN ;
```

NOTE: PROCEDURE CHART used (Total process time):

```
    real time          0.00 seconds
    cpu time           0.00 seconds
```

```
950
951 PROC PRINT DATA=ABMEANS LABEL NOOBS ;
```

```
952 TITLE3 'Listing of ABMEANS Dataset' ;
953 FORMAT A FA. ;
954 FORMAT B FB. ;
955
956 LABEL LSMEAN = 'Mean of Y' ;
957
958     VAR A B LSMEAN ;
959
960 RUN ;
```

NOTE: There were 9 observations read from the data set WORK.ABMEANS.

NOTE: PROCEDURE PRINT used (Total process time):

```
real time          0.00 seconds
cpu time           0.00 seconds
```

```
961 PROC CHART DATA=ABMEANS ;
962 TITLE3 'Bar Graph of Means for A*B Effect' ;
963 FORMAT B FB. ;
964
965 LABEL LSMEAN = 'Y' ;
966
967     VBAR B / GROUP=A DISCRETE TYPE=MEAN SUMVAR=LSMEAN REF=35 ;
968
969 RUN ;
```

NOTE: PROCEDURE CHART used (Total process time):

```
real time          0.00 seconds
cpu time           0.00 seconds
```

```
970
971 PROC PLOT DATA=ABMEANS ;
972 TITLE3 'Plot of A*B Cell Means' ;
973 FORMAT A FA. ;
974 FORMAT B FB. ;
975
976 LABEL LSMEAN = 'Mean of Y' ;
977
978     PLOT LSMEAN*B=A ;
979
980 RUN ;
```

```
981
982
983
984 TITLE 'Kirk (1995), p. 480: CRH-28(A) ANOVA' ;
985
```

NOTE: There were 9 observations read from the data set WORK.ABMEANS.

NOTE: PROCEDURE PLOT used (Total process time):

```
real time          0.01 seconds
cpu time           0.01 seconds
```

```
986 DATA CRH28 ;
987
988     INPUT  Y A B ;
989
990 LABEL  Y = 'Activity Level'
991     A = 'Ionization Condition'
992     B = 'Cages' ;
993
994 DATALINES ;
```

NOTE: The data set WORK.CRH28 has 32 observations and 3 variables.

NOTE: DATA statement used (Total process time):

```
real time          0.01 seconds
cpu time           0.01 seconds
```

```
1027 ;
1028
1029 PROC FORMAT ;
1030     VALUE  FA  1 = 'Positive Ions'
1031           2 = 'Negative Ions' ;
```

NOTE: Format FA is already on the library.

NOTE: Format FA has been output.

```
1032     VALUE  FB  1 = 'Cage 1'
1033           2 = 'Cage 2'
1034           3 = 'Cage 3'
1035           4 = 'Cage 4'
1036           5 = 'Cage 5'
1037           6 = 'Cage 6'
1038           7 = 'Cage 7'
1039           8 = 'Cage 8' ;
```

NOTE: Format FB is already on the library.

NOTE: Format FB has been output.

```
1040 RUN ;
```

NOTE: PROCEDURE FORMAT used (Total process time):

```
real time          0.01 seconds
cpu time           0.01 seconds
```

```
1041
1042 PROC PRINT  DATA=CRH28 LABEL N ;
1043     VAR  Y A B ;
1044 RUN ;
```

NOTE: There were 32 observations read from the data set WORK.CRH28.

NOTE: PROCEDURE PRINT used (Total process time):

```
real time          0.00 seconds
cpu time           0.00 seconds
```

```
1045
1046 PROC GLM  DATA=CRH28 ORDER=INTERNAL ;
1047 TITLE3 'A fixed, B(A) fixed' ;
1048 FORMAT  A FA. ;
```

```

1049 FORMAT B FB. ;
1050 CLASS A B ;
1051 MODEL Y = A B(A) / SS3 ;
1052 RUN ;

1053 TITLE3 'A fixed, B(A) random: Test of the A main effect' ;
1054 TEST H=A E=B(A) ;
1055 RUN ;

1056 QUIT ;

```

```

NOTE: PROCEDURE GLM used (Total process time):
      real time          0.07 seconds
      cpu time           0.01 seconds

```

```

1057
1058
1059 TITLE 'Kirk (1995), p. 516: SPF-2.4: Split-Plot Factorial' ;
1060
1061 DATA SPF24 (KEEP = Y A SUBJECT B)
1062 REPEAT (KEEP = Y1 Y2 Y3 Y4 A) ;
1063
1064 * Data are read in with the observations for each subject on a single
1064! line,
1065 together with information regarding the level of the A effect, and then
1066 two separate datasets are created at the same time: REPEAT, which is
1067 structured in the same manner as the input data, and SPF24, which has
1067! each
1068 observation for each subject on a separate line, together with
1068! information
1069 on the A effect, the B effect, and the SUBJECT number.
1070
1071 This is the opposite way the data were read for the RB-4 example,
1071! above.
1072 ;
1073 INPUT Y1 Y2 Y3 Y4 A ;
1074
1075 OUTPUT REPEAT ;
1076
1077 SUBJECT + 1 ;
1078
1079 ARRAY DV(4) Y1--Y4 ;
1080
1081 DO B = 1 TO 4 ;
1082 Y = DV(B) ;
1083 OUTPUT SPF24 ;
1084 END ;
1085
1086 LABEL Y1 = 'Response Latency @ B[1]'
1087 Y2 = 'Response Latency @ B[2]'
1088 Y3 = 'Response Latency @ B[3]'
1089 Y4 = 'Response Latency @ B[4]' ;
1090
1091 LABEL Y = 'Response Latency'

```

```
1092      A = 'Signal Presentation Mode'
1093      B = 'Monitoring Period' ;
1094
1095 DATALINES ;
```

NOTE: The data set WORK.SPF24 has 32 observations and 4 variables.

NOTE: The data set WORK.REPEAT has 8 observations and 5 variables.

NOTE: DATA statement used (Total process time):

```
real time      0.01 seconds
cpu time       0.00 seconds
```

```
1104 ;
1105
1106 PROC FORMAT ;
1107     VALUE  FA  1 = 'Auditory Signal'
1108             2 = 'Visual Signal'  ;
```

NOTE: Format FA is already on the library.

NOTE: Format FA has been output.

```
1109     VALUE  FB  1 = '1 Hour'
1110             2 = '2 Hours'
1111             3 = '3 Hours'
1112             4 = '4 Hours'  ;
```

NOTE: Format FB is already on the library.

NOTE: Format FB has been output.

```
1113 RUN ;
```

NOTE: PROCEDURE FORMAT used (Total process time):

```
real time      0.01 seconds
cpu time       0.01 seconds
```

```
1114
1115 PROC PRINT  DATA=SPF24 LABEL N ;
1116 TITLE3    'SPF-2.4 Data Listing' ;
1117 FORMAT    A  FA. ;
1118 FORMAT    B  FB. ;
1119
1120     VAR  Y  A  SUBJECT  B ;
1121
1122 RUN ;
```

NOTE: There were 32 observations read from the data set WORK.SPF24.

NOTE: PROCEDURE PRINT used (Total process time):

```
real time      0.01 seconds
cpu time       0.01 seconds
```

```
1123
1124 PROC GLM  DATA=SPF24 ORDER=INTERNAL ;
1125 TITLE3    'A fixed, B fixed' ;
1126 FORMAT    A  FA. ;
1127 FORMAT    B  FB. ;
1128     CLASS  A SUBJECT B ;
1129     MODEL  Y = A SUBJECT(A) B A*B B*SUBJECT(A) /  SS3  ;
```

```
1130 TEST H=A E=SUBJECT(A) ;
1131 TEST H=B E=B*SUBJECT(A) ;
1132 TEST H=A*B E=B*SUBJECT(A) ;
1133 LSMEANS A*B / ADJUST=BON ALPHA=.0166667 CL E=B*SUBJECT(A) STDERR
1133! TDIFF ;
1134 RUN ;

1135 QUIT ;
```

NOTE: PROCEDURE GLM used (Total process time):

```
real time      0.09 seconds
cpu time       0.04 seconds
```

```
1136
1137 PROC PRINT DATA=REPEAT LABEL N ;
1138 TITLE3 'REPEAT Data Listing' ;
1139 VAR Y1 Y2 Y3 Y4 A ;
1140 RUN ;
```

NOTE: There were 8 observations read from the data set WORK.REPEAT.

NOTE: PROCEDURE PRINT used (Total process time):

```
real time      0.00 seconds
cpu time       0.00 seconds
```

```
1141
1142 PROC GLM DATA=REPEAT ORDER=INTERNAL ;
1143 TITLE3 'MANOVA Approach through the REPEATED subcommand' ;
1144 FORMAT A FA. ;
1145 CLASS A ;
1146 MODEL Y1 Y2 Y3 Y4 = A / NOUNI SS3 ;
1147 REPEATED B 4 ;
1148 RUN ;

1149 QUIT ;
```

NOTE: PROCEDURE GLM used (Total process time):

```
real time      0.09 seconds
cpu time       0.03 seconds
```

```
1150
1151
1152
1153 TITLE 'Kirk (1995), p. 720: CRAC-4 ANOVA' ;
1154
1155 /*
1156 !NOTE! that Table 15.3-2 on p. 721 contains what Kirk terms the
1156! "adjusted
1157 sums of squares", and therefore the SS produced by PROC GLM do not
1157! agree
1158 with the SS in the Table. However, the Type III F value for the "A"
1158! effect
1159 does match the F value for "Between groups, Aadj (teaching groups)".
```

```
1160 */
1161
1162 DATA CRAC4 ;
1163
1164     INPUT  Y  X  A ;
1165
1166 LABEL  Y = 'Arithmetic Achievement'
1167       X = 'Intelligence'
1168       A = 'Teaching Method' ;
1169
1170 DATALINES ;
```

NOTE: The data set WORK.CRAC4 has 32 observations and 3 variables.

NOTE: DATA statement used (Total process time):

```
real time          0.00 seconds
cpu time           0.00 seconds
```

```
1203 ;
1204
1205 PROC FORMAT ;
1206     VALUE  FA  1 = 'A[1]'
1207             2 = 'A[2]'
1208             3 = 'A[3]'
1209             4 = 'A[4]';
```

NOTE: Format FA is already on the library.

NOTE: Format FA has been output.

```
1210 RUN ;
```

NOTE: PROCEDURE FORMAT used (Total process time):

```
real time          0.00 seconds
cpu time           0.00 seconds
```

```
1211
1212 PROC GLM  DATA=CRAC4  ORDER=INTERNAL ;
1213 FORMAT  A  FA. ;
1214     CLASS  A ;
1215     MODEL  Y = X  A  /  SS1  SS3  SOLUTION ;
1216
1217     LSMEANS  A  /  ADJUST=BON  ALPHA=.05  CL  STDERR  TDIFF  OUT=AMEANS ;
1218
1219     OUTPUT  OUT=CORRDATA  P=YHAT  R=E ;
1220 RUN ;

1221 QUIT ;
```

NOTE: The data set WORK.AMEANS has 4 observations and 4 variables.

NOTE: The data set WORK.CORRDATA has 32 observations and 5 variables.

NOTE: PROCEDURE GLM used (Total process time):

```
real time          0.09 seconds
cpu time           0.06 seconds
```

```
1222
```

```
1223 PROC PRINT DATA=CORRDATA LABEL N ;
1224 TITLE3 'Data Listing' ;
1225
1226 LABEL YHAT = 'Predicted Y'
1227         E   = 'Error in Prediction' ;
1228
1229         VAR  A Y YHAT E ;
1230
1231 RUN ;
```

NOTE: There were 32 observations read from the data set WORK.CORRDATA.

NOTE: PROCEDURE PRINT used (Total process time):

```
real time          0.00 seconds
cpu time           0.00 seconds
```

```
1232
1233 PROC PLOT DATA=CORRDATA ;
1234 TITLE3 'Bivariate Plots' ;
1235
1236 LABEL YHAT = 'Predicted Y'
1237         E   = 'Error in Prediction' ;
1238
1239         PLOT Y*YHAT = 'P' ;
1240         PLOT Y*E   = 'E' ;
1241         PLOT YHAT*E = '*' ;
1242
1243 RUN ;
```

1244

NOTE: There were 32 observations read from the data set WORK.CORRDATA.

NOTE: PROCEDURE PLOT used (Total process time):

```
real time          0.01 seconds
cpu time           0.01 seconds
```

```
1245 PROC CORR DATA=CORRDATA ;
1246 TITLE3 'Simple Pearson product-moment correlations' ;
1247
1248 LABEL YHAT = 'Predicted Y'
1249         E   = 'Error in Prediction' ;
1250
1251         VAR  Y YHAT E ;
1252
1253 RUN ;
```

NOTE: PROCEDURE CORR used (Total process time):

```
real time          0.01 seconds
cpu time           0.01 seconds
```

```
1254
1255 PROC PRINT DATA=AMEANS LABEL NOOBS ;
1256 TITLE3 'Listing of AMEANS Dataset' ;
```

```
1257 FORMAT A FA. ;
1258
1259 LABEL LSMEAN = 'Mean of Y' ;
1260
1261 VAR A LSMEAN ;
1262
1263 RUN ;
```

NOTE: There were 4 observations read from the data set WORK.AMEANS.

NOTE: PROCEDURE PRINT used (Total process time):

```
real time          0.01 seconds
cpu time           0.01 seconds
```

```
1264
1265 PROC CHART DATA=AMEANS ;
1266 TITLE3 'Bar Graph of A-effect Adjusted Means' ;
1267 FORMAT A FA. ;
1268
1269 LABEL LSMEAN = 'Y' ;
1270
1271 HBAR A / DISCRETE TYPE=MEAN SUMVAR=LSMEAN MEAN REF=5.375 ;
1272
1273 RUN ;
```

NOTE: PROCEDURE CHART used (Total process time):

```
real time          0.01 seconds
cpu time           0.01 seconds
```

```
1274
1275 PROC PLOT DATA=AMEANS ;
1276 TITLE3 'Plot of A-effect Adjusted Means' ;
1277 FORMAT A FA. ;
1278
1279 LABEL LSMEAN = 'Mean of Y' ;
1280
1281 PLOT LSMEAN*A='*';
1282
1283 RUN ;
```

```
1284
1285 QUIT ;
```

NOTE: There were 4 observations read from the data set WORK.AMEANS.

NOTE: PROCEDURE PLOT used (Total process time):

```
real time          0.01 seconds
cpu time           0.01 seconds
```

The REG Procedure

Number of Observations Read	15
Number of Observations Used	15

Descriptive Statistics

Variable	Sum	Mean	Uncorrected SS	Variance	Standard Deviation
Intercept	15.00000	1.00000	15.00000	0	0
X	115.00000	7.66667	1175.00000	20.95238	4.57738
Y	299.00000	19.93333	8635.00000	191.06667	13.82269

Descriptive Statistics

Variable	Label
Intercept	Intercept
X	Number of Years since PhD
Y	Number of Publications

Correlation

Variable	Label	X	Y
X	Number of Years since PhD	1.0000	0.6567
Y	Number of Publications	0.6567	1.0000

The REG Procedure
 Model: Y_ON_X
 Dependent Variable: Y Number of Publications

Number of Observations Read 15
 Number of Observations Used 15

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	1153.41856	1153.41856	9.85	0.0078
Error	13	1521.51477	117.03960		
Corrected Total	14	2674.93333			

Root MSE 10.81848 R-Square 0.4312
 Dependent Mean 19.93333 Adj R-Sq 0.3874
 Coeff Var 54.27333

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value
Intercept	Intercept	1	4.73068	5.59061	0.85
X	Number of Years since PhD	1	1.98295	0.63166	3.14

Parameter Estimates

Variable	Label	DF	Pr > t	Type II SS	Standardized Estimate
Intercept	Intercept	1	0.4128	83.80353	0
X	Number of Years since PhD	1	0.0078	1153.41856	0.65665

Parameter Estimates

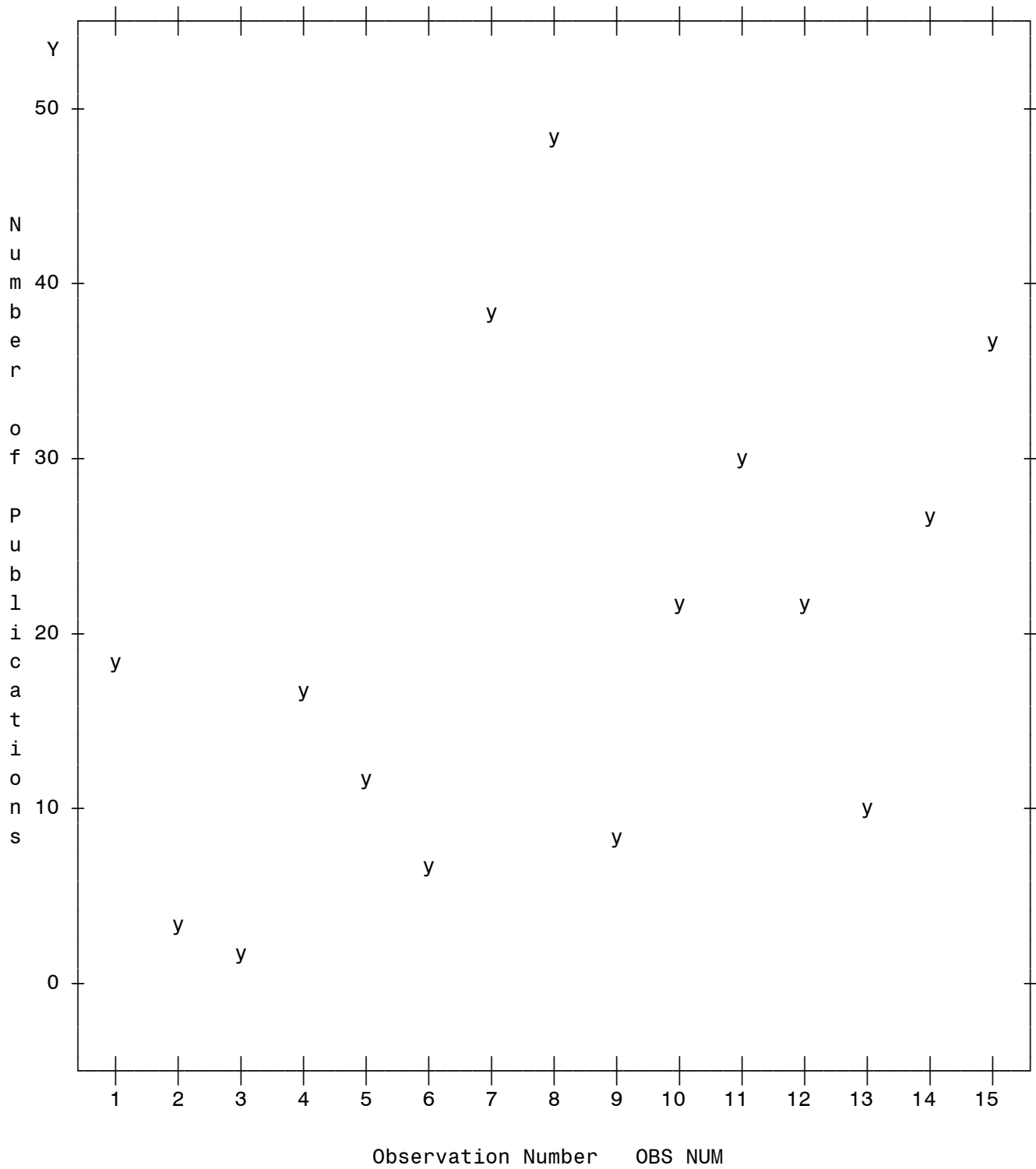
Variable	Label	DF	Squared Semi-partial Corr Type II	Squared Partial Corr Type II
Intercept	Intercept	1	.	.
X	Number of Years since PhD	1	0.43120	0.43120

Plot of y by Observation Number

The REG Procedure

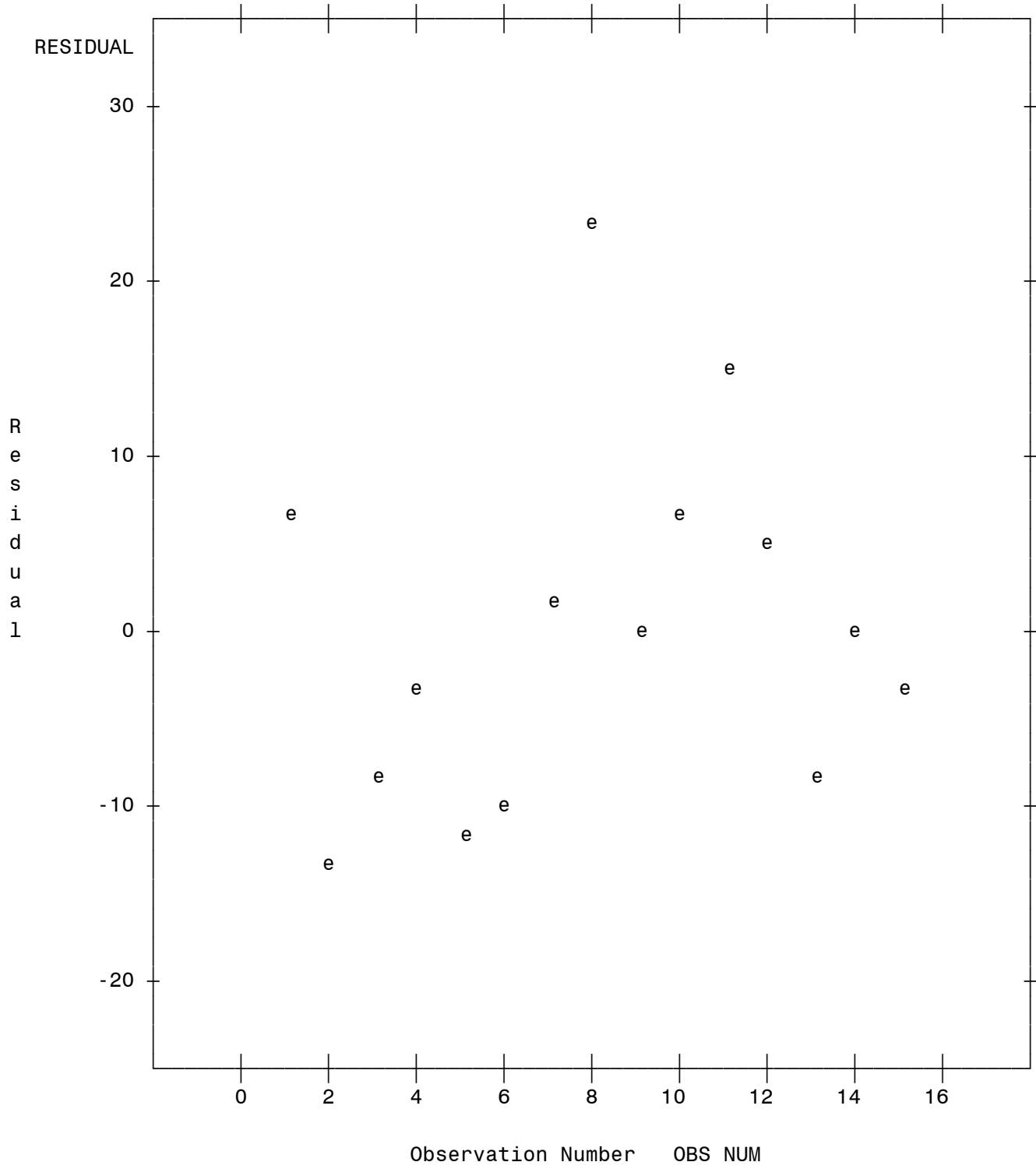
Model: Y_ON_X

Dependent Variable: Y Number of Publications



Plot of e by Observation Number

The REG Procedure
Model: Y_ON_X
Dependent Variable: Y Number of Publications

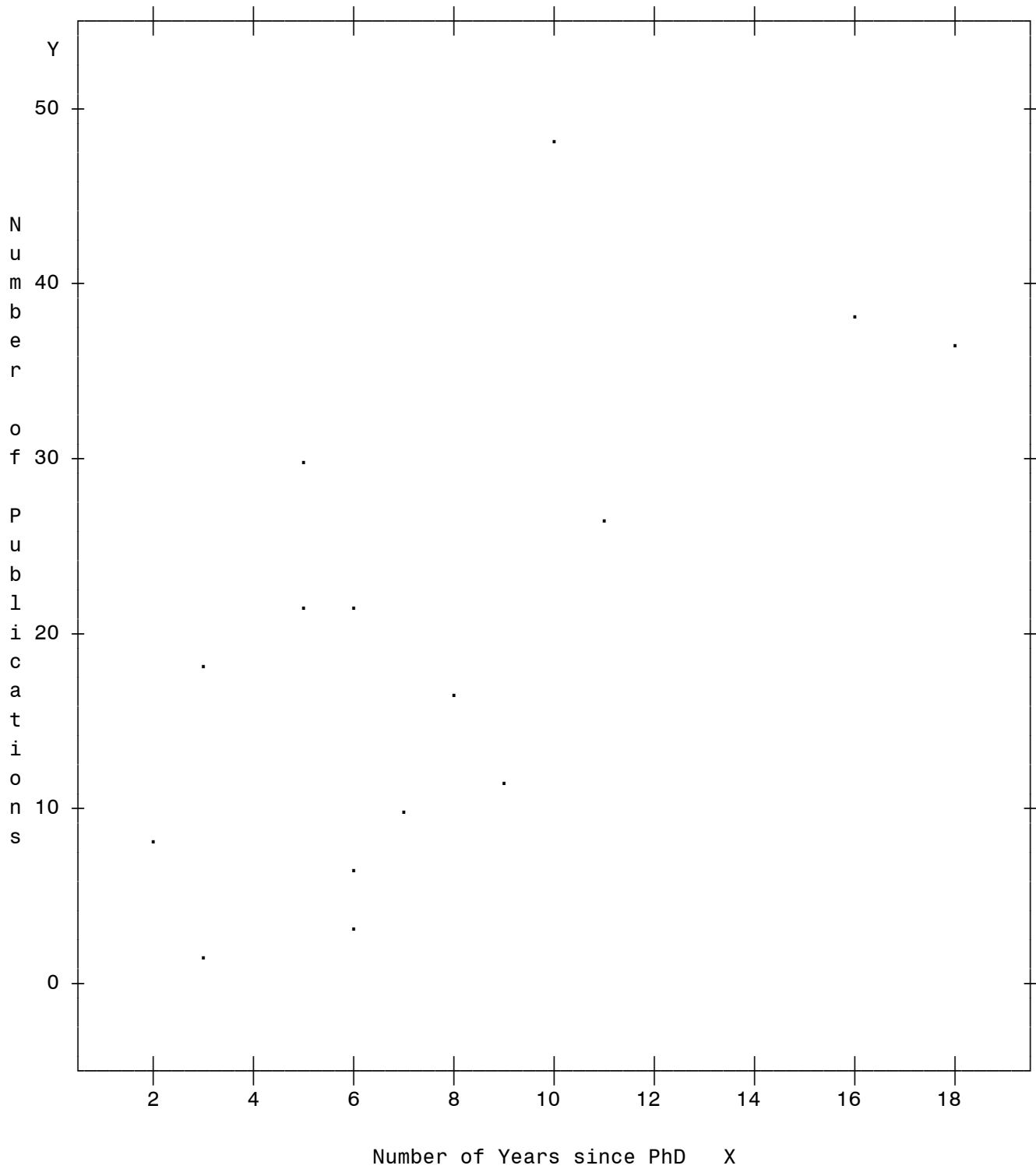


Plot of y by X

The REG Procedure

Model: Y_ON_X

Dependent Variable: Y Number of Publications

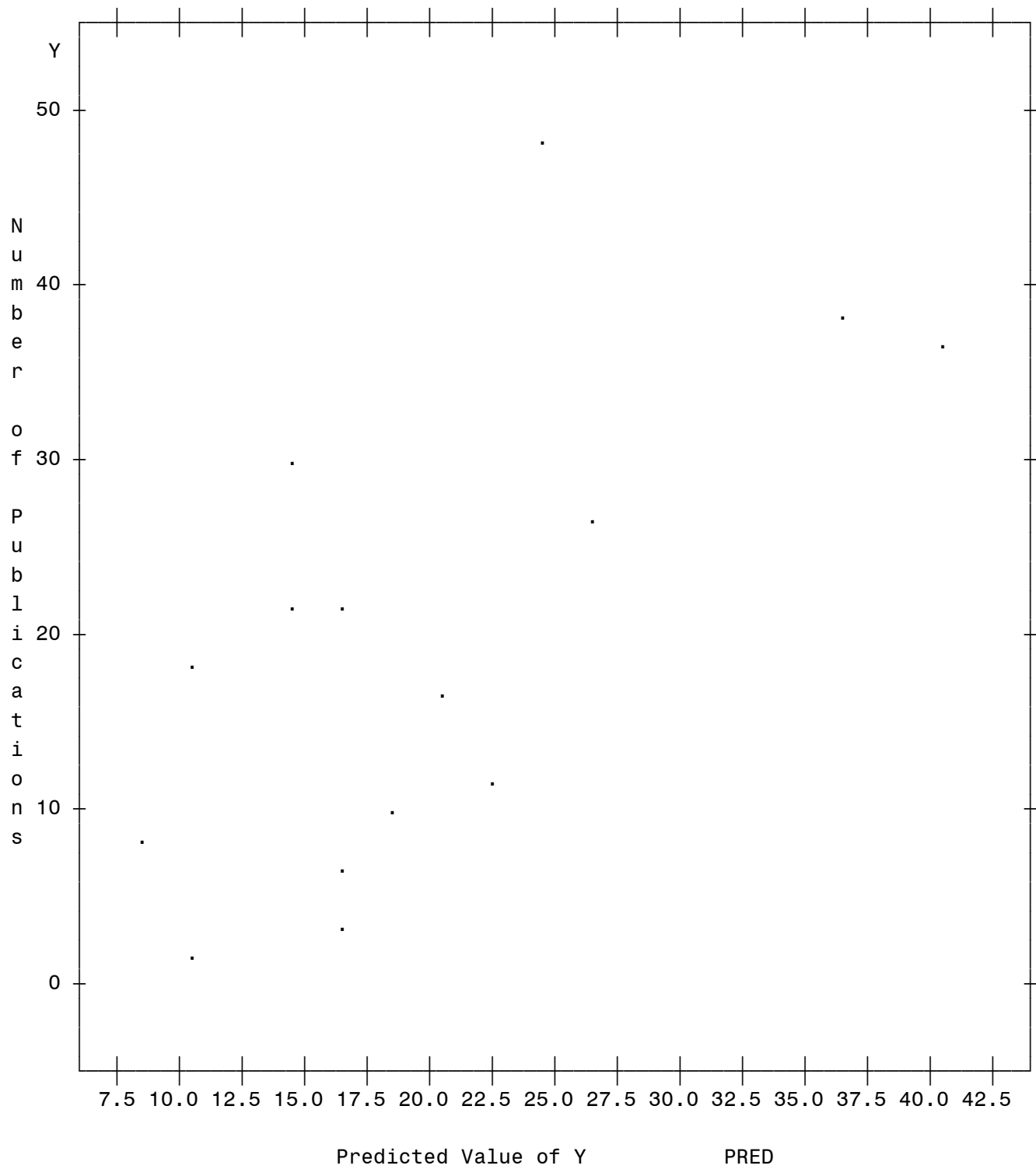


Plot of y by y-hat

The REG Procedure

Model: Y_ON_X

Dependent Variable: Y Number of Publications

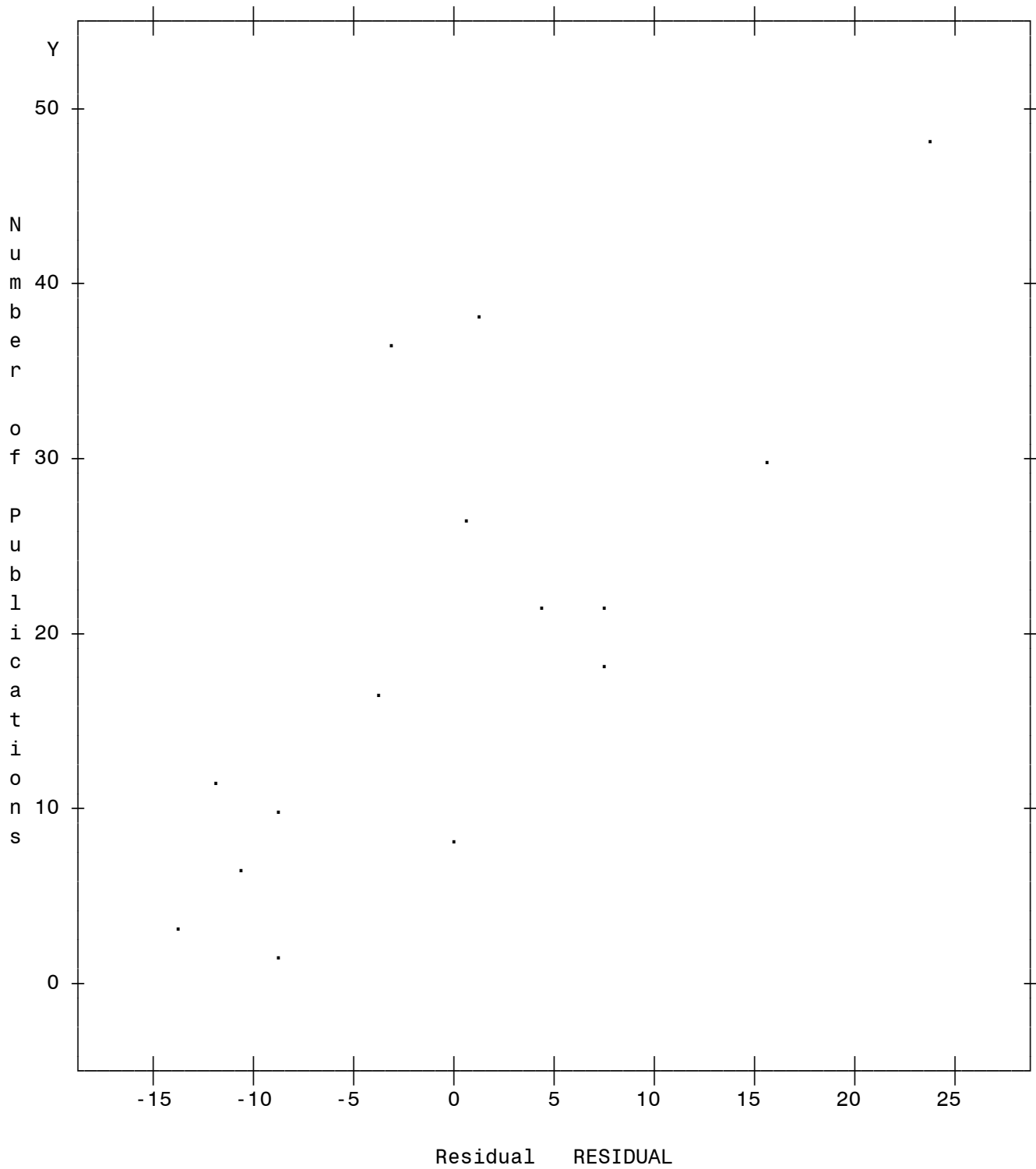


Plot of y by e

The REG Procedure

Model: Y_ON_X

Dependent Variable: Y Number of Publications

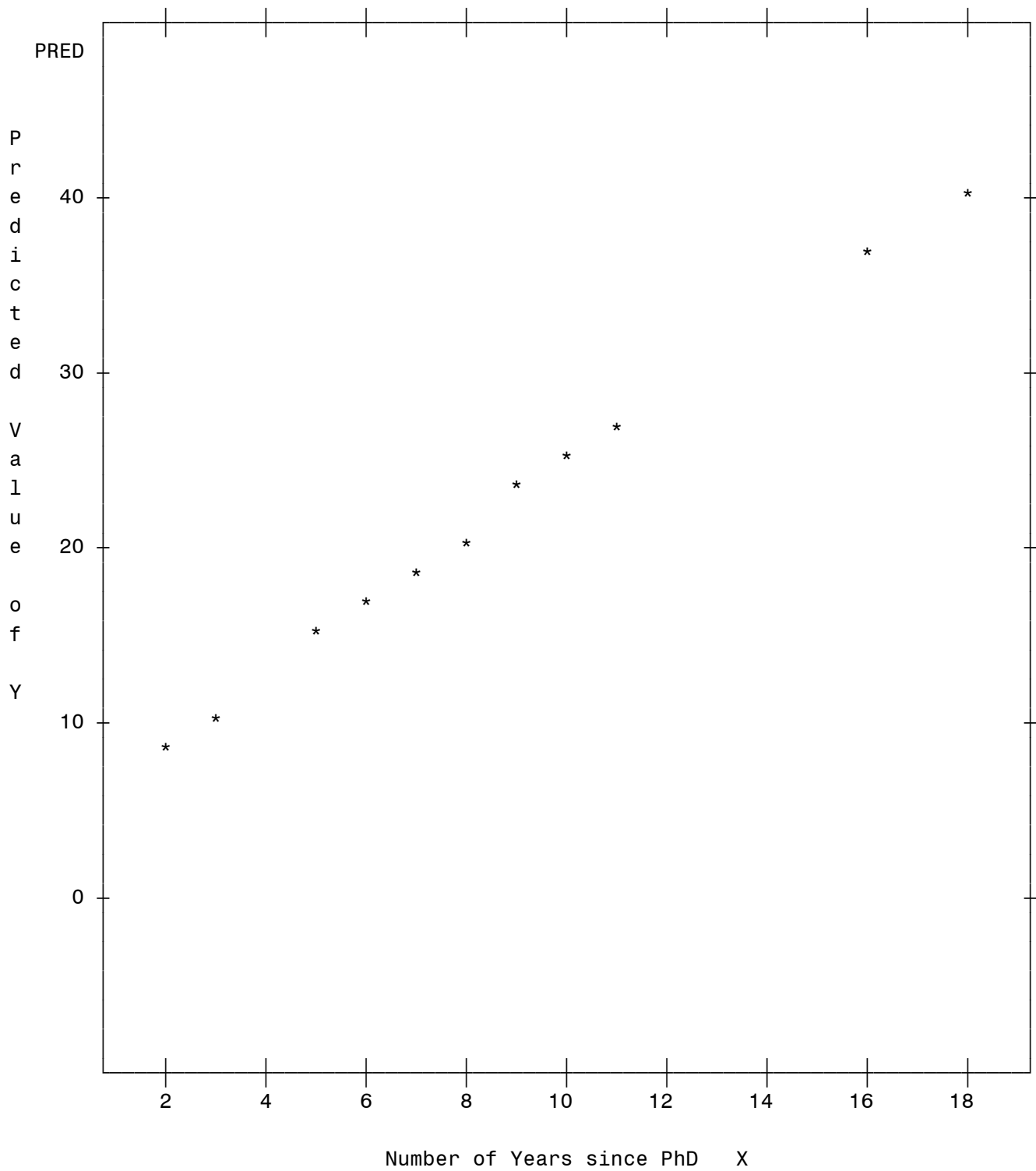


Plot of y-hat by X

The REG Procedure

Model: Y_ON_X

Dependent Variable: Y Number of Publications

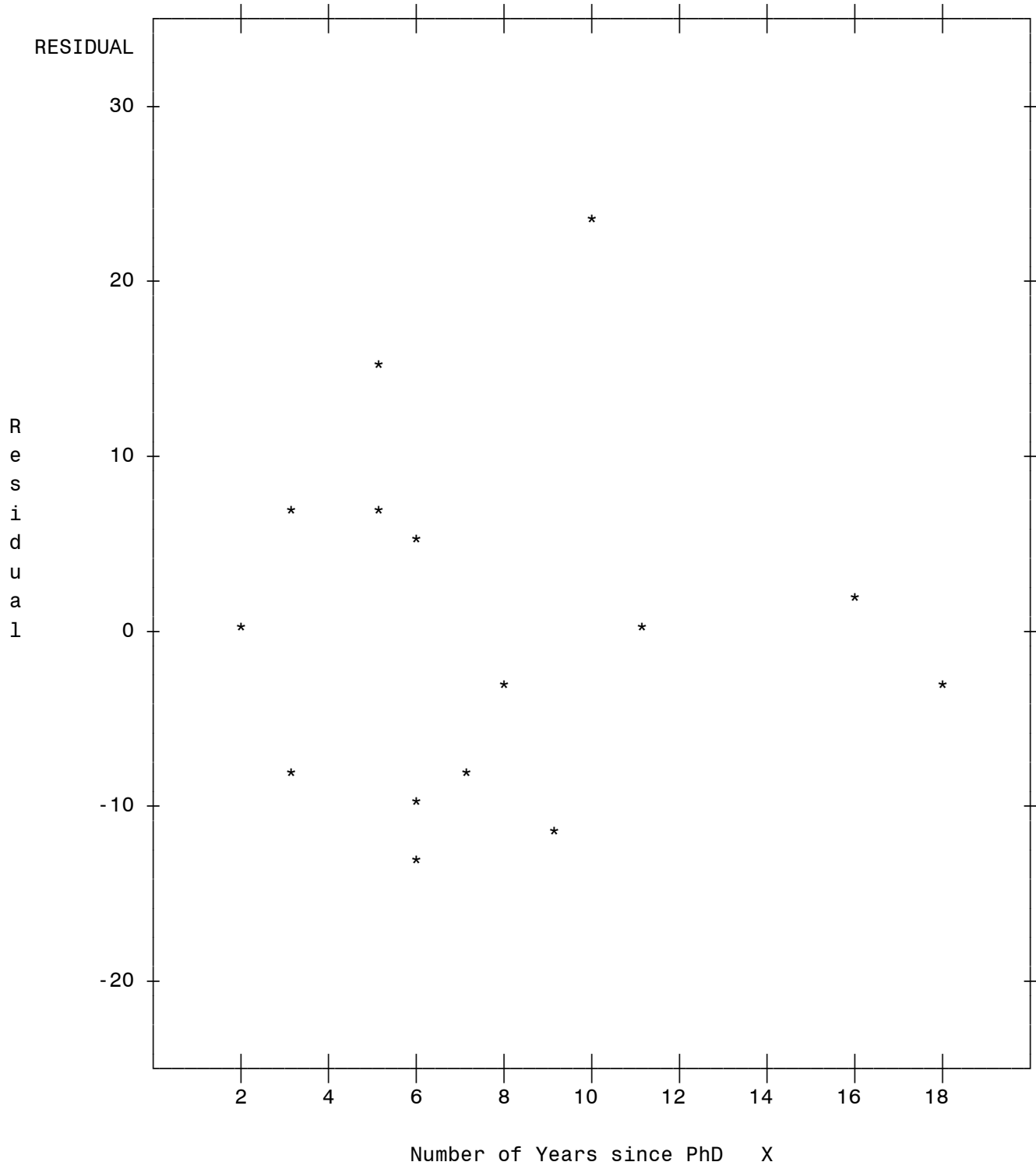


Plot of e by X

The REG Procedure

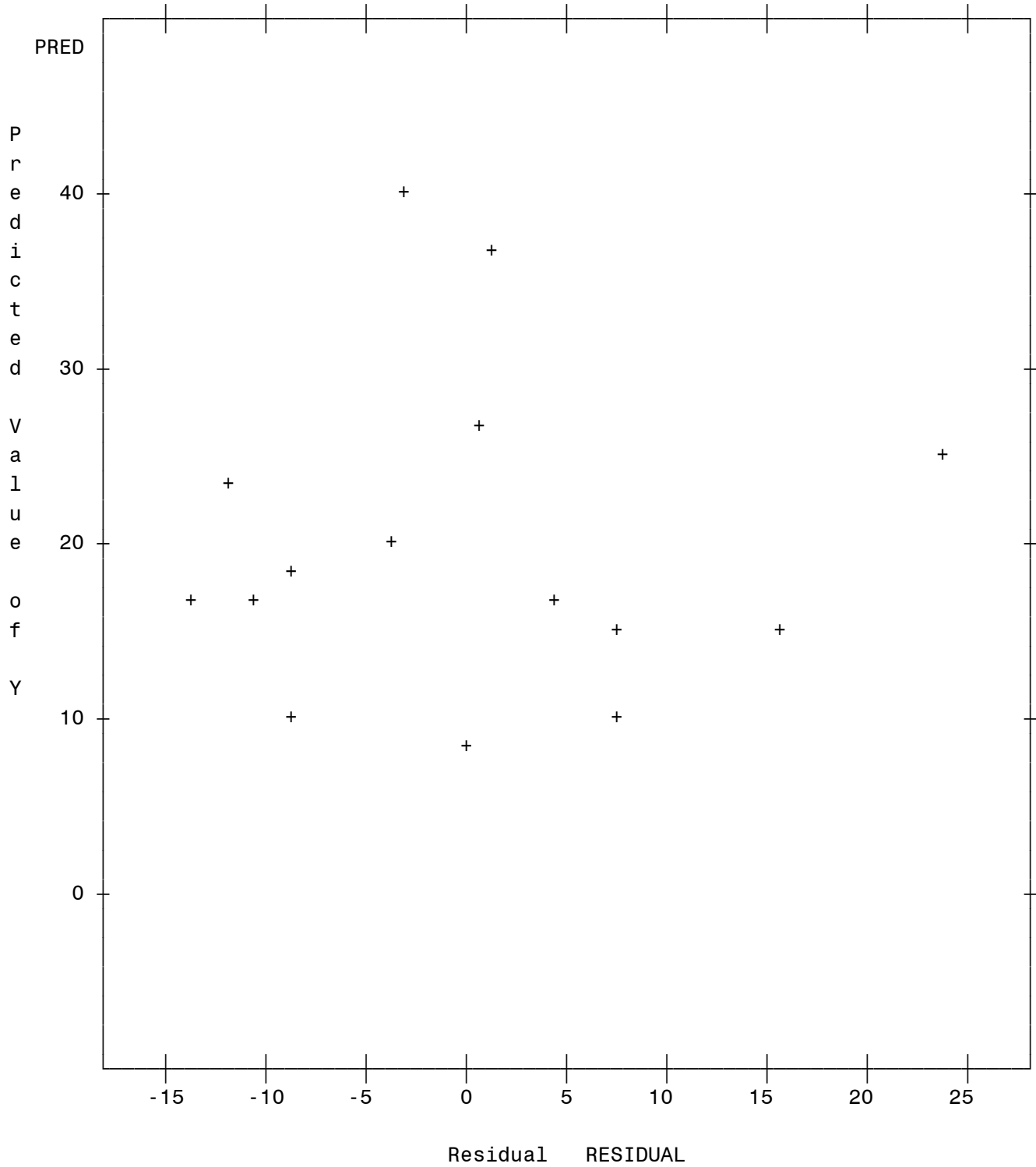
Model: Y_ON_X

Dependent Variable: Y Number of Publications



Plot of \hat{y} by e

The REG Procedure
Model: Y_ON_X
Dependent Variable: Y Number of Publications



Data Listing

Obs	Number of Years since PhD	Number of Publications	Predicted Y	Error in Prediction
1	3	18	10.6795	7.3205
2	6	3	16.6284	-13.6284
3	3	2	10.6795	-8.6795
4	8	17	20.5943	-3.5943
5	9	11	22.5773	-11.5773
6	6	6	16.6284	-10.6284
7	16	38	36.4580	1.5420
8	10	48	24.5602	23.4398
9	2	9	8.6966	0.3034
10	5	22	14.6455	7.3545
11	5	30	14.6455	15.3545
12	6	21	16.6284	4.3716
13	7	10	18.6114	-8.6114
14	11	27	26.5432	0.4568
15	18	37	40.4239	-3.4239

N = 15

Simple Pearson product-moment correlations

The CORR Procedure

4 Variables: Y YHAT X E

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Y	15	19.93333	13.82269	299.00000	2.00000	48.00000
YHAT	15	19.93333	9.07673	299.00000	8.69659	40.42386
X	15	7.66667	4.57738	115.00000	2.00000	18.00000
E	15	0	10.42495	0	-13.62841	23.43977

Simple Statistics

Variable Label

Y	Number of Publications
YHAT	Predicted Y
X	Number of Years since PhD
E	Error in Prediction

Pearson Correlation Coefficients, N = 15

Prob > |r| under H0: Rho=0

	Y	YHAT	X	E
Y Number of Publications	1.00000	0.65665 0.0078	0.65665 0.0078	0.75419 0.0012
YHAT Predicted Y	0.65665 0.0078	1.00000	1.00000 <.0001	0.00000 1.0000
X Number of Years since PhD	0.65665 0.0078	1.00000 <.0001	1.00000	0.00000 1.0000
E Error in Prediction	0.75419 0.0012	0.00000 1.0000	0.00000 1.0000	1.00000

The REG Procedure

Number of Observations Read	62
Number of Observations Used	62

Descriptive Statistics

Variable	Sum	Mean	Uncorrected SS	Variance	Standard Deviation
Intercept	62.00000	1.00000	62.00000	0	0
X1	421.00000	6.79032	3975.00000	18.29958	4.27780
X2	1127.00000	18.17742	32449	196.11555	14.00413
X3	27.00000	0.43548	27.00000	0.24987	0.49987
X4	2494.00000	40.22581	118310	294.86621	17.17167
Y	3398577	54816	1.920422E11	94206882	9706.02299

Descriptive Statistics

Variable	Label
Intercept	Intercept
X1	Time since Ph.D.
X2	No. of Publications
X3	Sex: Female=1, Male=0
X4	No. of Citations
Y	Salary

Correlation

Variable	Label	X1	X2	X3
X1	Time since Ph.D.	1.0000	0.6505	-0.2096
X2	No. of Publications	0.6505	1.0000	-0.1588
X3	Sex: Female=1, Male=0	-0.2096	-0.1588	1.0000
X4	No. of Citations	0.3729	0.3334	-0.1492
Y	Salary	0.6079	0.5061	-0.2010

Correlation

Variable	Label	X4	Y
X1	Time since Ph.D.	0.3729	0.6079
X2	No. of Publications	0.3334	0.5061
X3	Sex: Female=1, Male=0	-0.1492	-0.2010
X4	No. of Citations	1.0000	0.5498

The REG Procedure

Correlation

Variable	Label	X4	Y
Y	Salary	0.5498	1.0000

The REG Procedure
Model: FULL_MODEL
Dependent Variable: Y Salary

Number of Observations Read 62
Number of Observations Used 62

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	2891959939	722989985	14.44	<.0001
Error	57	2854659884	50081752		
Corrected Total	61	5746619823			

Root MSE 7076.84622 R-Square 0.5032
Dependent Mean 54816 Adj R-Sq 0.4684
Coeff Var 12.91024

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	39587	2717.47984	14.57	<.0001
X1	Time since Ph.D.	1	857.00614	287.94588	2.98	0.0043
X2	No. of Publications	1	92.74635	85.92823	1.08	0.2850
X3	Sex: Female=1, Male=0	1	-917.76718	1859.93599	-0.49	0.6236
X4	No. of Citations	1	201.93116	57.50910	3.51	0.0009

Parameter Estimates

Variable	Label	DF	Type II SS	Standardized Estimate	Squared Semi-partial Corr Type II
Intercept	Intercept	1	10628199710	0	.
X1	Time since Ph.D.	1	443634835	0.37771	0.07720
X2	No. of Publications	1	58344700	0.13382	0.01015
X3	Sex: Female=1, Male=0	1	12194067	-0.04727	0.00212
X4	No. of Citations	1	617466023	0.35725	0.10745

The REG Procedure
Model: FULL_MODEL
Dependent Variable: Y Salary

Parameter Estimates

Variable	Label	DF	Squared Partial Corr Type II
Intercept	Intercept	1	.
X1	Time since Ph.D.	1	0.13450
X2	No. of Publications	1	0.02003
X3	Sex: Female=1, Male=0	1	0.00425
X4	No. of Citations	1	0.17784

The REG Procedure
 Model: FULL_MODEL
 Dependent Variable: Y Salary

Output Statistics

Obs	Dependent Variable	Predicted Value	Residual
1	51876	53007	-1131
2	54511	49340	5171
3	53425	51523	1902
4	61863	54886	6977
5	52926	55682	-2756
6	47034	52757	-5723
7	66432	66517	-84.5050
8	61100	63917	-2817
9	41934	45973	-4039
10	47454	51769	-4315
11	49832	51391	-1559
12	47047	52937	-5890
13	39115	50644	-11529
14	59677	59596	81.1849
15	61458	70763	-9305
16	54528	51933	2595
17	60327	54858	5469
18	56600	60076	-3476
19	52542	55272	-2730
20	50455	49786	668.7513
21	51647	54426	-2779
22	62895	51589	11306
23	53740	49778	3962
24	75822	75302	520.2678
25	56596	57008	-412.4598
26	55682	52418	3264
27	62091	52833	9258
28	42162	55539	-13377
29	52646	43489	9157
30	74199	64541	9658
31	50729	55267	-4538
32	70011	49340	20671
33	37939	47605	-9666
34	39652	43010	-3358
35	68987	62996	5991
36	55579	57112	-1533
37	54671	55628	-956.6831
38	57704	53090	4614
39	44045	49672	-5627

The REG Procedure
 Model: FULL_MODEL
 Dependent Variable: Y Salary

Output Statistics

Obs	Dependent Variable	Predicted Value	Residual
40	51122	57789	-6667
41	47082	51943	-4861
42	60009	61032	-1023
43	58632	54198	4434
44	38340	46857	-8517
45	71219	75135	-3916
46	53712	55643	-1931
47	54782	52751	2031
48	83503	69043	14460
49	47212	52206	-4994
50	52840	49236	3604
51	53650	52817	832.7792
52	50931	55716	-4785
53	66784	63279	3505
54	49751	47249	2502
55	74343	60620	13723
56	57710	53012	4698
57	52676	47905	4771
58	41195	51359	-10164
59	45662	49705	-4043
60	47606	60681	-13075
61	44301	49011	-4710
62	58582	48123	10459

Sum of Residuals	0
Sum of Squared Residuals	2854659884
Predicted Residual SS (PRESS)	3450518789

TESTs of Submodels within the Full Model

The REG Procedure
Model: FULL_MODEL

Test X1_X4 Results for Dependent Variable Y

Source	DF	Mean Square	F Value	Pr > F
Numerator	2	667005900	13.32	<.0001
Denominator	57	50081752		

TESTs of Submodels within the Full Model

The REG Procedure
Model: FULL_MODEL

Test X2_X3 Results for Dependent Variable Y

Source	DF	Mean Square	F Value	Pr > F
Numerator	2	35826182	0.72	0.4934
Denominator	57	50081752		

TESTs of Submodels within the Full Model

The REG Procedure
Model: FULL_MODEL

Test X1_X4_X2 Results for Dependent Variable Y

Source	DF	Mean Square	F Value	Pr > F
Numerator	3	886627021	17.70	<.0001
Denominator	57	50081752		

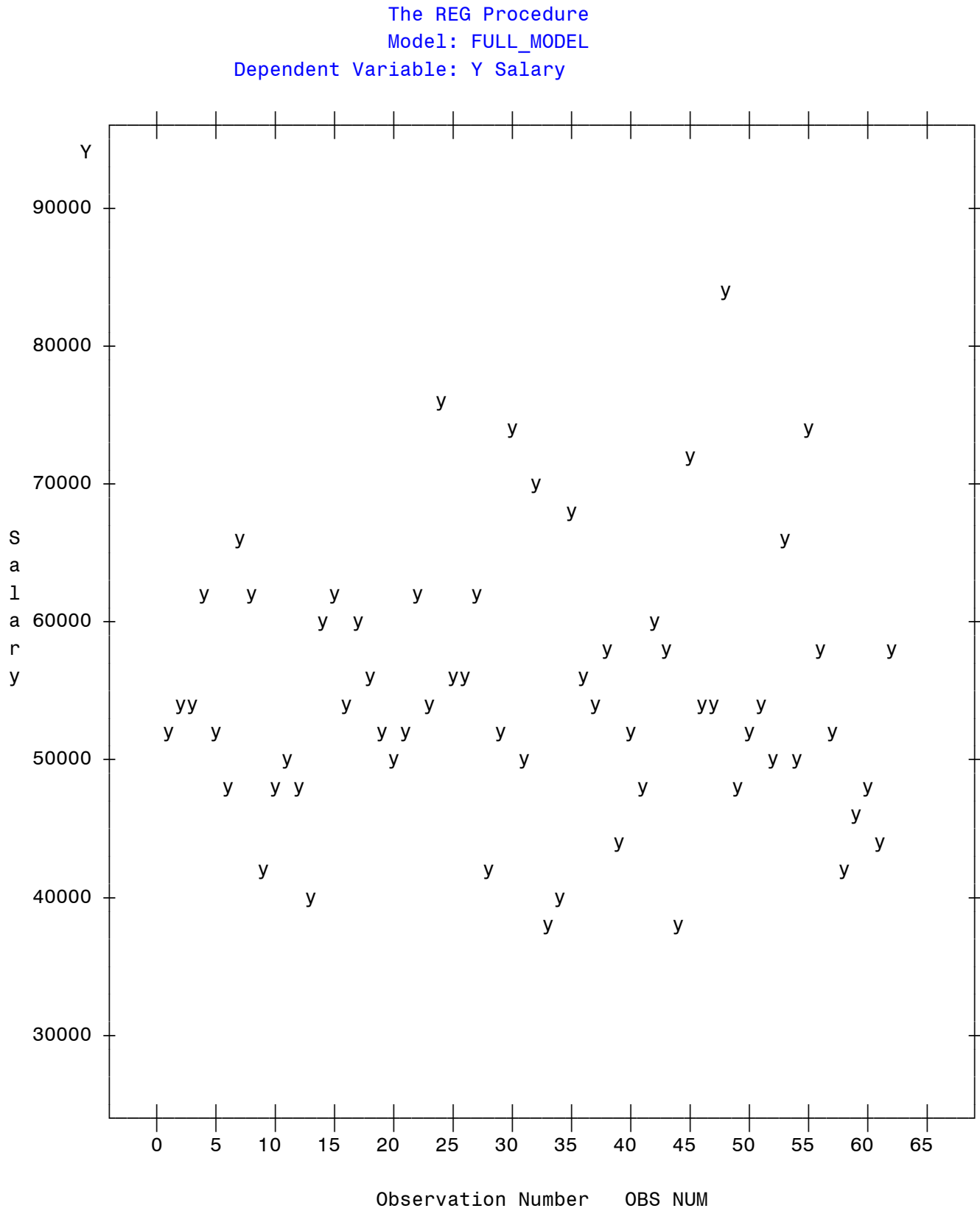
TESTs of Submodels within the Full Model

The REG Procedure
Model: FULL_MODEL

Test X1_X4_X3 Results for Dependent Variable Y

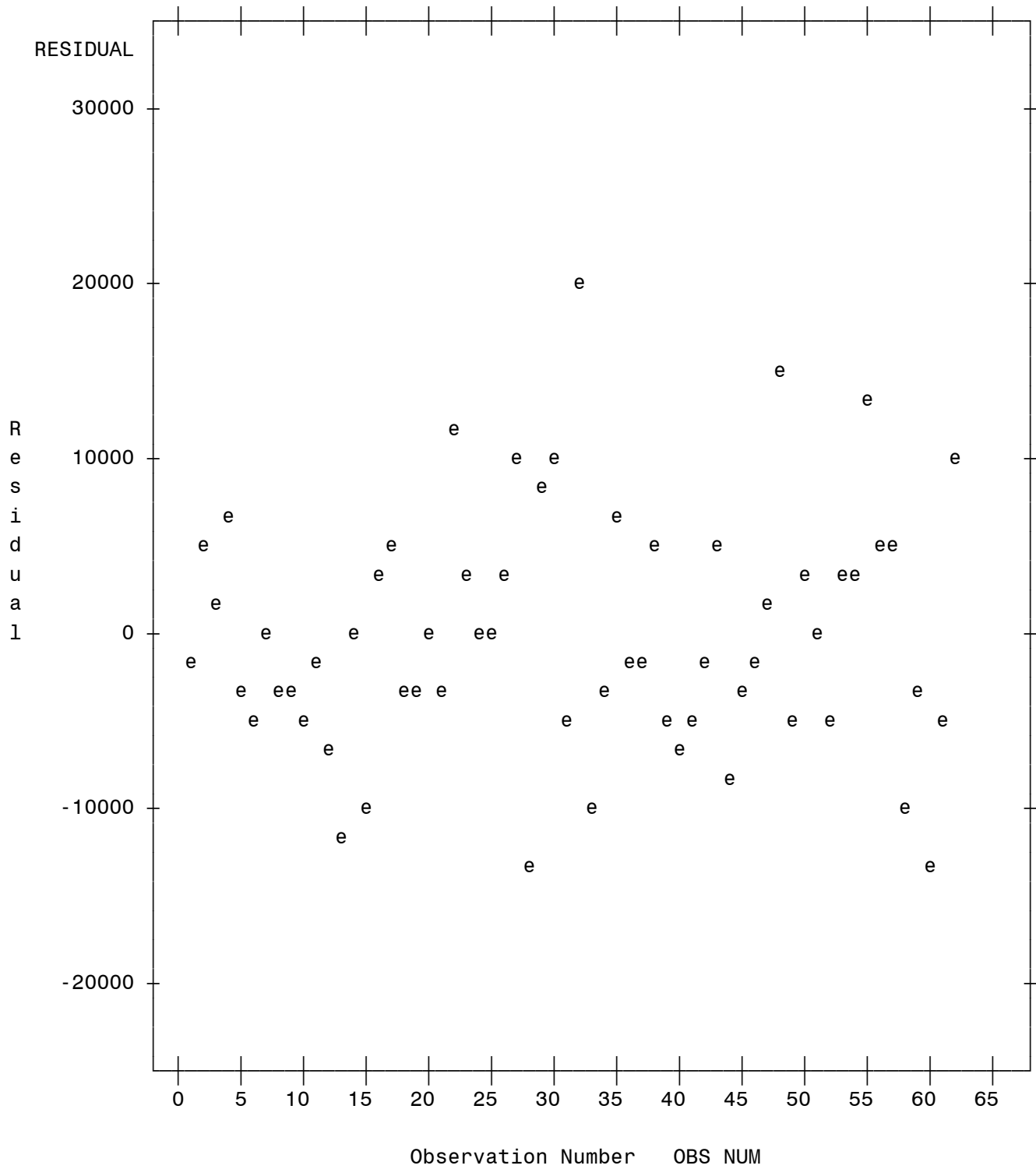
Source	DF	Mean Square	F Value	Pr > F
Numerator	3	473254871	9.45	<.0001
Denominator	57	50081752		

Plot of y by Observation Number



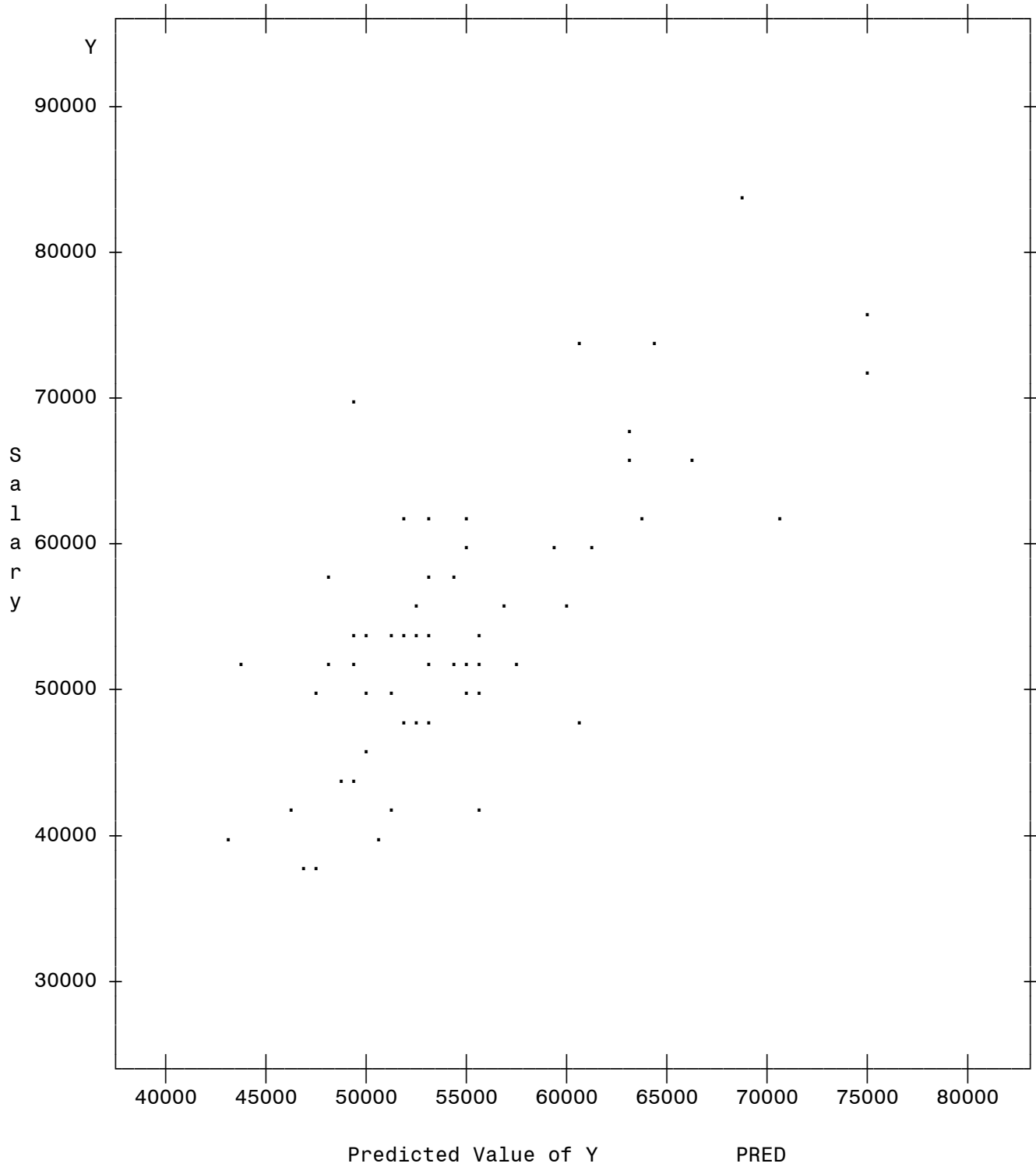
Plot of e by Observation Number

The REG Procedure
Model: FULL_MODEL
Dependent Variable: Y Salary



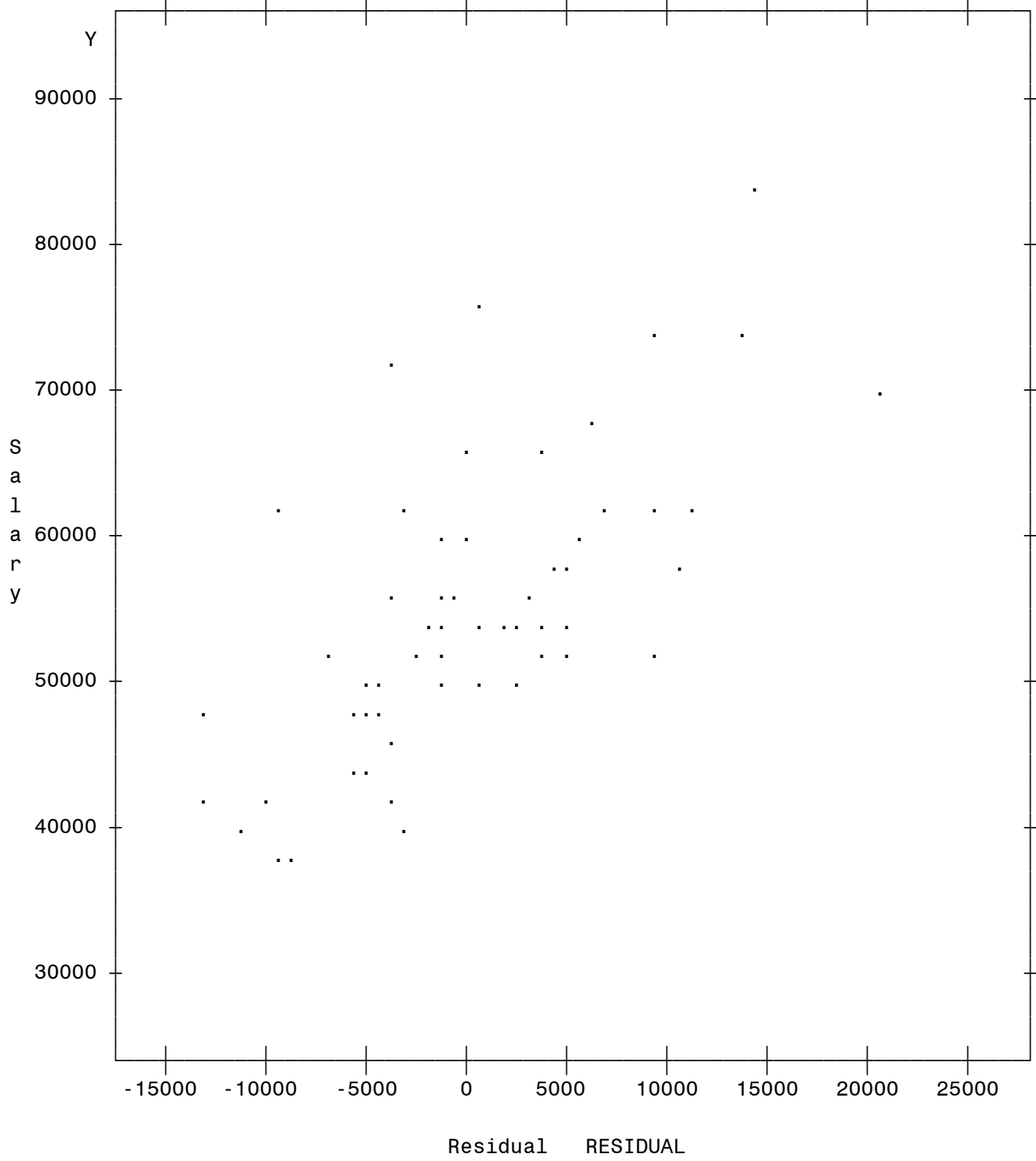
Plot of y by y-hat

The REG Procedure
Model: FULL_MODEL
Dependent Variable: Y Salary



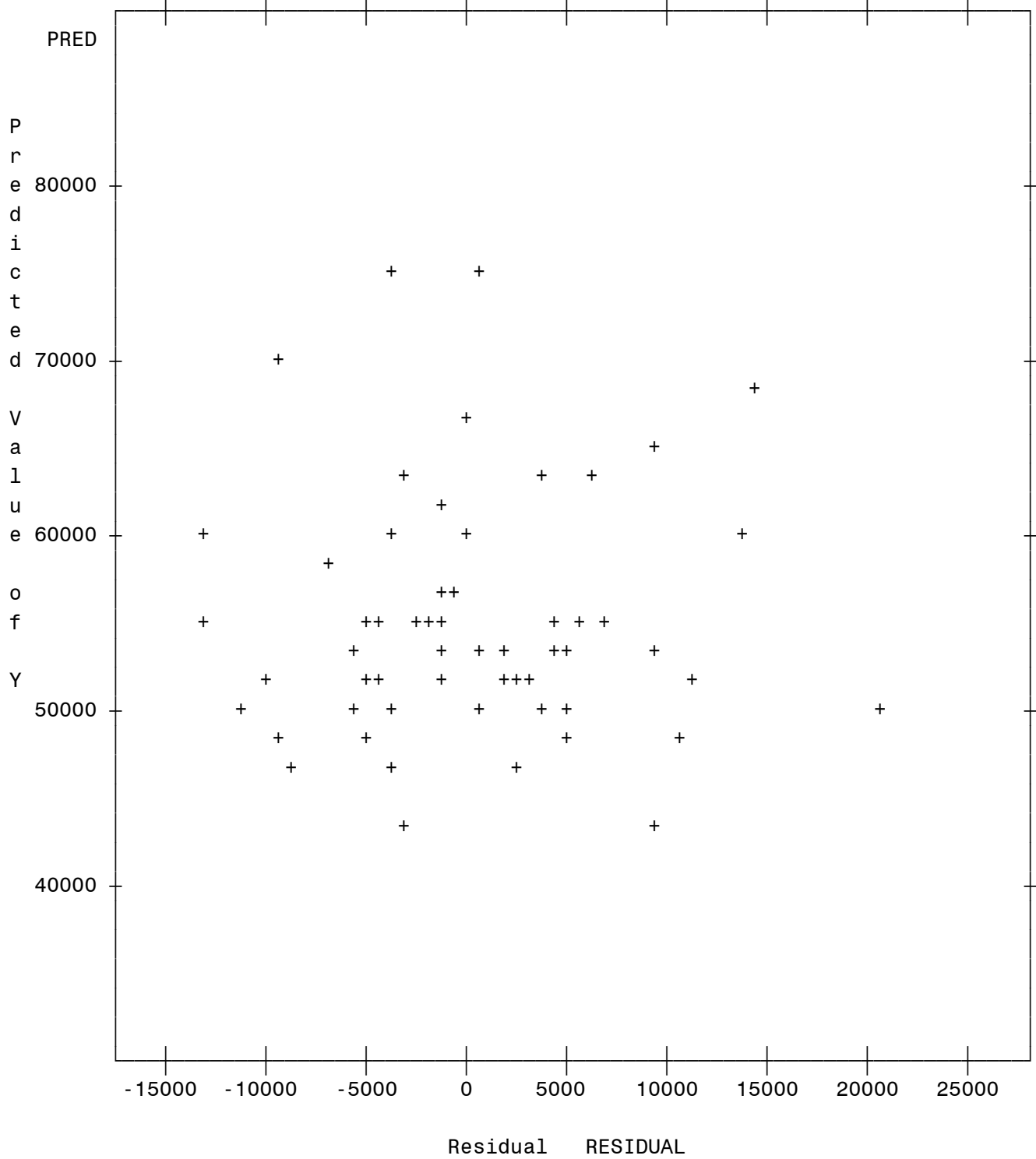
Plot of y by e

The REG Procedure
Model: FULL_MODEL
Dependent Variable: Y Salary



Plot of y-hat by e

The REG Procedure
Model: FULL_MODEL
Dependent Variable: Y Salary



Data Listing

Obs	Time since Ph.D.	No. of Publications	Sex: Female=1, Male=0	No. of Citations	Salary	Predicted Y	Error in Prediction
1	3	18	1	50	51876	53006.59	-1130.59
2	6	3	1	26	54511	49340.07	5170.93
3	3	2	1	50	53425	51522.65	1902.35
4	8	17	0	34	61863	54885.75	6977.25
5	9	11	1	41	52926	55682.03	-2756.03
6	6	6	0	37	47034	52757.32	-5723.32
7	16	38	0	48	66432	66516.50	-84.50
8	10	48	0	56	61100	63917.38	-2817.38
9	2	9	0	19	41934	45972.77	-4038.77
10	5	22	0	29	47454	51768.80	-4314.80
11	5	30	1	28	49832	51391.08	-1559.08
12	6	21	0	31	47047	52936.93	-5889.93
13	7	10	1	25	39115	50644.37	-11529.37
14	11	27	0	40	59677	59595.82	81.18
15	18	37	0	61	61458	70762.88	-9304.88
16	6	8	0	32	54528	51933.15	2594.85
17	9	13	1	36	60327	54857.86	5469.14
18	7	6	0	69	56600	60076.12	-3476.12
19	7	12	1	47	52542	55272.35	-2730.35
20	3	29	1	29	50455	49786.25	668.75
21	7	29	1	35	51647	54425.86	-2778.86
22	5	7	0	35	62895	51589.20	11305.80
23	7	6	0	18	53740	49777.63	3962.37
24	13	69	0	90	75822	75301.73	520.27
25	5	11	0	60	56596	57008.46	-412.46
26	8	9	1	30	55682	52418.28	3263.72
27	8	20	1	27	62091	52832.70	9258.30
28	7	41	1	35	42162	55538.82	-13376.82
29	2	3	1	14	52646	43488.87	9157.13
30	13	27	0	56	74199	64540.73	9658.27
31	5	14	0	50	50729	55267.39	-4538.39
32	3	23	0	25	70011	49339.81	20671.19
33	1	1	0	35	37939	47604.69	-9665.69
34	3	7	0	1	39652	43009.52	-3357.52
35	9	19	0	69	68987	62995.84	5991.16
36	3	11	0	69	55579	57111.83	-1532.83
37	9	31	0	27	54671	55627.68	-956.68
38	3	9	0	50	57704	53089.64	4614.36
39	4	12	1	32	44045	49672.36	-5627.36
40	10	32	0	33	51122	57789.02	-6667.02
41	1	26	0	45	47082	51942.66	-4860.66
42	11	12	0	54	60009	61031.66	-1022.66

Data Listing

Obs	Time since Ph.D.	No. of Publications	Sex: Female=1, Male=0	No. of Citations	Salary	Predicted Y	Error in Prediction
43	5	9	0	47	58632	54197.86	4434.14
44	1	6	0	29	38340	46856.84	-8516.84
45	21	39	0	69	71219	75134.84	-3915.84
46	7	16	1	47	53712	55643.33	-1931.33
47	5	12	1	43	54782	52750.61	2031.39
48	16	50	0	55	83503	69042.98	14460.02
49	5	18	0	33	47212	52205.54	-4993.54
50	4	16	1	28	52840	49235.62	3604.38
51	5	5	0	42	53650	52817.22	832.78
52	11	20	0	24	50931	55715.69	-4784.69
53	16	50	1	31	66784	63278.86	3505.14
54	3	6	1	27	49751	47249.22	2501.78
55	4	19	1	83	74343	60620.07	13722.93
56	4	11	1	49	57710	53012.44	4697.56
57	5	13	0	14	52676	47905.12	4770.88
58	6	3	1	36	41195	51359.38	-10164.38
59	4	8	1	34	45662	49705.24	-4043.24
60	8	11	1	70	47606	60681.02	-13075.02
61	3	25	1	27	44301	49011.40	-4710.40
62	4	4	1	28	58582	48122.66	10459.34

N = 62

Simple Pearson product-moment correlations

The CORR Procedure

7 Variables: Y YHAT X1 X2 X3 X4 E

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Y	62	54816	9706	3398577	37939	83503
YHAT	62	54816	6885	3398577	43010	75302
X1	62	6.79032	4.27780	421.00000	1.00000	21.00000
X2	62	18.17742	14.00413	1127	1.00000	69.00000
X3	62	0.43548	0.49987	27.00000	0	1.00000
X4	62	40.22581	17.17167	2494	1.00000	90.00000
E	62	0	6841	0	-13377	20671

Simple Statistics

Variable Label

Y	Salary
YHAT	Predicted Y
X1	Time since Ph.D.
X2	No. of Publications
X3	Sex: Female=1, Male=0
X4	No. of Citations
E	Error in Prediction

Pearson Correlation Coefficients, N = 62

Prob > |r| under H0: Rho=0

	Y	YHAT	X1	X2
Y Salary	1.00000	0.70940 <.0001	0.60790 <.0001	0.50615 <.0001
YHAT Predicted Y	0.70940 <.0001	1.00000	0.85692 <.0001	0.71349 <.0001
X1 Time since Ph.D.	0.60790 <.0001	0.85692 <.0001	1.00000	0.65055 <.0001
X2 No. of Publications	0.50615 <.0001	0.71349 <.0001	0.65055 <.0001	1.00000

Simple Pearson product-moment correlations

The CORR Procedure

Pearson Correlation Coefficients, N = 62

Prob > |r| under H0: Rho=0

	Y	YHAT	X1	X2
X3	-0.20096	-0.28328	-0.20959	-0.15875
Sex: Female=1, Male=0	0.1173	0.0257	0.1021	0.2178
X4	0.54977	0.77498	0.37290	0.33339
No. of Citations	<.0001	<.0001	0.0028	0.0081
E	0.70481	0.00000	0.00000	0.00000
Error in Prediction	<.0001	1.0000	1.0000	1.0000

Pearson Correlation Coefficients, N = 62

Prob > |r| under H0: Rho=0

	X3	X4	E
Y	-0.20096	0.54977	0.70481
Salary	0.1173	<.0001	<.0001
YHAT	-0.28328	0.77498	0.00000
Predicted Y	0.0257	<.0001	1.0000
X1	-0.20959	0.37290	0.00000
Time since Ph.D.	0.1021	0.0028	1.0000
X2	-0.15875	0.33339	0.00000
No. of Publications	0.2178	0.0081	1.0000
X3	1.00000	-0.14915	0.00000
Sex: Female=1, Male=0		0.2473	1.0000
X4	-0.14915	1.00000	0.00000
No. of Citations	0.2473		1.0000
E	0.00000	0.00000	1.00000
Error in Prediction	1.0000	1.0000	

The GLM Procedure

Class Level Information

Class	Levels	Values
A	4	12 Hours 18 Hours 24 Hours 30 Hours

Number of Observations Read	32
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Number of Observations Used	32
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The GLM Procedure

Dependent Variable: Y Hand-Steadiness

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	49.0000000	16.3333333	7.50	0.0008
Error	28	61.0000000	2.1785714		
Corrected Total	31	110.0000000			

R-Square	Coeff Var	Root MSE	Y Mean
0.445455	34.72938	1.475998	4.250000

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	3	49.0000000	16.3333333	7.50	0.0008

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
(1) A Main Effect	3	49.0000000	16.3333333	7.50	0.0008
(2) A Main Effect	3	49.0000000	16.3333333	7.50	0.0008
Linear	1	44.1000000	44.1000000	20.24	0.0001
Quadratic	1	4.5000000	4.5000000	2.07	0.1617
Cubic	1	0.4000000	0.4000000	0.18	0.6716
Deviations	2	4.9000000	2.4500000	1.12	0.3390

Parameter	Estimate	Standard Error	t Value	Pr > t
A[1] v. A[2]	-0.5000000	0.73799923	-0.68	0.5036
A[3] v. A[4]	-2.0000000	0.73799923	-2.71	0.0114
(A[1]+A[2])/2 v. (A[3]+A[4])/2	-2.0000000	0.52184426	-3.83	0.0007
Linear	0.5250000	0.11668792	4.50	0.0001
Quadratic	0.3750000	0.26092213	1.44	0.1617
Cubic	0.0500000	0.11668792	0.43	0.6716

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Bonferroni

A	Y LSMEAN	Standard Error	Pr > t	LSMEAN Number
12 Hours	3.0000000	0.52184426	<.0001	1
18 Hours	3.5000000	0.52184426	<.0001	2
24 Hours	4.2500000	0.52184426	<.0001	3
30 Hours	6.2500000	0.52184426	<.0001	4

Least Squares Means for Effect A
t for H0: LSMean(i)=LSMean(j) / Pr > |t|

Dependent Variable: Y

i/j	1	2	3	4
1		-0.67751	-1.69377	-4.4038
		1.0000	0.6084	0.0008
2	0.677507		-1.01626	-3.72629
	1.0000		1.0000	0.0052
3	1.693769	1.016261		-2.71003
	0.6084	1.0000		0.0681
4	4.403799	3.726291	2.71003	
	0.0008	0.0052	0.0681	

A	Y LSMEAN	95% Confidence Limits	
12 Hours	3.000000	1.931050	4.068950
18 Hours	3.500000	2.431050	4.568950
24 Hours	4.250000	3.181050	5.318950
30 Hours	6.250000	5.181050	7.318950

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Scheffe

A	Y LSMEAN	Standard Error	Pr > t	LSMEAN Number
12 Hours	3.0000000	0.52184426	<.0001	1
18 Hours	3.5000000	0.52184426	<.0001	2
24 Hours	4.2500000	0.52184426	<.0001	3
30 Hours	6.2500000	0.52184426	<.0001	4

Least Squares Means for Effect A
t for H0: LSMean(i)=LSMean(j) / Pr > |t|

Dependent Variable: Y

i/j	1	2	3	4
1		-0.67751 0.9269	-1.69377 0.4270	-4.4038 0.0018
2	0.677507 0.9269		-1.01626 0.7935	-3.72629 0.0094
3	1.693769 0.4270	1.016261 0.7935		-2.71003 0.0845
4	4.403799 0.0018	3.726291 0.0094	2.71003 0.0845	

A	Y LSMEAN	95% Confidence Limits	
12 Hours	3.000000	1.931050	4.068950
18 Hours	3.500000	2.431050	4.568950
24 Hours	4.250000	3.181050	5.318950
30 Hours	6.250000	5.181050	7.318950

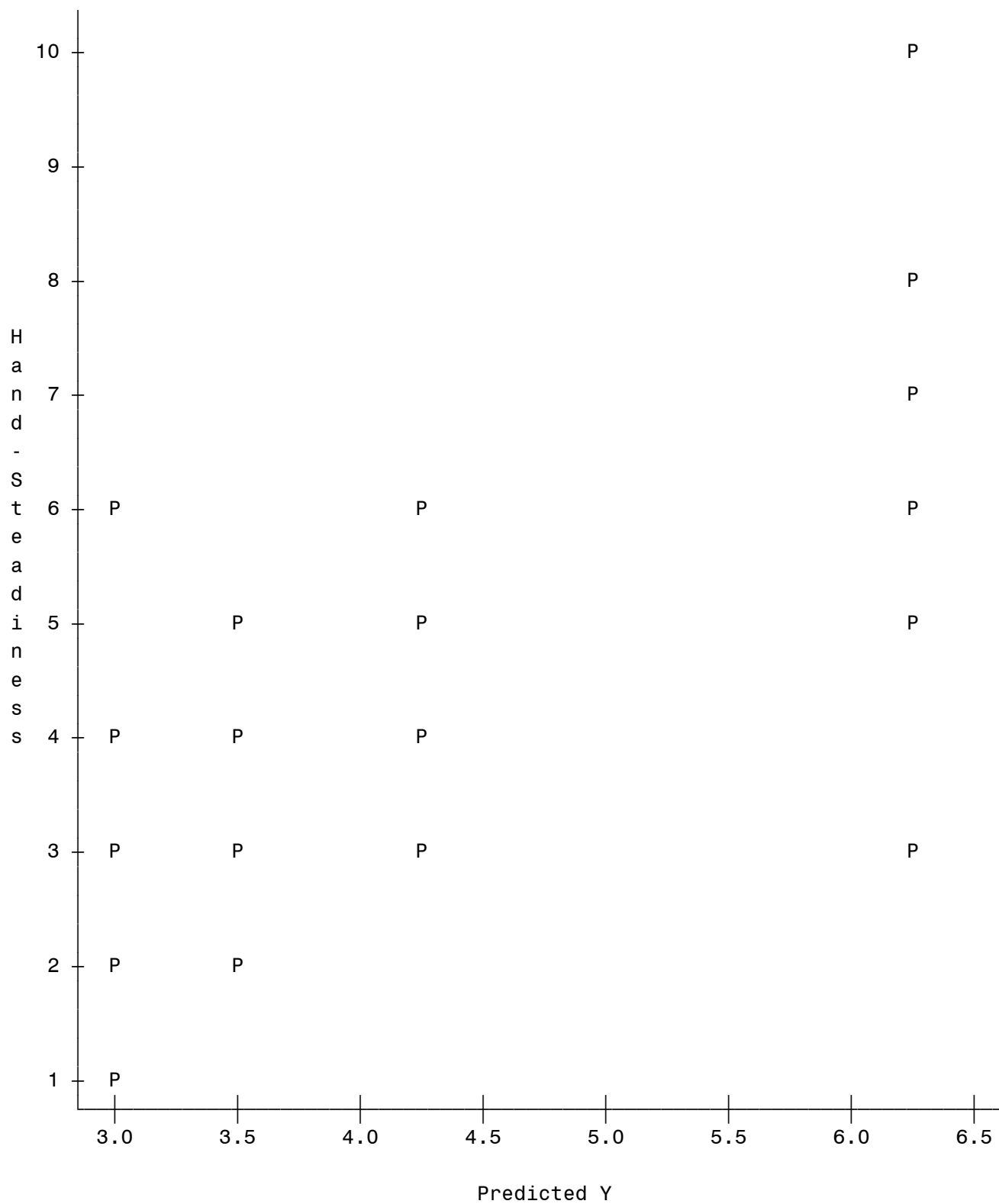
Data Listing

Obs	Sleep Deprivation	Hand- Steadiness	Predicted Y	Error in Prediction
1	12 Hours	4	3.00	1.00
2	12 Hours	6	3.00	3.00
3	12 Hours	3	3.00	-0.00
4	12 Hours	3	3.00	-0.00
5	12 Hours	1	3.00	-2.00
6	12 Hours	3	3.00	-0.00
7	12 Hours	2	3.00	-1.00
8	12 Hours	2	3.00	-1.00
9	18 Hours	4	3.50	0.50
10	18 Hours	5	3.50	1.50
11	18 Hours	4	3.50	0.50
12	18 Hours	3	3.50	-0.50
13	18 Hours	2	3.50	-1.50
14	18 Hours	3	3.50	-0.50
15	18 Hours	4	3.50	0.50
16	18 Hours	3	3.50	-0.50
17	24 Hours	5	4.25	0.75
18	24 Hours	6	4.25	1.75
19	24 Hours	5	4.25	0.75
20	24 Hours	4	4.25	-0.25
21	24 Hours	3	4.25	-1.25
22	24 Hours	4	4.25	-0.25
23	24 Hours	3	4.25	-1.25
24	24 Hours	4	4.25	-0.25
25	30 Hours	3	6.25	-3.25
26	30 Hours	5	6.25	-1.25
27	30 Hours	6	6.25	-0.25
28	30 Hours	5	6.25	-1.25
29	30 Hours	6	6.25	-0.25
30	30 Hours	7	6.25	0.75
31	30 Hours	8	6.25	1.75
32	30 Hours	10	6.25	3.75

N = 32

Bivariate Plots

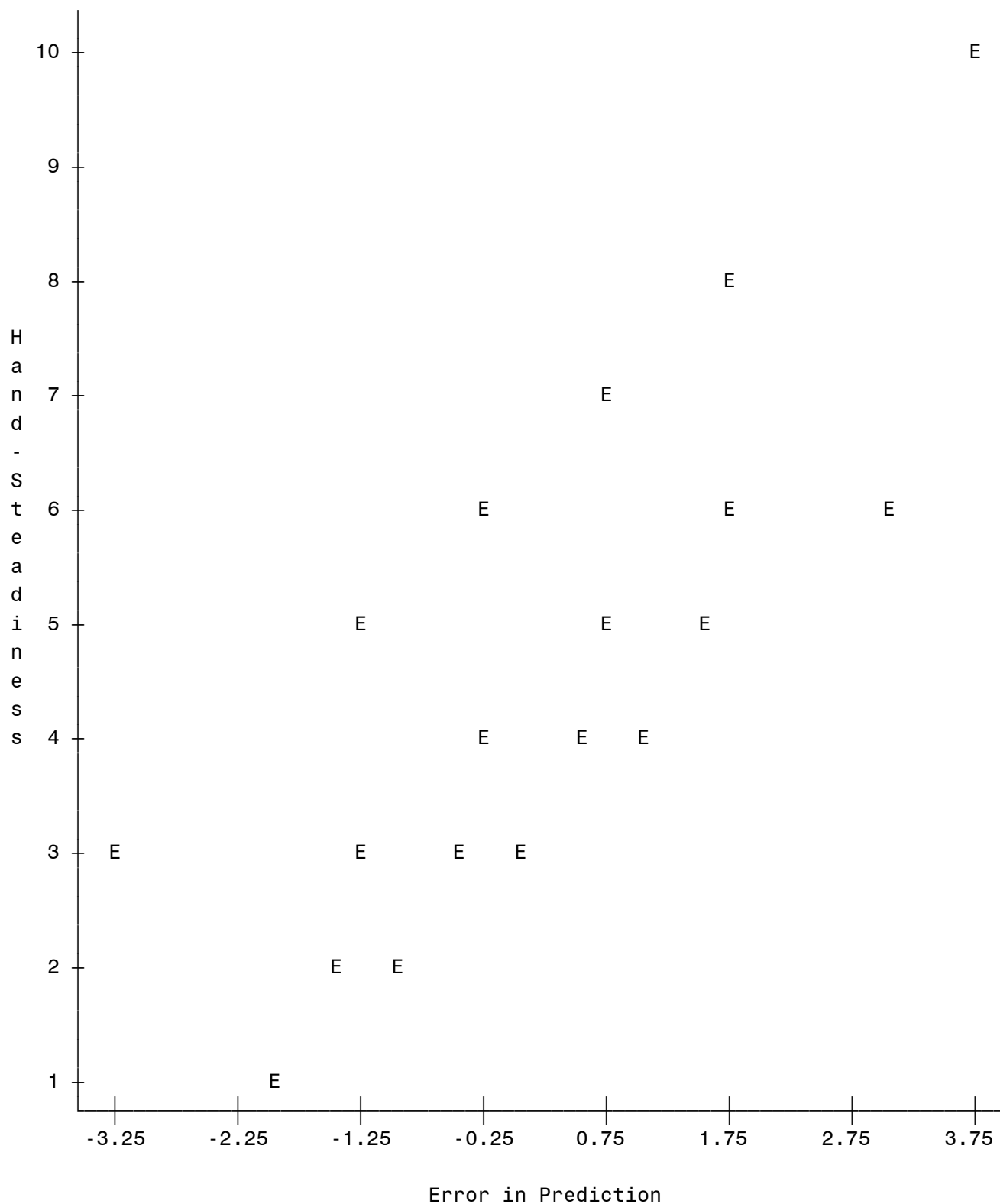
Plot of Y*YHAT. Symbol used is 'P'.



NOTE: 13 obs hidden.

Bivariate Plots

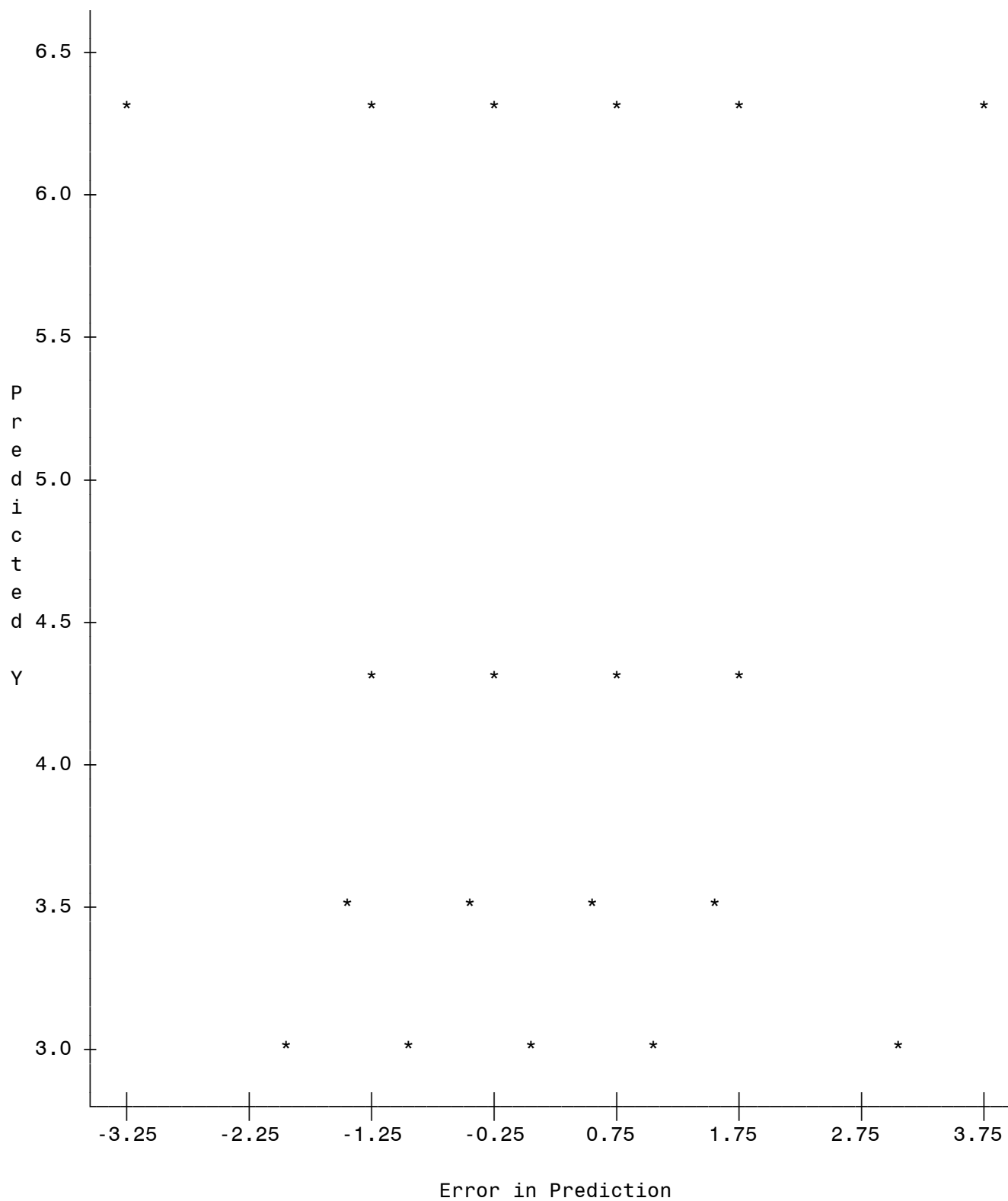
Plot of Y*E. Symbol used is 'E'.



NOTE: 13 obs hidden.

Bivariate Plots

Plot of YHAT*E. Symbol used is '*'.



NOTE: 13 obs hidden.

Simple Pearson product-moment correlations

The CORR Procedure

3 Variables: Y YHAT E

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Y	32	4.25000	1.88372	136.00000	1.00000	10.00000
YHAT	32	4.25000	1.25724	136.00000	3.00000	6.25000
E	32	0	1.40276	0	-3.25000	3.75000

Simple Statistics

Variable Label

Y	Hand-Steadiness
YHAT	Predicted Y
E	Error in Prediction

Pearson Correlation Coefficients, N = 32

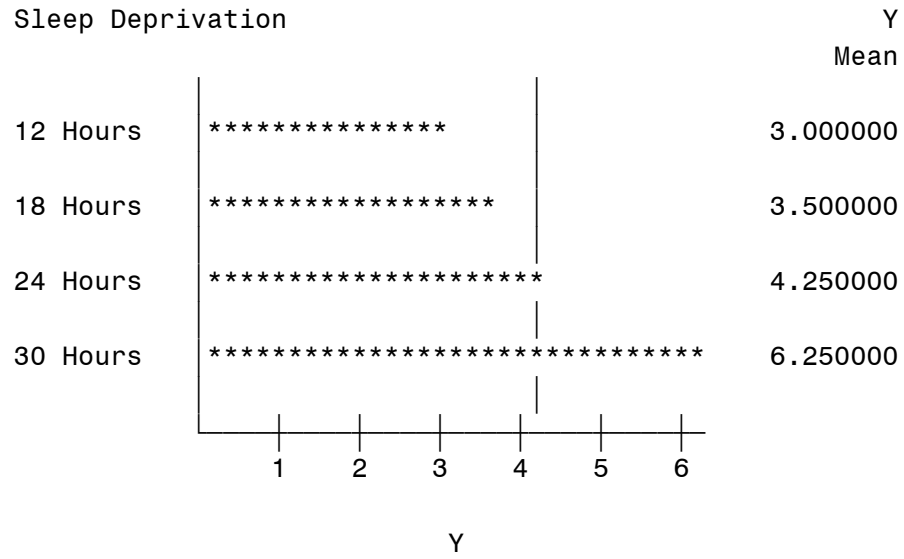
Prob > |r| under H0: Rho=0

	Y	YHAT	E
Y Hand-Steadiness	1.00000	0.66742 <.0001	0.74468 <.0001
YHAT Predicted Y	0.66742 <.0001	1.00000	0.00000 1.0000
E Error in Prediction	0.74468 <.0001	0.00000 1.0000	1.00000

Listing of AMEANS Dataset

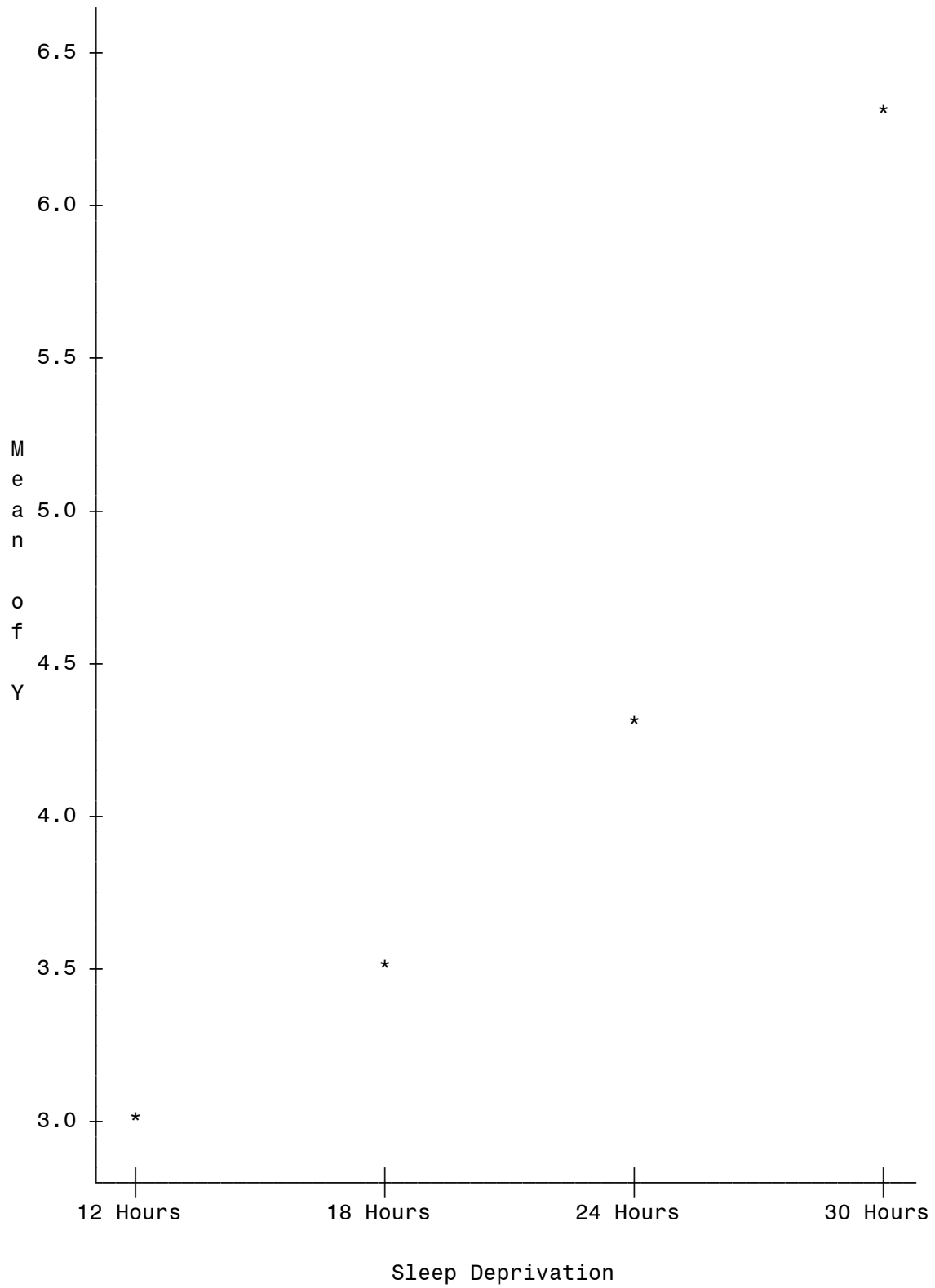
Sleep Deprivation	Mean of Y
12 Hours	3.00
18 Hours	3.50
24 Hours	4.25
30 Hours	6.25

Bar Graph of A-effect Means



Plot of A-effect Means

Plot of LSMEAN*A. Symbol used is '*'.



Data Listing

Obs	Hand- Steadiness	Sleep Deprivation	X1	X2	X3
1	4	1	1	0	0
2	6	1	1	0	0
3	3	1	1	0	0
4	3	1	1	0	0
5	1	1	1	0	0
6	3	1	1	0	0
7	2	1	1	0	0
8	2	1	1	0	0
9	4	2	0	1	0
10	5	2	0	1	0
11	4	2	0	1	0
12	3	2	0	1	0
13	2	2	0	1	0
14	3	2	0	1	0
15	4	2	0	1	0
16	3	2	0	1	0
17	5	3	0	0	1
18	6	3	0	0	1
19	5	3	0	0	1
20	4	3	0	0	1
21	3	3	0	0	1
22	4	3	0	0	1
23	3	3	0	0	1
24	4	3	0	0	1
25	3	4	-1	-1	-1
26	5	4	-1	-1	-1
27	6	4	-1	-1	-1
28	5	4	-1	-1	-1
29	6	4	-1	-1	-1
30	7	4	-1	-1	-1
31	8	4	-1	-1	-1
32	10	4	-1	-1	-1

N = 32

Data Listing

The REG Procedure

Number of Observations Read	32
Number of Observations Used	32

Descriptive Statistics

Variable	Sum	Mean	Uncorrected SS	Variance	Standard Deviation
Intercept	32.00000	1.00000	32.00000	0	0
X1	0	0	16.00000	0.51613	0.71842
X2	0	0	16.00000	0.51613	0.71842
X3	0	0	16.00000	0.51613	0.71842
Y	136.00000	4.25000	688.00000	3.54839	1.88372

Descriptive Statistics

Variable	Label
Intercept	Intercept
X1	
X2	
X3	
Y	Hand-Steadiness

Correlation

Variable	Label	X1	X2	X3	Y
X1		1.0000	0.5000	0.5000	-0.6198
X2		0.5000	1.0000	0.5000	-0.5244
X3		0.5000	0.5000	1.0000	-0.3814
Y	Hand-Steadiness	-0.6198	-0.5244	-0.3814	1.0000

Data Listing

The REG Procedure

Model: A_MODEL

Dependent Variable: Y Hand-Steadiness

Number of Observations Read	32
Number of Observations Used	32

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	49.00000	16.33333	7.50	0.0008
Error	28	61.00000	2.17857		
Corrected Total	31	110.00000			

Root MSE	1.47600	R-Square	0.4455
Dependent Mean	4.25000	Adj R-Sq	0.3860
Coeff Var	34.72938		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	4.25000	0.26092	16.29	<.0001
X1		1	-1.25000	0.45193	-2.77	0.0099
X2		1	-0.75000	0.45193	-1.66	0.1082
X3		1	0	0.45193	0.00	1.0000

Parameter Estimates

Variable	Label	DF	Type II SS	Squared Semi-partial Corr Type II	Squared Partial Corr Type II
Intercept	Intercept	1	578.00000	.	.
X1		1	16.66667	0.15152	0.21459
X2		1	6.00000	0.05455	0.08955
X3		1	0	0	0

Data Listing

The REG Procedure

Model: A_MODEL

Dependent Variable: Y Hand-Steadiness

Output Statistics

Obs	Dependent Variable	Predicted Value	Residual
1	4.0000	3.0000	1.0000
2	6.0000	3.0000	3.0000
3	3.0000	3.0000	0
4	3.0000	3.0000	0
5	1.0000	3.0000	-2.0000
6	3.0000	3.0000	0
7	2.0000	3.0000	-1.0000
8	2.0000	3.0000	-1.0000
9	4.0000	3.5000	0.5000
10	5.0000	3.5000	1.5000
11	4.0000	3.5000	0.5000
12	3.0000	3.5000	-0.5000
13	2.0000	3.5000	-1.5000
14	3.0000	3.5000	-0.5000
15	4.0000	3.5000	0.5000
16	3.0000	3.5000	-0.5000
17	5.0000	4.2500	0.7500
18	6.0000	4.2500	1.7500
19	5.0000	4.2500	0.7500
20	4.0000	4.2500	-0.2500
21	3.0000	4.2500	-1.2500
22	4.0000	4.2500	-0.2500
23	3.0000	4.2500	-1.2500
24	4.0000	4.2500	-0.2500
25	3.0000	6.2500	-3.2500
26	5.0000	6.2500	-1.2500
27	6.0000	6.2500	-0.2500
28	5.0000	6.2500	-1.2500
29	6.0000	6.2500	-0.2500
30	7.0000	6.2500	0.7500
31	8.0000	6.2500	1.7500
32	10.0000	6.2500	3.7500

Sum of Residuals	0
Sum of Squared Residuals	61.00000
Predicted Residual SS (PRESS)	79.67347

Data Listing

The REG Procedure

Model: A_MODEL

Test A_TEST Results for Dependent Variable Y

Source	DF	Mean Square	F Value	Pr > F
Numerator	3	16.33333	7.50	0.0008
Denominator	28	2.17857		

Data Listing

Obs	Y	A	PI
1	3	1	1
2	4	2	1
3	4	3	1
4	3	4	1
5	2	1	2
6	4	2	2
7	4	3	2
8	5	4	2
9	2	1	3
10	3	2	3
11	3	3	3
12	6	4	3
13	3	1	4
14	3	2	4
15	3	3	4
16	5	4	4
17	1	1	5
18	2	2	5
19	4	3	5
20	7	4	5
21	3	1	6
22	3	2	6
23	6	3	6
24	6	4	6
25	4	1	7
26	4	2	7
27	5	3	7
28	10	4	7
29	6	1	8
30	5	2	8
31	5	3	8
32	8	4	8

A*PI Interaction Effect Included in the Model

The GLM Procedure

Class Level Information

Class	Levels	Values
A	4	1st Level 2nd Level 3rd Level 4th Level
PI	8	1 2 3 4 5 6 7 8

Number of Observations Read	32
Number of Observations Used	32

A*PI Interaction Effect Included in the Model

The GLM Procedure

Dependent Variable: Y Dependent Variable

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	110.0000000	3.5483871	.	.
Error	0	0.0000000	.		
Corrected Total	31	110.0000000			

R-Square	Coeff Var	Root MSE	Y Mean
1.000000	.	.	4.250000

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	3	49.0000000	16.33333333	.	.
PI	7	31.5000000	4.5000000	.	.
A*PI	21	29.5000000	1.40476190	.	.

Tests of Hypotheses Using the Type III MS for A*PI as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	3	49.0000000	16.33333333	11.63	0.0001

A*PI Interaction Effect Included in the Model

The GLM Procedure

Observation	Observed	Predicted	Residual
1	3.00000000	3.00000000	0.00000000
2	4.00000000	4.00000000	0.00000000
3	4.00000000	4.00000000	0.00000000
4	3.00000000	3.00000000	0.00000000
5	2.00000000	2.00000000	0.00000000
6	4.00000000	4.00000000	0.00000000
7	4.00000000	4.00000000	0.00000000
8	5.00000000	5.00000000	0.00000000
9	2.00000000	2.00000000	0.00000000
10	3.00000000	3.00000000	0.00000000
11	3.00000000	3.00000000	0.00000000
12	6.00000000	6.00000000	0.00000000
13	3.00000000	3.00000000	0.00000000
14	3.00000000	3.00000000	0.00000000
15	3.00000000	3.00000000	0.00000000
16	5.00000000	5.00000000	0.00000000
17	1.00000000	1.00000000	0.00000000
18	2.00000000	2.00000000	0.00000000
19	4.00000000	4.00000000	0.00000000
20	7.00000000	7.00000000	0.00000000
21	3.00000000	3.00000000	0.00000000
22	3.00000000	3.00000000	0.00000000
23	6.00000000	6.00000000	0.00000000
24	6.00000000	6.00000000	0.00000000
25	4.00000000	4.00000000	0.00000000
26	4.00000000	4.00000000	0.00000000
27	5.00000000	5.00000000	0.00000000
28	10.00000000	10.00000000	0.00000000
29	6.00000000	6.00000000	0.00000000
30	5.00000000	5.00000000	0.00000000
31	5.00000000	5.00000000	0.00000000
32	8.00000000	8.00000000	0.00000000

A*PI Interaction Effect Included in the Model

The GLM Procedure

Sum of Residuals	5.306866E-14
Sum of Squared Residuals	1.103912E-28
Sum of Squared Residuals - Error SS	1.103912E-28
First Order Autocorrelation	0
Durbin-Watson D	0

A*PI Interaction Effect Included in the Model

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Bonferroni

Standard Errors and Probabilities Calculated Using the Type III MS for A*PI as an
Error Term

A	Y LSMEAN	Standard Error	Pr > t	LSMEAN Number
1st Level	3.0000000	0.41904085	<.0001	1
2nd Level	3.5000000	0.41904085	<.0001	2
3rd Level	4.2500000	0.41904085	<.0001	3
4th Level	6.2500000	0.41904085	<.0001	4

Least Squares Means for Effect A
t for H0: LSMean(i)=LSMean(j) / Pr > |t|

Dependent Variable: Y

i/j	1	2	3	4
1		-0.84372	-2.1093	-5.48418
		1.0000	0.2826	0.0001
2	0.843721		-1.26558	-4.64046
	1.0000		1.0000	0.0008
3	2.109301	1.265581		-3.37488
	0.2826	1.0000		0.0172
4	5.484184	4.640463	3.374882	
	0.0001	0.0008	0.0172	

A	Y LSMEAN	95% Confidence Limits	
1st Level	3.000000	2.128557	3.871443
2nd Level	3.500000	2.628557	4.371443
3rd Level	4.250000	3.378557	5.121443
4th Level	6.250000	5.378557	7.121443

A*PI Interaction Effect Excluded from the Model

The GLM Procedure

Class Level Information

Class	Levels	Values
A	4	1st Level 2nd Level 3rd Level 4th Level
PI	8	1 2 3 4 5 6 7 8

Number of Observations Read	32
Number of Observations Used	32

A*PI Interaction Effect Excluded from the Model

The GLM Procedure

Dependent Variable: Y Dependent Variable

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	10	80.5000000	8.0500000	5.73	0.0004
Error	21	29.5000000	1.4047619		
Corrected Total	31	110.0000000			

R-Square	Coeff Var	Root MSE	Y Mean
0.731818	27.88768	1.185227	4.250000

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	3	49.0000000	16.33333333	11.63	0.0001
PI	7	31.5000000	4.5000000	3.20	0.0180

A*PI Interaction Effect Excluded from the Model

The GLM Procedure

Observation	Observed	Predicted	Residual
1	3.00000000	2.25000000	0.75000000
2	4.00000000	2.75000000	1.25000000
3	4.00000000	3.50000000	0.50000000
4	3.00000000	5.50000000	-2.50000000
5	2.00000000	2.50000000	-0.50000000
6	4.00000000	3.00000000	1.00000000
7	4.00000000	3.75000000	0.25000000
8	5.00000000	5.75000000	-0.75000000
9	2.00000000	2.25000000	-0.25000000
10	3.00000000	2.75000000	0.25000000
11	3.00000000	3.50000000	-0.50000000
12	6.00000000	5.50000000	0.50000000
13	3.00000000	2.25000000	0.75000000
14	3.00000000	2.75000000	0.25000000
15	3.00000000	3.50000000	-0.50000000
16	5.00000000	5.50000000	-0.50000000
17	1.00000000	2.25000000	-1.25000000
18	2.00000000	2.75000000	-0.75000000
19	4.00000000	3.50000000	0.50000000
20	7.00000000	5.50000000	1.50000000
21	3.00000000	3.25000000	-0.25000000
22	3.00000000	3.75000000	-0.75000000
23	6.00000000	4.50000000	1.50000000
24	6.00000000	6.50000000	-0.50000000
25	4.00000000	4.50000000	-0.50000000
26	4.00000000	5.00000000	-1.00000000
27	5.00000000	5.75000000	-0.75000000
28	10.00000000	7.75000000	2.25000000
29	6.00000000	4.75000000	1.25000000
30	5.00000000	5.25000000	-0.25000000
31	5.00000000	6.00000000	-1.00000000
32	8.00000000	8.00000000	0.00000000

A*PI Interaction Effect Excluded from the Model

The GLM Procedure

Sum of Residuals	-0.00000000
Sum of Squared Residuals	29.50000000
Sum of Squared Residuals - Error SS	-0.00000000
First Order Autocorrelation	0.13559322
Durbin-Watson D	1.70974576

A*PI Interaction Effect Excluded from the Model

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Bonferroni

A	Y LSMEAN	Standard Error	Pr > t	LSMEAN Number
1st Level	3.0000000	0.41904085	<.0001	1
2nd Level	3.5000000	0.41904085	<.0001	2
3rd Level	4.2500000	0.41904085	<.0001	3
4th Level	6.2500000	0.41904085	<.0001	4

Least Squares Means for Effect A
t for H0: LSMean(i)=LSMean(j) / Pr > |t|

Dependent Variable: Y

i/j	1	2	3	4
1		-0.84372	-2.1093	-5.48418
		1.0000	0.2826	0.0001
2	0.843721		-1.26558	-4.64046
	1.0000		1.0000	0.0008
3	2.109301	1.265581		-3.37488
	0.2826	1.0000		0.0172
4	5.484184	4.640463	3.374882	
	0.0001	0.0008	0.0172	

A	Y LSMEAN	95% Confidence Limits	
1st Level	3.000000	2.128557	3.871443
2nd Level	3.500000	2.628557	4.371443
3rd Level	4.250000	3.378557	5.121443
4th Level	6.250000	5.378557	7.121443

Data listing

Obs	A	Y	YHAT	E
1	1st Level	3	2.25	0.75
2	2nd Level	4	2.75	1.25
3	3rd Level	4	3.50	0.50
4	4th Level	3	5.50	-2.50
5	1st Level	2	2.50	-0.50
6	2nd Level	4	3.00	1.00
7	3rd Level	4	3.75	0.25
8	4th Level	5	5.75	-0.75
9	1st Level	2	2.25	-0.25
10	2nd Level	3	2.75	0.25
11	3rd Level	3	3.50	-0.50
12	4th Level	6	5.50	0.50
13	1st Level	3	2.25	0.75
14	2nd Level	3	2.75	0.25
15	3rd Level	3	3.50	-0.50
16	4th Level	5	5.50	-0.50
17	1st Level	1	2.25	-1.25
18	2nd Level	2	2.75	-0.75
19	3rd Level	4	3.50	0.50
20	4th Level	7	5.50	1.50
21	1st Level	3	3.25	-0.25
22	2nd Level	3	3.75	-0.75
23	3rd Level	6	4.50	1.50
24	4th Level	6	6.50	-0.50
25	1st Level	4	4.50	-0.50
26	2nd Level	4	5.00	-1.00
27	3rd Level	5	5.75	-0.75
28	4th Level	10	7.75	2.25
29	1st Level	6	4.75	1.25
30	2nd Level	5	5.25	-0.25
31	3rd Level	5	6.00	-1.00
32	4th Level	8	8.00	0.00

Simple Pearson product-moment correlations

The CORR Procedure

3 Variables: Y YHAT E

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Y	32	4.25000	1.88372	136.00000	1.00000	10.00000
YHAT	32	4.25000	1.61145	136.00000	2.25000	8.00000
E	32	0	0.97551	0	-2.50000	2.25000

Simple Statistics

Variable Label

Y	Dependent Variable
YHAT	Predicted Y
E	Error in Prediction

Pearson Correlation Coefficients, N = 32

Prob > |r| under H0: Rho=0

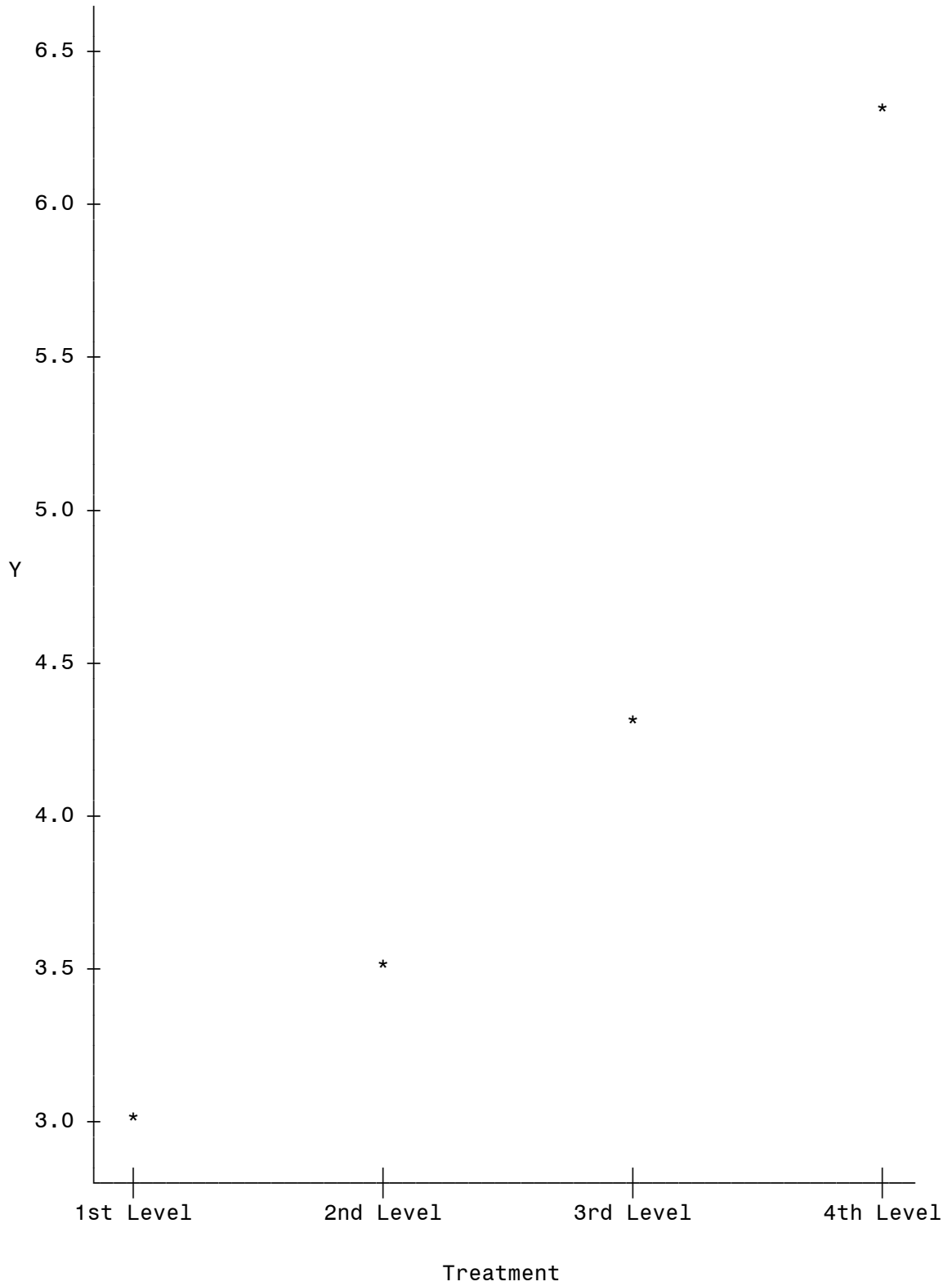
	Y	YHAT	E
Y Dependent Variable	1.00000	0.85546 <.0001	0.51786 0.0024
YHAT Predicted Y	0.85546 <.0001	1.00000	0.00000 1.0000
E Error in Prediction	0.51786 0.0024	0.00000 1.0000	1.00000

Listing of MEANS dataset

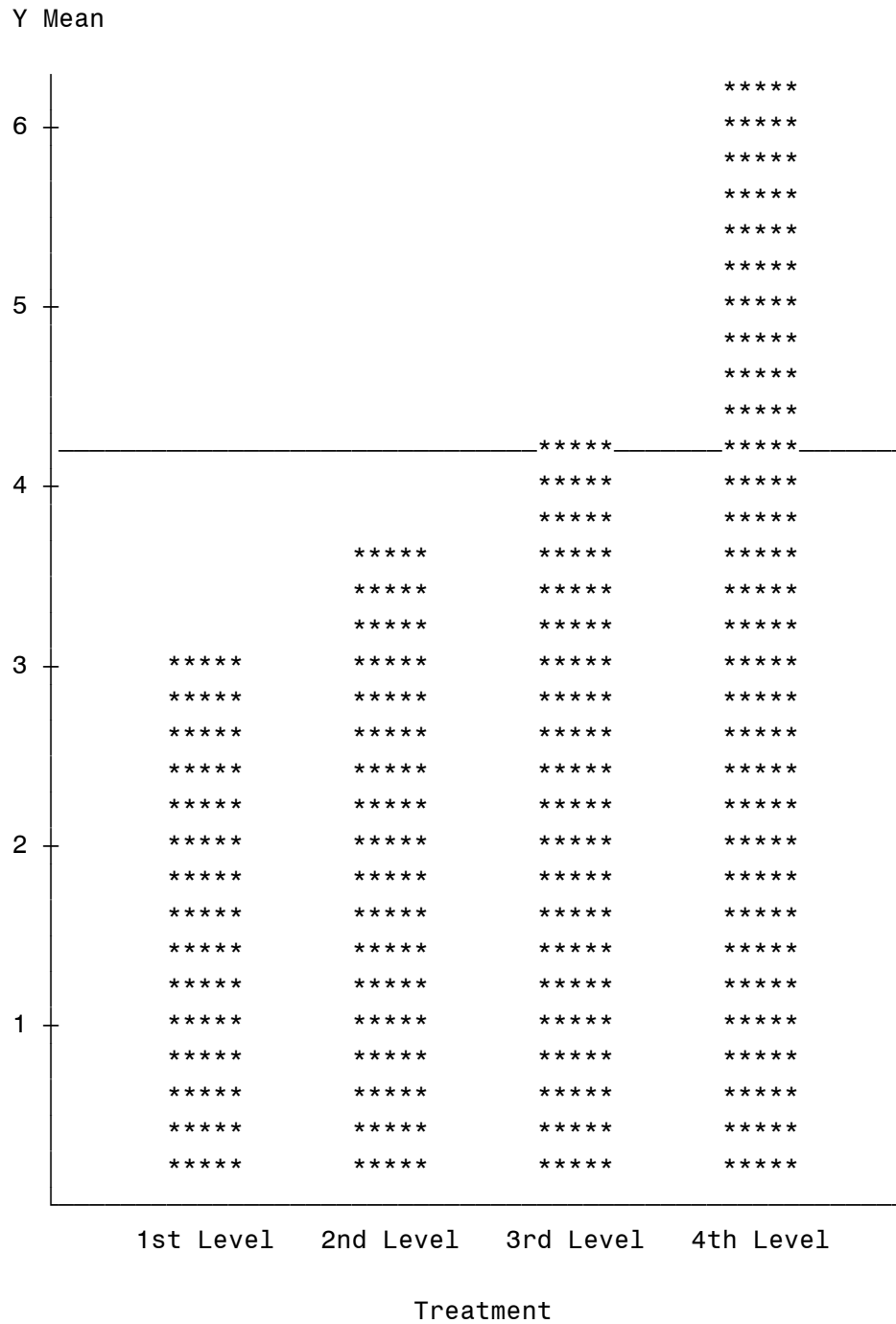
Obs	A	LSMEAN
1	1st Level	3.00
2	2nd Level	3.50
3	3rd Level	4.25
4	4th Level	6.25

Plot of A means

Plot of LSMEAN*A. Symbol used is '*'.



Bar Graph of A-effect Means



Data listing

Obs	Y1	Y2	Y3	Y4
1	3	4	4	3
2	2	4	4	5
3	2	3	3	6
4	3	3	3	5
5	1	2	4	7
6	3	3	6	6
7	4	4	5	10
8	6	5	5	8

MANOVA Approach through the REPEATED subcommand

The GLM Procedure

Number of Observations Read	8
Number of Observations Used	8

MANOVA Approach through the REPEATED subcommand

The GLM Procedure
 Repeated Measures Analysis of Variance

Repeated Measures Level Information

Dependent Variable	Y1	Y2	Y3	Y4
Level of A	1	2	3	4

MANOVA Test Criteria and Exact F Statistics for the Hypothesis of no A Effect

H = Type III SSCP Matrix for A

E = Error SSCP Matrix

S=1 M=0.5 N=1.5

Statistic	Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda	0.24580793	5.11	3	5	0.0554
Pillai's Trace	0.75419207	5.11	3	5	0.0554
Hotelling-Lawley Trace	3.06821705	5.11	3	5	0.0554
Roy's Greatest Root	3.06821705	5.11	3	5	0.0554

MANOVA Approach through the REPEATED subcommand

The GLM Procedure
 Repeated Measures Analysis of Variance
 Univariate Tests of Hypotheses for Within Subject Effects

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	3	49.00000000	16.33333333	11.63	0.0001
Error(A)	21	29.50000000	1.40476190		

Source	Adj Pr > F	
	G - G	H - F
A	0.0015	0.0003
Error(A)		

Greenhouse-Geisser Epsilon	0.6195
Huynh-Feldt Epsilon	0.8343

Data Listing

Obs	Y	A	B	C
1	1	1	1	1
2	2	1	1	1
3	2	2	1	2
4	3	2	1	2
5	5	3	1	3
6	6	3	1	3
7	9	4	1	4
8	8	4	1	4
9	3	2	2	1
10	4	2	2	1
11	8	3	2	2
12	6	3	2	2
13	9	4	2	3
14	8	4	2	3
15	2	1	2	4
16	3	1	2	4
17	5	3	3	1
18	7	3	3	1
19	10	4	3	2
20	11	4	3	2
21	3	1	3	3
22	2	1	3	3
23	5	2	3	4
24	4	2	3	4
25	7	4	4	1
26	10	4	4	1
27	6	1	4	2
28	3	1	4	2
29	3	2	4	3
30	4	2	4	3
31	6	3	4	4
32	7	3	4	4

Residual Effect Excluded

The GLM Procedure

Class Level Information

Class	Levels	Values
A	4	Compound #1 Compound #2 Compound #3 Compound #4
B	4	1 2 3 4
C	4	1 2 3 4

Number of Observations Read	32
Number of Observations Used	32

Residual Effect Excluded

The GLM Procedure

Dependent Variable: Y Thickness of Tread

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	211.5000000	23.5000000	21.54	<.0001
Error	22	24.0000000	1.0909091		
Corrected Total	31	235.5000000			

R-Square	Coeff Var	Root MSE	Y Mean
0.898089	19.43192	1.044466	5.375000

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	3	194.5000000	64.8333333	59.43	<.0001
B	3	9.2500000	3.0833333	2.83	0.0622
C	3	7.7500000	2.5833333	2.37	0.0983

Residual Effect Excluded

The GLM Procedure

Observation	Observed	Predicted	Residual
1	1.00000000	1.37500000	-0.37500000
2	2.00000000	1.37500000	0.62500000
3	2.00000000	3.37500000	-1.37500000
4	3.00000000	3.37500000	-0.37500000
5	5.00000000	5.00000000	0.00000000
6	6.00000000	5.00000000	1.00000000
7	9.00000000	8.25000000	0.75000000
8	8.00000000	8.25000000	-0.25000000
9	3.00000000	3.00000000	0.00000000
10	4.00000000	3.00000000	1.00000000
11	8.00000000	7.00000000	1.00000000
12	6.00000000	7.00000000	-1.00000000
13	9.00000000	8.62500000	0.37500000
14	8.00000000	8.62500000	-0.62500000
15	2.00000000	2.87500000	-0.87500000
16	3.00000000	2.87500000	0.12500000
17	5.00000000	6.25000000	-1.25000000
18	7.00000000	6.25000000	0.75000000
19	10.00000000	10.25000000	-0.25000000
20	11.00000000	10.25000000	0.75000000
21	3.00000000	2.87500000	0.12500000
22	2.00000000	2.87500000	-0.87500000
23	5.00000000	4.12500000	0.87500000
24	4.00000000	4.12500000	-0.12500000
25	7.00000000	8.87500000	-1.87500000
26	10.00000000	8.87500000	1.12500000
27	6.00000000	3.87500000	2.12500000
28	3.00000000	3.87500000	-0.87500000
29	3.00000000	3.50000000	-0.50000000
30	4.00000000	3.50000000	0.50000000
31	6.00000000	6.75000000	-0.75000000
32	7.00000000	6.75000000	0.25000000

Residual Effect Excluded

The GLM Procedure

Sum of Residuals	-0.00000000
Sum of Squared Residuals	24.00000000
Sum of Squared Residuals - Error SS	-0.00000000
First Order Autocorrelation	-0.17773438
Durbin-Watson D	2.34700521

Residual Effect Excluded
Residual Effect Included as the A*B*C effect

The GLM Procedure

Class Level Information

Class	Levels	Values
A	4	Compound #1 Compound #2 Compound #3 Compound #4
B	4	1 2 3 4
C	4	1 2 3 4

Number of Observations Read	32
Number of Observations Used	32

Residual Effect Excluded
Residual Effect Included as the A*B*C effect

The GLM Procedure

Dependent Variable: Y Thickness of Tread

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	15	216.5000000	14.4333333	12.15	<.0001
Error	16	19.0000000	1.1875000		
Corrected Total	31	235.5000000			

R-Square	Coeff Var	Root MSE	Y Mean
0.919321	20.27395	1.089725	5.375000

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	3	194.5000000	64.8333333	54.60	<.0001
B	3	9.2500000	3.0833333	2.60	0.0884
C	3	7.7500000	2.5833333	2.18	0.1308
A*B*C	6	5.0000000	0.8333333	0.70	0.6525

Residual Effect Excluded
Residual Effect Included as the A*B*C effect

The GLM Procedure

Observation	Observed	Predicted	Residual
1	1.00000000	1.50000000	-0.50000000
2	2.00000000	1.50000000	0.50000000
3	2.00000000	2.50000000	-0.50000000
4	3.00000000	2.50000000	0.50000000
5	5.00000000	5.50000000	-0.50000000
6	6.00000000	5.50000000	0.50000000
7	9.00000000	8.50000000	0.50000000
8	8.00000000	8.50000000	-0.50000000
9	3.00000000	3.50000000	-0.50000000
10	4.00000000	3.50000000	0.50000000
11	8.00000000	7.00000000	1.00000000
12	6.00000000	7.00000000	-1.00000000
13	9.00000000	8.50000000	0.50000000
14	8.00000000	8.50000000	-0.50000000
15	2.00000000	2.50000000	-0.50000000
16	3.00000000	2.50000000	0.50000000
17	5.00000000	6.00000000	-1.00000000
18	7.00000000	6.00000000	1.00000000
19	10.00000000	10.50000000	-0.50000000
20	11.00000000	10.50000000	0.50000000
21	3.00000000	2.50000000	0.50000000
22	2.00000000	2.50000000	-0.50000000
23	5.00000000	4.50000000	0.50000000
24	4.00000000	4.50000000	-0.50000000
25	7.00000000	8.50000000	-1.50000000
26	10.00000000	8.50000000	1.50000000
27	6.00000000	4.50000000	1.50000000
28	3.00000000	4.50000000	-1.50000000
29	3.00000000	3.50000000	-0.50000000
30	4.00000000	3.50000000	0.50000000
31	6.00000000	6.50000000	-0.50000000
32	7.00000000	6.50000000	0.50000000

Residual Effect Excluded
Residual Effect Included as the A*B*C effect

The GLM Procedure

Sum of Residuals	-0.00000000
Sum of Squared Residuals	19.00000000
Sum of Squared Residuals - Error SS	-0.00000000
First Order Autocorrelation	-0.35526316
Durbin-Watson D	2.68421053

Residual Effect Excluded
Residual Effect Included as the A*B*C effect

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Bonferroni

A	Y LSMEAN	Standard Error	Pr > t	LSMEAN Number
Compound #1	2.75000000	0.38527588	<.0001	1
Compound #2	3.50000000	0.38527588	<.0001	2
Compound #3	6.25000000	0.38527588	<.0001	3
Compound #4	9.00000000	0.38527588	<.0001	4

Least Squares Means for Effect A
t for H0: LSMean(i)=LSMean(j) / Pr > |t|

Dependent Variable: Y

i/j	1	2	3	4
1		-1.37649 1.0000	-6.42364 <.0001	-11.4708 <.0001
2	1.376494 1.0000		-5.04715 0.0007	-10.0943 <.0001
3	6.423641 <.0001	5.047146 0.0007		-5.04715 0.0007
4	11.47079 <.0001	10.09429 <.0001	5.047146 0.0007	

A	Y LSMEAN	95% Confidence Limits	
Compound #1	2.750000	1.933252	3.566748
Compound #2	3.500000	2.683252	4.316748
Compound #3	6.250000	5.433252	7.066748
Compound #4	9.000000	8.183252	9.816748

Data listing

Obs	A	B	C	Y	YHAT	E
1	Compound #1	1	1	1	1.5	-0.5
2	Compound #1	1	1	2	1.5	0.5
3	Compound #2	1	2	2	2.5	-0.5
4	Compound #2	1	2	3	2.5	0.5
5	Compound #3	1	3	5	5.5	-0.5
6	Compound #3	1	3	6	5.5	0.5
7	Compound #4	1	4	9	8.5	0.5
8	Compound #4	1	4	8	8.5	-0.5
9	Compound #2	2	1	3	3.5	-0.5
10	Compound #2	2	1	4	3.5	0.5
11	Compound #3	2	2	8	7.0	1.0
12	Compound #3	2	2	6	7.0	-1.0
13	Compound #4	2	3	9	8.5	0.5
14	Compound #4	2	3	8	8.5	-0.5
15	Compound #1	2	4	2	2.5	-0.5
16	Compound #1	2	4	3	2.5	0.5
17	Compound #3	3	1	5	6.0	-1.0
18	Compound #3	3	1	7	6.0	1.0
19	Compound #4	3	2	10	10.5	-0.5
20	Compound #4	3	2	11	10.5	0.5
21	Compound #1	3	3	3	2.5	0.5
22	Compound #1	3	3	2	2.5	-0.5
23	Compound #2	3	4	5	4.5	0.5
24	Compound #2	3	4	4	4.5	-0.5
25	Compound #4	4	1	7	8.5	-1.5
26	Compound #4	4	1	10	8.5	1.5
27	Compound #1	4	2	6	4.5	1.5
28	Compound #1	4	2	3	4.5	-1.5
29	Compound #2	4	3	3	3.5	-0.5
30	Compound #2	4	3	4	3.5	0.5
31	Compound #3	4	4	6	6.5	-0.5
32	Compound #3	4	4	7	6.5	0.5

Simple Pearson product-moment correlations

The CORR Procedure

3 Variables: Y YHAT E

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Y	32	5.37500	2.75622	172.00000	1.00000	11.00000
YHAT	32	5.37500	2.64270	172.00000	1.50000	10.50000
E	32	0	0.78288	0	-1.50000	1.50000

Simple Statistics

Variable Label

Y	Thickness of Tread
YHAT	Predicted Y
E	Error in Prediction

Pearson Correlation Coefficients, N = 32

Prob > |r| under H0: Rho=0

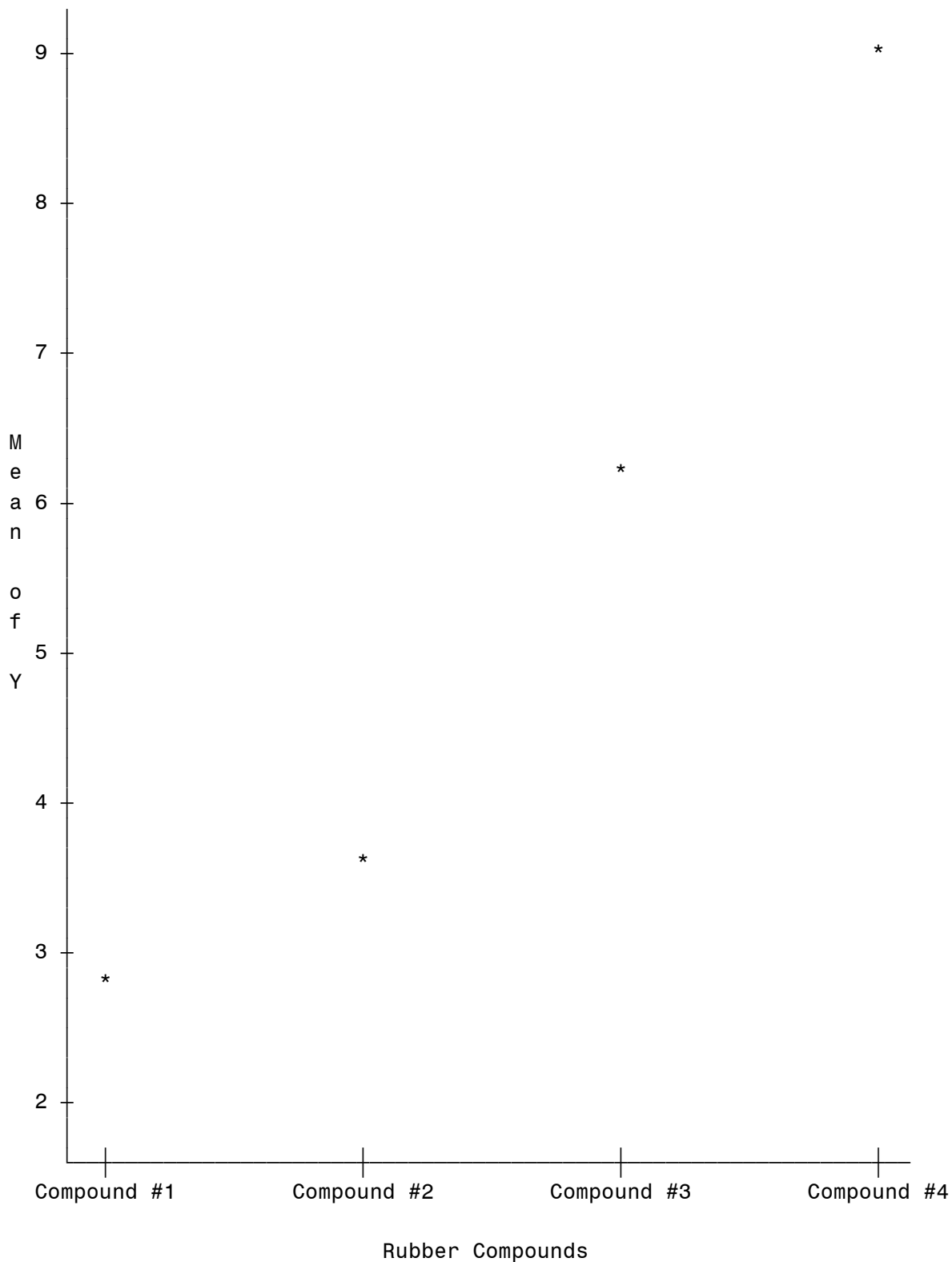
	Y	YHAT	E
Y Thickness of Tread	1.00000	0.95881 <.0001	0.28404 0.1151
YHAT Predicted Y	0.95881 <.0001	1.00000	0.00000 1.0000
E Error in Prediction	0.28404 0.1151	0.00000 1.0000	1.00000

Listing of AMEANS dataset

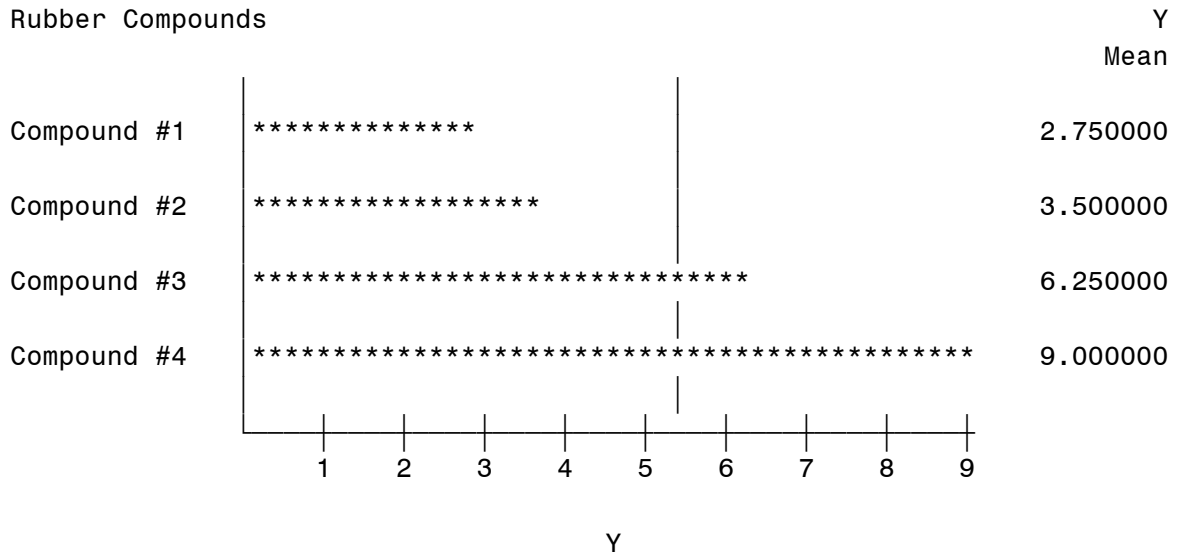
Obs	A	LSMEAN
1	Compound #1	2.75
2	Compound #2	3.50
3	Compound #3	6.25
4	Compound #4	9.00

Plot of A Effect means

Plot of LSMEAN*A. Symbol used is '*'.



Bar Chart of A-effect Means



Data Listing

Obs	Attitude towards Minority Groups	Type of Beat	Length of Training Course
1	24	Upperclass Beat	5 hrs. Training
2	33	Upperclass Beat	5 hrs. Training
3	37	Upperclass Beat	5 hrs. Training
4	29	Upperclass Beat	5 hrs. Training
5	42	Upperclass Beat	5 hrs. Training
6	44	Upperclass Beat	10 hrs. Training
7	36	Upperclass Beat	10 hrs. Training
8	25	Upperclass Beat	10 hrs. Training
9	27	Upperclass Beat	10 hrs. Training
10	43	Upperclass Beat	10 hrs. Training
11	38	Upperclass Beat	15 hrs. Training
12	29	Upperclass Beat	15 hrs. Training
13	28	Upperclass Beat	15 hrs. Training
14	47	Upperclass Beat	15 hrs. Training
15	48	Upperclass Beat	15 hrs. Training
16	30	Middleclass Beat	5 hrs. Training
17	21	Middleclass Beat	5 hrs. Training
18	39	Middleclass Beat	5 hrs. Training
19	26	Middleclass Beat	5 hrs. Training
20	34	Middleclass Beat	5 hrs. Training
21	35	Middleclass Beat	10 hrs. Training
22	40	Middleclass Beat	10 hrs. Training
23	27	Middleclass Beat	10 hrs. Training
24	31	Middleclass Beat	10 hrs. Training
25	22	Middleclass Beat	10 hrs. Training
26	26	Middleclass Beat	15 hrs. Training
27	27	Middleclass Beat	15 hrs. Training
28	36	Middleclass Beat	15 hrs. Training
29	46	Middleclass Beat	15 hrs. Training
30	45	Middleclass Beat	15 hrs. Training
31	21	Innercity Beat	5 hrs. Training
32	18	Innercity Beat	5 hrs. Training
33	10	Innercity Beat	5 hrs. Training
34	31	Innercity Beat	5 hrs. Training
35	20	Innercity Beat	5 hrs. Training
36	41	Innercity Beat	10 hrs. Training
37	39	Innercity Beat	10 hrs. Training
38	50	Innercity Beat	10 hrs. Training
39	36	Innercity Beat	10 hrs. Training
40	34	Innercity Beat	10 hrs. Training
41	42	Innercity Beat	15 hrs. Training

Data Listing

Obs	Attitude towards Minority Groups	Type of Beat	Length of Training Course
42	52	Innercity Beat	15 hrs. Training
43	53	Innercity Beat	15 hrs. Training
44	49	Innercity Beat	15 hrs. Training
45	64	Innercity Beat	15 hrs. Training

N = 45

A fixed, B fixed

The GLM Procedure

Class Level Information

Class	Levels	Values
A	3	Upperclass Beat Middleclass Beat Innercity Beat
B	3	5 hrs. Training 10 hrs. Training 15 hrs. Training

Number of Observations Read	45
Number of Observations Used	45

A fixed, B fixed

The GLM Procedure

Dependent Variable: Y Attitude towards Minority Groups

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	2970.000000	371.250000	5.94	<.0001
Error	36	2250.000000	62.500000		
Corrected Total	44	5220.000000			

R-Square	Coeff Var	Root MSE	Y Mean
0.568966	22.58770	7.905694	35.00000

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	2	190.000000	95.000000	1.52	0.2324
B	2	1543.333333	771.666667	12.35	<.0001
A*B	4	1236.666667	309.166667	4.95	0.0028

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
A within B[1]	2	463.333333	231.666667	3.71	0.0344
B within A[3]	2	2613.333333	1306.666667	20.91	<.0001
Psi[1(B)]	2	571.666667	285.833333	4.57	0.0170
Psi[2(A)]Psi[3(B)]	1	106.666667	106.666667	1.71	0.1997

A fixed, B fixed

The GLM Procedure
Least Squares Means

A	Y LSMEAN
Upperclass Beat	35.3333333
Middleclass Beat	32.3333333
Innercity Beat	37.3333333

A fixed, B fixed

The GLM Procedure
Least Squares Means

B	Y LSMEAN
5 hrs. Training	27.666667
10 hrs. Training	35.3333333
15 hrs. Training	42.0000000

A fixed, B fixed

The GLM Procedure
Least Squares Means

Adjustment for Multiple Comparisons: Scheffe

A	B	Y LSMEAN	Standard Error	Pr > t	LSMEAN Number
Upperclass Beat	5 hrs. Training	33.000000	3.5355339	<.0001	1
Upperclass Beat	10 hrs. Training	35.000000	3.5355339	<.0001	2
Upperclass Beat	15 hrs. Training	38.000000	3.5355339	<.0001	3
Middleclass Beat	5 hrs. Training	30.000000	3.5355339	<.0001	4
Middleclass Beat	10 hrs. Training	31.000000	3.5355339	<.0001	5
Middleclass Beat	15 hrs. Training	36.000000	3.5355339	<.0001	6
Innercity Beat	5 hrs. Training	20.000000	3.5355339	<.0001	7
Innercity Beat	10 hrs. Training	40.000000	3.5355339	<.0001	8
Innercity Beat	15 hrs. Training	52.000000	3.5355339	<.0001	9

Least Squares Means for Effect A*B
t for H0: LSMean(i)=LSMean(j) / Pr > |t|

Dependent Variable: Y

i/j	1	2	3	4	5
1		-0.4 1.0000	-1 0.9978	0.6 0.9999	0.4 1.0000
2	0.4 1.0000		-0.6 0.9999	1 0.9978	0.8 0.9996
3	1 0.9978	0.6 0.9999		1.6 0.9531	1.4 0.9790
4	-0.6 0.9999	-1 0.9978	-1.6 0.9531		-0.2 1.0000
5	-0.4 1.0000	-0.8 0.9996	-1.4 0.9790	0.2 1.0000	
6	0.6 0.9999	0.2 1.0000	-0.4 1.0000	1.2 0.9923	1 0.9978
7	-2.6 0.5701	-3 0.3704	-3.6 0.1535	-2 0.8480	-2.2 0.7674
8	1.4 0.9790	1 0.9978	0.4 1.0000	2 0.8480	1.8 0.9103
9	3.8 0.1083	3.4 0.2119	2.8 0.4672	4.4 0.0333	4.2 0.0503

A fixed, B fixed

The GLM Procedure
Least Squares Means

Adjustment for Multiple Comparisons: Scheffe

Least Squares Means for Effect A*B
t for H0: LSMean(i)=LSMean(j) / Pr > |t|

Dependent Variable: Y

i/j	6	7	8	9
1	-0.6 0.9999	2.6 0.5701	-1.4 0.9790	-3.8 0.1083
2	-0.2 1.0000	3 0.3704	-1 0.9978	-3.4 0.2119
3	0.4 1.0000	3.6 0.1535	-0.4 1.0000	-2.8 0.4672
4	-1.2 0.9923	2 0.8480	-2 0.8480	-4.4 0.0333
5	-1 0.9978	2.2 0.7674	-1.8 0.9103	-4.2 0.0503
6		3.2 0.2844	-0.8 0.9996	-3.2 0.2844
7	-3.2 0.2844		-4 0.0747	-6.4 0.0003
8	0.8 0.9996	4 0.0747		-2.4 0.6726
9	3.2 0.2844	6.4 0.0003	2.4 0.6726	

A	B	Y LSMEAN	98.33333% Confidence Limits	
Upperclass Beat	5 hrs. Training	33.000000	24.122135	41.877865
Upperclass Beat	10 hrs. Training	35.000000	26.122135	43.877865
Upperclass Beat	15 hrs. Training	38.000000	29.122135	46.877865
Middleclass Beat	5 hrs. Training	30.000000	21.122135	38.877865
Middleclass Beat	10 hrs. Training	31.000000	22.122135	39.877865
Middleclass Beat	15 hrs. Training	36.000000	27.122135	44.877865
Innercity Beat	5 hrs. Training	20.000000	11.122135	28.877865
Innercity Beat	10 hrs. Training	40.000000	31.122135	48.877865
Innercity Beat	15 hrs. Training	52.000000	43.122135	60.877865

A fixed, B fixed

The GLM Procedure
Least Squares Means

A	B	Y LSMEAN
Upperclass Beat	5 hrs. Training	33.0000000
Upperclass Beat	10 hrs. Training	35.0000000
Upperclass Beat	15 hrs. Training	38.0000000
Middleclass Beat	5 hrs. Training	30.0000000
Middleclass Beat	10 hrs. Training	31.0000000
Middleclass Beat	15 hrs. Training	36.0000000
Innercity Beat	5 hrs. Training	20.0000000
Innercity Beat	10 hrs. Training	40.0000000
Innercity Beat	15 hrs. Training	52.0000000

A fixed, B fixed

The GLM Procedure
Least Squares Means

A*B Effect Sliced by A for Y

A	DF	Sum of Squares	Mean Square	F Value	Pr > F
Upperclass Beat	2	63.333333	31.666667	0.51	0.6067
Middleclass Beat	2	103.333333	51.666667	0.83	0.4456
Innercity Beat	2	2613.333333	1306.666667	20.91	<.0001

A fixed, B fixed

The GLM Procedure
Least Squares Means

A	B	Y LSMEAN
Upperclass Beat	5 hrs. Training	33.0000000
Upperclass Beat	10 hrs. Training	35.0000000
Upperclass Beat	15 hrs. Training	38.0000000
Middleclass Beat	5 hrs. Training	30.0000000
Middleclass Beat	10 hrs. Training	31.0000000
Middleclass Beat	15 hrs. Training	36.0000000
Innercity Beat	5 hrs. Training	20.0000000
Innercity Beat	10 hrs. Training	40.0000000
Innercity Beat	15 hrs. Training	52.0000000

A fixed, B fixed

The GLM Procedure
Least Squares Means

A*B Effect Sliced by B for Y

B	DF	Sum of Squares	Mean Square	F Value	Pr > F
5 hrs. Training	2	463.333333	231.666667	3.71	0.0344
10 hrs. Training	2	203.333333	101.666667	1.63	0.2107
15 hrs. Training	2	760.000000	380.000000	6.08	0.0053

A fixed, B random: Test of the A main effect

The GLM Procedure

Dependent Variable: Y Attitude towards Minority Groups

Tests of Hypotheses Using the Type III MS for A*B as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	2	190.0000000	95.0000000	0.31	0.7514

A random, B fixed: Test of the B main effect

The GLM Procedure

Dependent Variable: Y Attitude towards Minority Groups

Tests of Hypotheses Using the Type III MS for A*B as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
B	2	1543.333333	771.666667	2.50	0.1979

A random, B random: Test of the A and B main effects

The GLM Procedure

Dependent Variable: Y Attitude towards Minority Groups

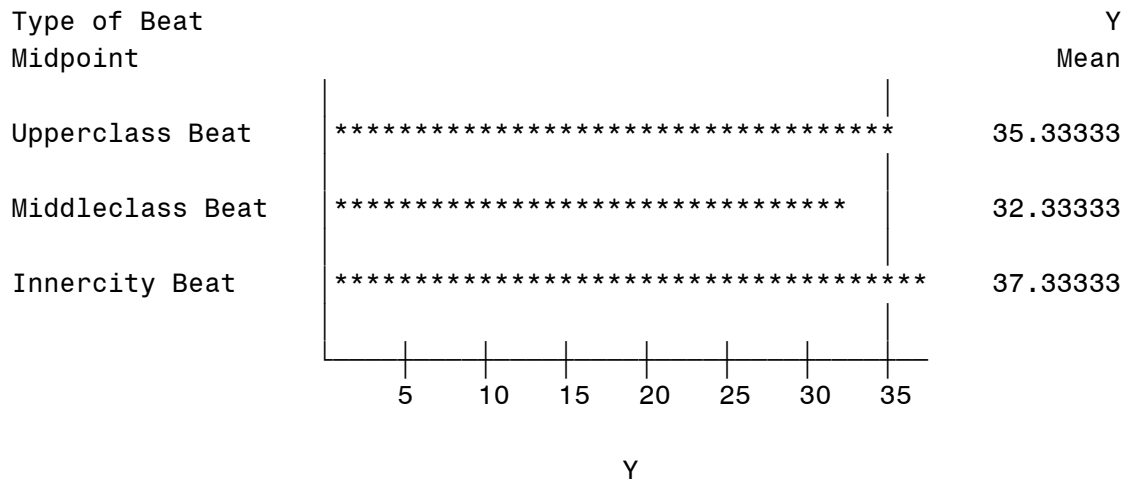
Tests of Hypotheses Using the Type III MS for A*B as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	2	190.000000	95.000000	0.31	0.7514
B	2	1543.333333	771.666667	2.50	0.1979

Listing of AMEANS Dataset

Type of Beat	Mean of Y
Upperclass Beat	35.3333
Middleclass Beat	32.3333
Innercity Beat	37.3333

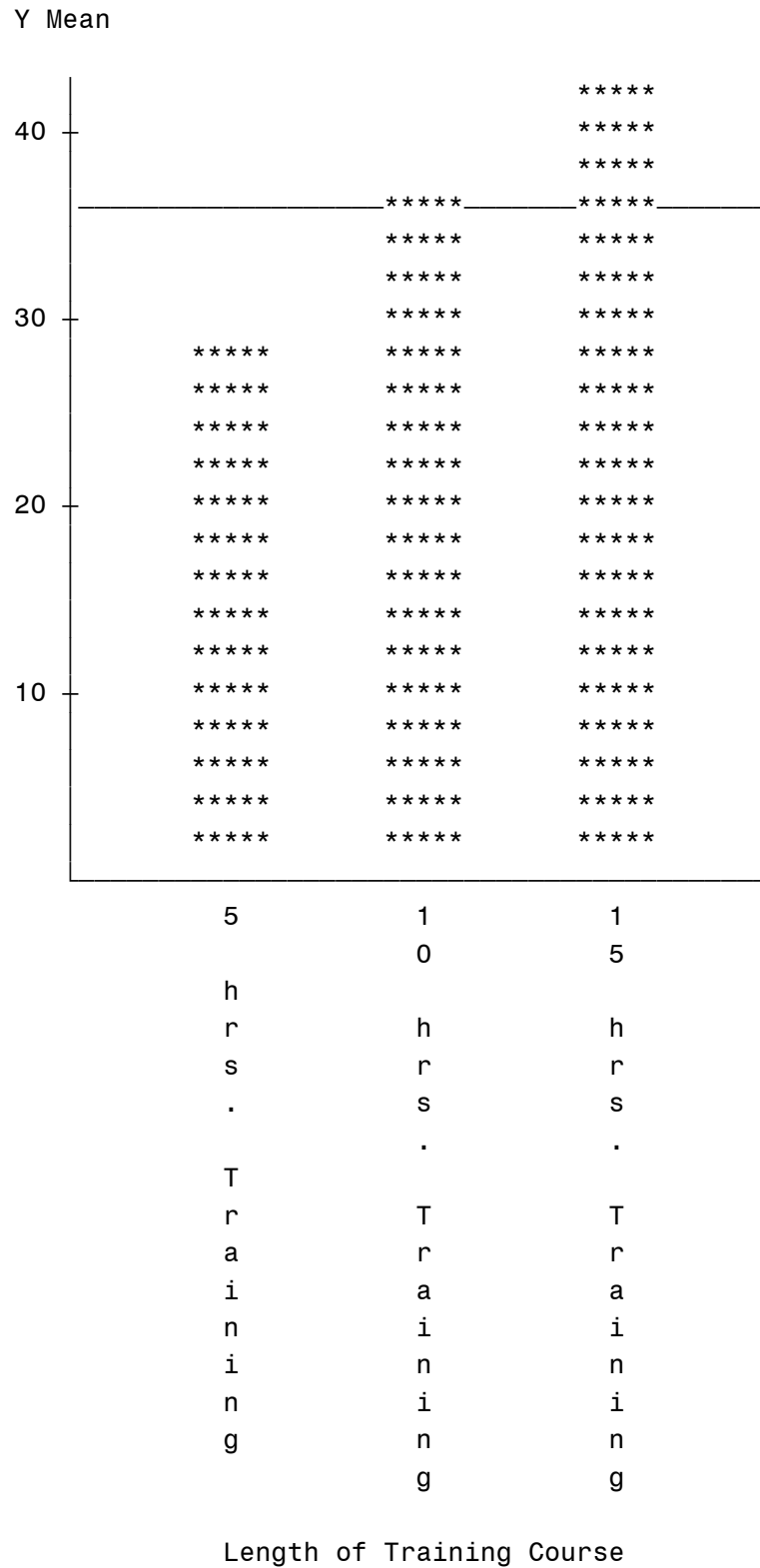
Bar Graph of A main-effect Means



Listing of BMEANS Dataset

Length of Training Course	Mean of Y
5 hrs. Training	27.6667
10 hrs. Training	35.3333
15 hrs. Training	42.0000

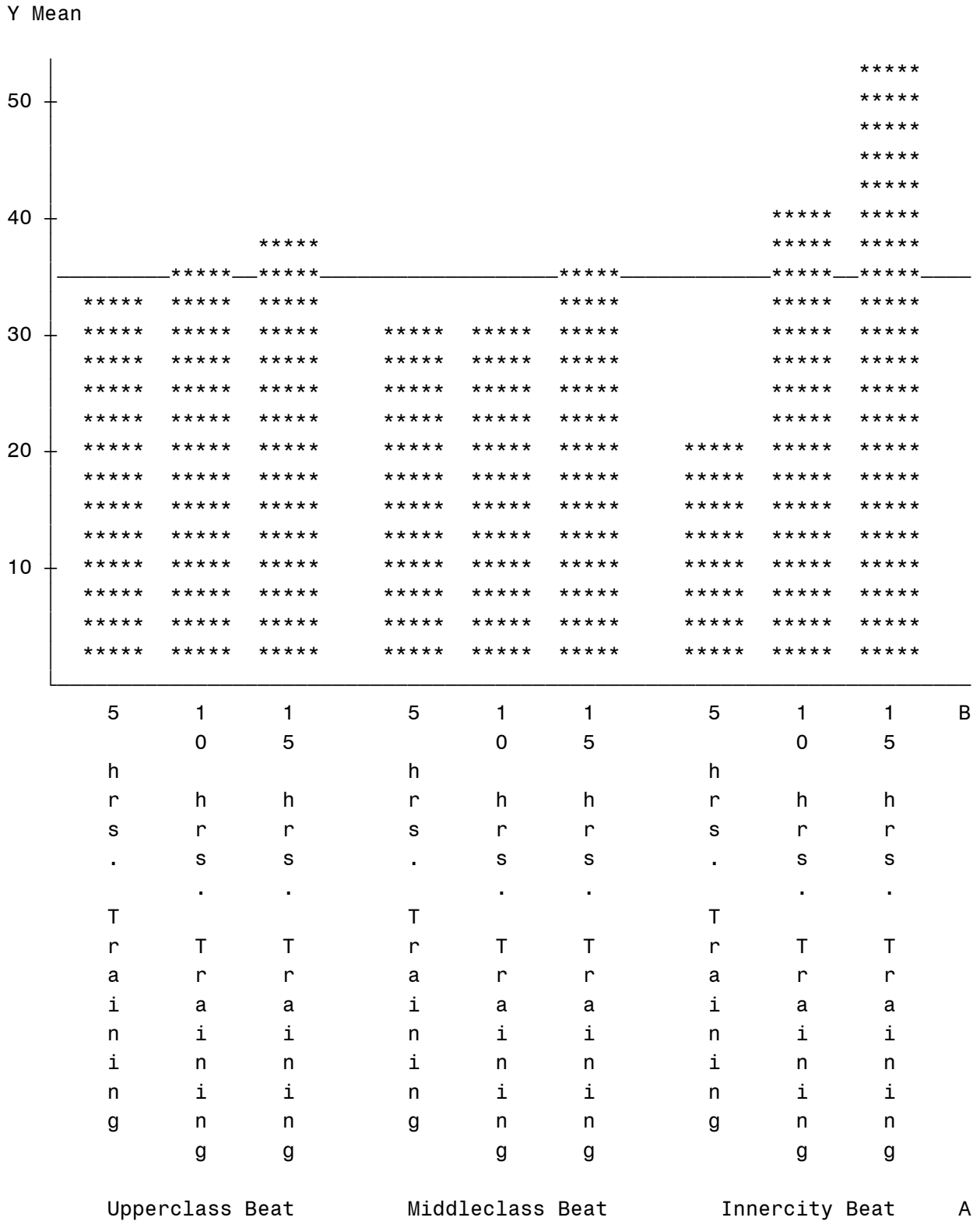
Bar Graph of B main-effect Means



Listing of ABMEANS Dataset

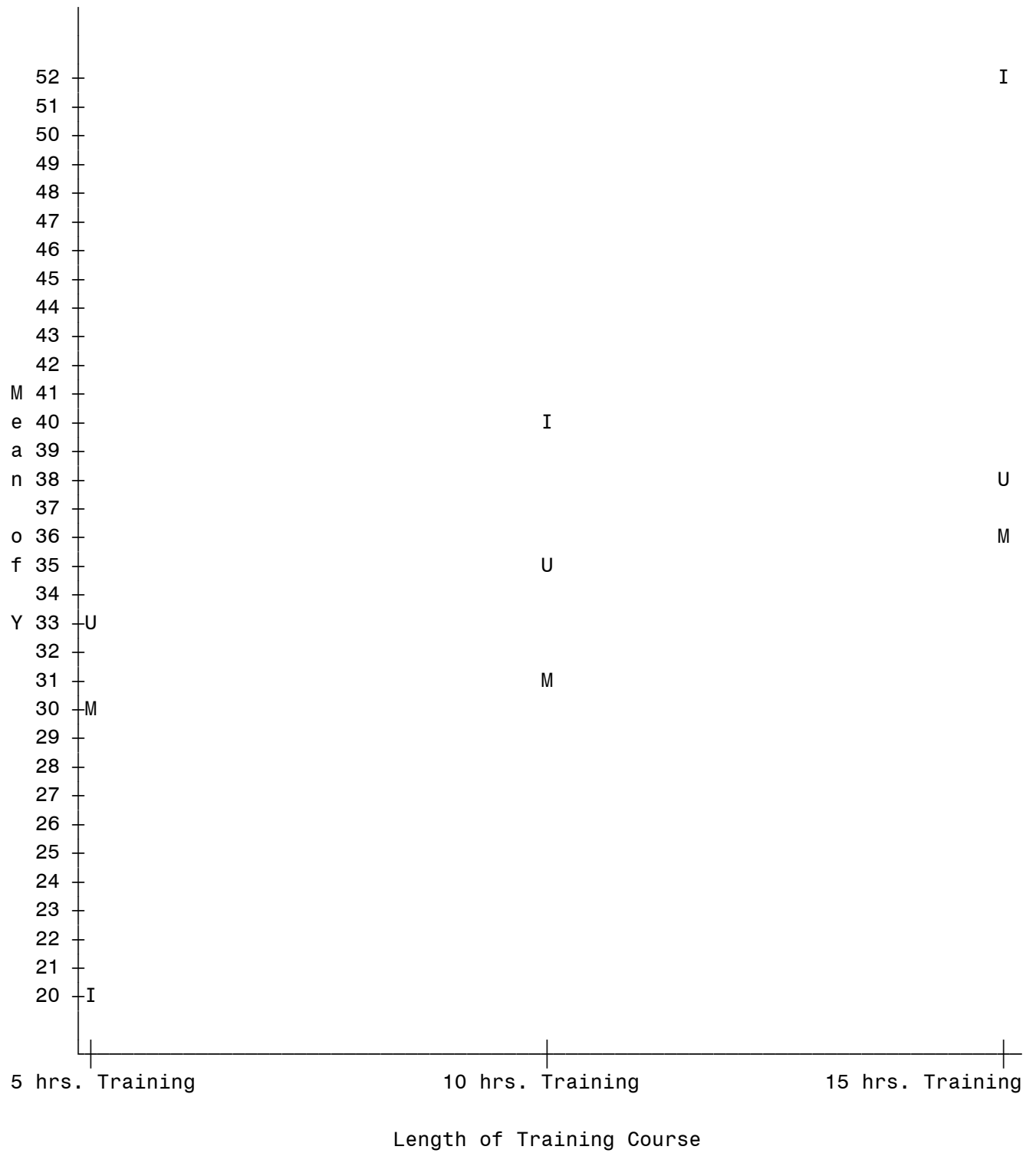
Type of Beat	Length of Training Course	Mean of Y
Upperclass Beat	5 hrs. Training	33
Upperclass Beat	10 hrs. Training	35
Upperclass Beat	15 hrs. Training	38
Middleclass Beat	5 hrs. Training	30
Middleclass Beat	10 hrs. Training	31
Middleclass Beat	15 hrs. Training	36
Innercity Beat	5 hrs. Training	20
Innercity Beat	10 hrs. Training	40
Innercity Beat	15 hrs. Training	52

Bar Graph of Means for A*B Effect



Plot of A*B Cell Means

Plot of LSMEAN*B. Symbol is value of A.



Obs	Activity Level	Ionization Condition	Cages
1	3	1	1
2	6	1	1
3	3	1	1
4	3	1	1
5	1	1	2
6	2	1	2
7	2	1	2
8	2	1	2
9	5	1	3
10	6	1	3
11	5	1	3
12	6	1	3
13	2	1	4
14	3	1	4
15	4	1	4
16	3	1	4
17	7	2	5
18	8	2	5
19	7	2	5
20	6	2	5
21	4	2	6
22	5	2	6
23	4	2	6
24	3	2	6
25	7	2	7
26	8	2	7
27	9	2	7
28	8	2	7
29	10	2	8
30	10	2	8
31	9	2	8
32	11	2	8

N = 32

A fixed, B(A) fixed

The GLM Procedure

Class Level Information

Class	Levels	Values
A	2	Positive Ions Negative Ions
B	8	Cage 1 Cage 2 Cage 3 Cage 4 Cage 5 Cage 6 Cage 7 Cage 8
		Number of Observations Read 32
		Number of Observations Used 32

A fixed, B(A) fixed

The GLM Procedure

Dependent Variable: Y Activity Level

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	217.0000000	31.0000000	40.22	<.0001
Error	24	18.5000000	0.7708333		
Corrected Total	31	235.5000000			

R-Square	Coeff Var	Root MSE	Y Mean
0.921444	16.33435	0.877971	5.375000

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	1	112.5000000	112.5000000	145.95	<.0001
B(A)	6	104.5000000	17.4166667	22.59	<.0001

A fixed, B(A) random: Test of the A main effect

The GLM Procedure

Dependent Variable: Y Activity Level

Tests of Hypotheses Using the Type III MS for B(A) as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	1	112.5000000	112.5000000	6.46	0.0440

SPF-2.4 Data Listing

Obs	Response Latency	Signal Presentation Mode	SUBJECT	Monitoring Period
1	3	Auditory Signal	1	1 Hour
2	4	Auditory Signal	1	2 Hours
3	7	Auditory Signal	1	3 Hours
4	7	Auditory Signal	1	4 Hours
5	6	Auditory Signal	2	1 Hour
6	5	Auditory Signal	2	2 Hours
7	8	Auditory Signal	2	3 Hours
8	8	Auditory Signal	2	4 Hours
9	3	Auditory Signal	3	1 Hour
10	4	Auditory Signal	3	2 Hours
11	7	Auditory Signal	3	3 Hours
12	9	Auditory Signal	3	4 Hours
13	3	Auditory Signal	4	1 Hour
14	3	Auditory Signal	4	2 Hours
15	6	Auditory Signal	4	3 Hours
16	8	Auditory Signal	4	4 Hours
17	1	Visual Signal	5	1 Hour
18	2	Visual Signal	5	2 Hours
19	5	Visual Signal	5	3 Hours
20	10	Visual Signal	5	4 Hours
21	2	Visual Signal	6	1 Hour
22	3	Visual Signal	6	2 Hours
23	6	Visual Signal	6	3 Hours
24	10	Visual Signal	6	4 Hours
25	2	Visual Signal	7	1 Hour
26	4	Visual Signal	7	2 Hours
27	5	Visual Signal	7	3 Hours
28	9	Visual Signal	7	4 Hours
29	2	Visual Signal	8	1 Hour
30	3	Visual Signal	8	2 Hours
31	6	Visual Signal	8	3 Hours
32	11	Visual Signal	8	4 Hours

N = 32

A fixed, B fixed

The GLM Procedure

Class Level Information

Class	Levels	Values
A	2	Auditory Signal Visual Signal
SUBJECT	8	1 2 3 4 5 6 7 8
B	4	1 Hour 2 Hours 3 Hours 4 Hours

Number of Observations Read	32
Number of Observations Used	32

A fixed, B fixed

The GLM Procedure

Dependent Variable: Y Response Latency

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	235.5000000	7.5967742	.	.
Error	0	0.0000000	.		
Corrected Total	31	235.5000000			

R-Square	Coeff Var	Root MSE	Y Mean
1.000000	.	.	5.375000

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	1	3.1250000	3.1250000	.	.
SUBJECT(A)	6	9.3750000	1.5625000	.	.
B	3	194.5000000	64.8333333	.	.
A*B	3	19.3750000	6.4583333	.	.
SUBJECT*B(A)	18	9.1250000	0.5069444	.	.

Tests of Hypotheses Using the Type III MS for SUBJECT(A) as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	1	3.12500000	3.12500000	2.00	0.2070

Tests of Hypotheses Using the Type III MS for SUBJECT*B(A) as an Error Term

Source	DF	Type III SS	Mean Square	F Value	Pr > F
B	3	194.5000000	64.8333333	127.89	<.0001
A*B	3	19.3750000	6.4583333	12.74	0.0001

A fixed, B fixed

The GLM Procedure
Least Squares Means

Adjustment for Multiple Comparisons: Bonferroni

Standard Errors and Probabilities Calculated Using the Type III MS for
SUBJECT*B(A) as an Error Term

A	B	Y LSMEAN	Standard Error	Pr > t	LSMEAN Number
Auditory Signal	1 Hour	3.7500000	0.3560002	<.0001	1
Auditory Signal	2 Hours	4.0000000	0.3560002	<.0001	2
Auditory Signal	3 Hours	7.0000000	0.3560002	<.0001	3
Auditory Signal	4 Hours	8.0000000	0.3560002	<.0001	4
Visual Signal	1 Hour	1.7500000	0.3560002	0.0001	5
Visual Signal	2 Hours	3.0000000	0.3560002	<.0001	6
Visual Signal	3 Hours	5.5000000	0.3560002	<.0001	7
Visual Signal	4 Hours	10.0000000	0.3560002	<.0001	8

Least Squares Means for Effect A*B
t for H0: LSMean(i)=LSMean(j) / Pr > |t|

Dependent Variable: Y

i/j	1	2	3	4	5	6	7	8
1		-0.49656	-6.45533	-8.44158	3.972508	1.489691	-3.47594	-12.4141
		1.0000	0.0001	<.0001	0.0250	1.0000	0.0755	<.0001
2	0.496564		-5.95876	-7.94502	4.469072	1.986254	-2.97938	-11.9175
	1.0000		0.0003	<.0001	0.0083	1.0000	0.2251	<.0001
3	6.455326	5.958762		-1.98625	10.42783	7.945017	2.979381	-5.95876
	0.0001	0.0003		1.0000	<.0001	<.0001	0.2251	0.0003
4	8.44158	7.945017	1.986254		12.41409	9.931271	4.965635	-3.97251
	<.0001	<.0001	1.0000		<.0001	<.0001	0.0028	0.0250
5	-3.97251	-4.46907	-10.4278	-12.4141		-2.48282	-7.44845	-16.3866
	0.0250	0.0083	<.0001	<.0001		0.6473	<.0001	<.0001
6	-1.48969	-1.98625	-7.94502	-9.93127	2.482818		-4.96564	-13.9038
	1.0000	1.0000	<.0001	<.0001	0.6473		0.0028	<.0001
7	3.475945	2.979381	-2.97938	-4.96564	7.448453	4.965635		-8.93814
	0.0755	0.2251	0.2251	0.0028	<.0001	0.0028		<.0001
8	12.41409	11.91752	5.958762	3.972508	16.3866	13.90378	8.938144	
	<.0001	<.0001	0.0003	0.0250	<.0001	<.0001	<.0001	

A fixed, B fixed

The GLM Procedure
Least Squares Means

A	B	Y LSMEAN	98.33333% Confidence Limits	
Auditory Signal	1 Hour	3.750000	2.810464	4.689536
Auditory Signal	2 Hours	4.000000	3.060464	4.939536
Auditory Signal	3 Hours	7.000000	6.060464	7.939536
Auditory Signal	4 Hours	8.000000	7.060464	8.939536
Visual Signal	1 Hour	1.750000	0.810464	2.689536
Visual Signal	2 Hours	3.000000	2.060464	3.939536
Visual Signal	3 Hours	5.500000	4.560464	6.439536
Visual Signal	4 Hours	10.000000	9.060464	10.939536

REPEAT Data Listing

Obs	Response Latency @ B[1]	Response Latency @ B[2]	Response Latency @ B[3]	Response Latency @ B[4]	Signal Presentation Mode
1	3	4	7	7	1
2	6	5	8	8	1
3	3	4	7	9	1
4	3	3	6	8	1
5	1	2	5	10	2
6	2	3	6	10	2
7	2	4	5	9	2
8	2	3	6	11	2

N = 8

MANOVA Approach through the REPEATED subcommand

The GLM Procedure

Class Level Information

Class	Levels	Values
A	2	Auditory Signal Visual Signal

Number of Observations Read	8
Number of Observations Used	8

MANOVA Approach through the REPEATED subcommand

The GLM Procedure
 Repeated Measures Analysis of Variance

Repeated Measures Level Information

Dependent Variable	Y1	Y2	Y3	Y4
Level of B	1	2	3	4

MANOVA Test Criteria and Exact F Statistics for the Hypothesis of no B Effect

H = Type III SSCP Matrix for B

E = Error SSCP Matrix

S=1 M=0.5 N=1

Statistic	Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda	0.02747678	47.19	3	4	0.0014
Pillai's Trace	0.97252322	47.19	3	4	0.0014
Hotelling-Lawley Trace	35.39436620	47.19	3	4	0.0014
Roy's Greatest Root	35.39436620	47.19	3	4	0.0014

MANOVA Test Criteria and Exact F Statistics for the Hypothesis of no B*A Effect

H = Type III SSCP Matrix for B*A

E = Error SSCP Matrix

S=1 M=0.5 N=1

Statistic	Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda	0.14430894	7.91	3	4	0.0371
Pillai's Trace	0.85569106	7.91	3	4	0.0371
Hotelling-Lawley Trace	5.92957746	7.91	3	4	0.0371
Roy's Greatest Root	5.92957746	7.91	3	4	0.0371

MANOVA Approach through the REPEATED subcommand

The GLM Procedure
Repeated Measures Analysis of Variance
Tests of Hypotheses for Between Subjects Effects

Source	DF	Type III SS	Mean Square	F Value	Pr > F
A	1	3.1250000	3.1250000	2.00	0.2070
Error	6	9.3750000	1.5625000		

MANOVA Approach through the REPEATED subcommand

The GLM Procedure
 Repeated Measures Analysis of Variance
 Univariate Tests of Hypotheses for Within Subject Effects

Source	DF	Type III SS	Mean Square	F Value	Pr > F
B	3	194.5000000	64.83333333	127.89	<.0001
B*A	3	19.3750000	6.45833333	12.74	0.0001
Error(B)	18	9.1250000	0.5069444		

Source	Adj Pr > F	
	G - G	H - F
B	<.0001	<.0001
B*A	0.0019	0.0002
Error(B)		

Greenhouse-Geisser Epsilon	0.5841
Huynh-Feldt Epsilon	0.9432

The GLM Procedure

Class Level Information

Class	Levels	Values
A	4	A[1] A[2] A[3] A[4]

Number of Observations Read	32
Number of Observations Used	32

The GLM Procedure

Dependent Variable: Y Arithmetic Achievement

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	228.4531542	57.1132885	218.83	<.0001
Error	27	7.0468458	0.2609943		
Corrected Total	31	235.5000000			

R-Square	Coeff Var	Root MSE	Y Mean
0.970077	9.504670	0.510876	5.375000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
X	1	226.6603190	226.6603190	868.45	<.0001
A	3	1.7928352	0.5976117	2.29	0.1010

Source	DF	Type III SS	Mean Square	F Value	Pr > F
X	1	33.95315418	33.95315418	130.09	<.0001
A	3	1.79283521	0.59761174	2.29	0.1010

Parameter	Estimate	Standard Error	t Value	Pr > t
Intercept	-4.136387217 B	1.16580898	-3.55	0.0014
X	0.167877153	0.01471862	11.41	<.0001
A A[1]	0.213270388 B	0.62157850	0.34	0.7342
A A[2]	0.228807844 B	0.56349497	0.41	0.6879
A A[3]	0.670496991 B	0.39393361	1.70	0.1002
A A[4]	0.000000000 B	.	.	.

NOTE: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Bonferroni

A	Y LSMEAN	Standard Error	Pr > t	LSMEAN Number
A[1]	5.31012658	0.28810778	<.0001	1
A[2]	5.32566404	0.24134018	<.0001	2
A[3]	5.76735319	0.18551262	<.0001	3
A[4]	5.09685619	0.38695027	<.0001	4

Least Squares Means for Effect A
t for H0: LSMean(i)=LSMean(j) / Pr > |t|

Dependent Variable: Y

i/j	1	2	3	4
1		-0.05898 1.0000	-1.23793 1.0000	0.343111 1.0000
2	0.058981 1.0000		-1.35532 1.0000	0.406051 1.0000
3	1.237931 1.0000	1.355317 1.0000		1.702056 0.6014
4	-0.34311 1.0000	-0.40605 1.0000	-1.70206 0.6014	

A	Y LSMEAN	95% Confidence Limits	
A[1]	5.310127	4.718978	5.901275
A[2]	5.325664	4.830475	5.820853
A[3]	5.767353	5.386713	6.147994
A[4]	5.096856	4.302900	5.890813

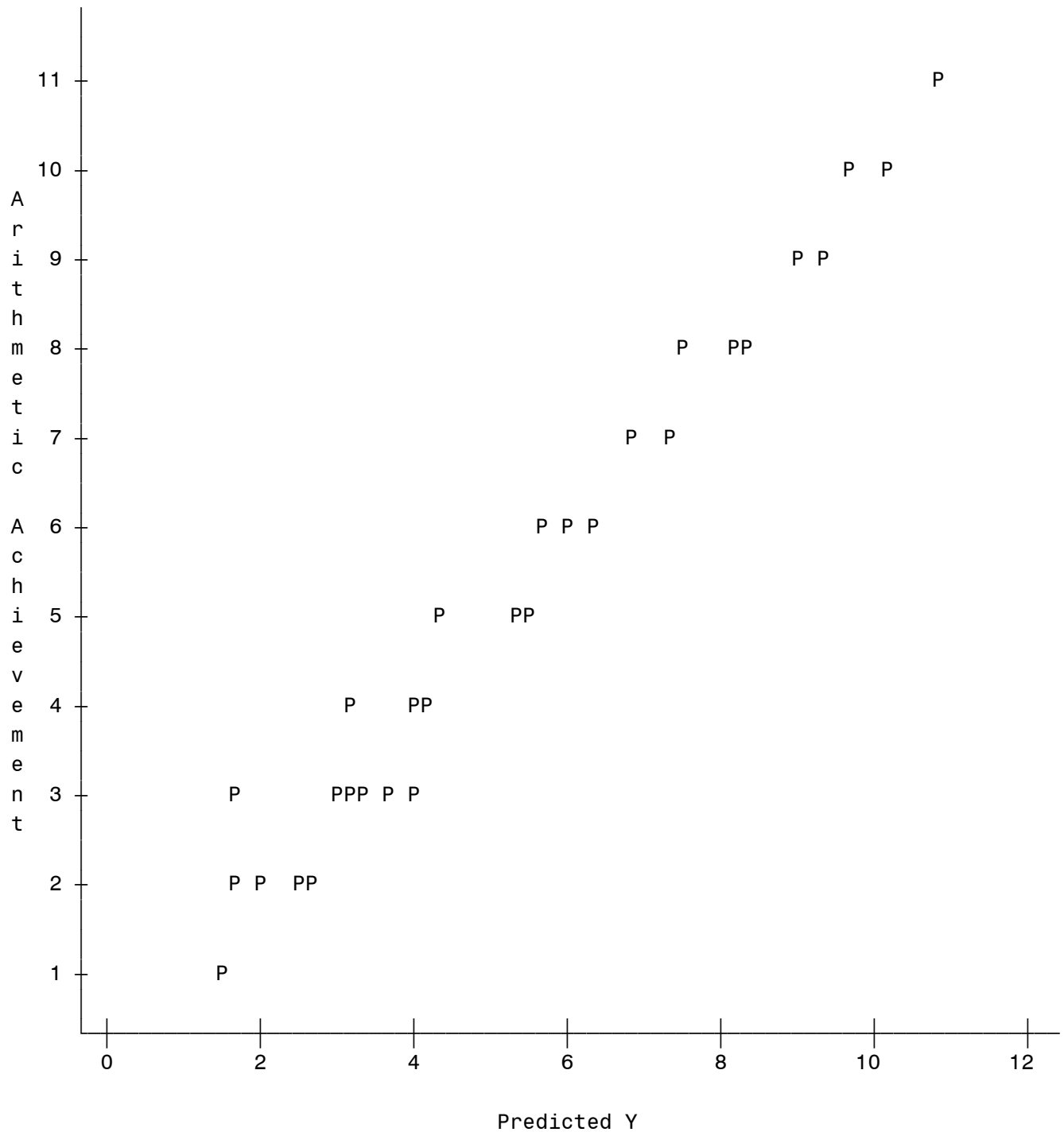
Data Listing

Obs	Teaching Method	Arithmetic Achievement	Predicted Y	Error in Prediction
1	A[1]	3	3.1277	-0.12772
2	A[1]	6	5.6459	0.35412
3	A[1]	3	1.6168	1.38317
4	A[1]	3	3.9671	-0.96711
5	A[1]	1	1.4490	-0.44895
6	A[1]	2	1.9526	0.04742
7	A[1]	2	1.6168	0.38317
8	A[1]	2	2.6241	-0.62409
9	A[2]	4	3.9826	0.01735
10	A[2]	5	4.3184	0.68160
11	A[2]	4	3.1433	0.85674
12	A[2]	3	2.9754	0.02462
13	A[2]	2	2.4718	-0.47175
14	A[2]	3	3.3111	-0.31114
15	A[2]	4	4.1505	-0.15052
16	A[2]	3	3.6469	-0.64689
17	A[3]	7	6.7746	0.22538
18	A[3]	8	7.4461	0.55388
19	A[3]	7	7.2782	-0.27825
20	A[3]	6	5.9352	0.06477
21	A[3]	5	5.2637	-0.26372
22	A[3]	6	6.2710	-0.27098
23	A[3]	5	5.4316	-0.43160
24	A[3]	6	5.5995	0.40052
25	A[4]	7	6.7756	0.22437
26	A[4]	8	8.2865	-0.28652
27	A[4]	9	9.2938	-0.29379
28	A[4]	8	8.1186	-0.11864
29	A[4]	10	10.1332	-0.13317
30	A[4]	10	9.6295	0.37046
31	A[4]	9	8.9580	0.04197
32	A[4]	11	10.8047	0.19532

N = 32

Bivariate Plots

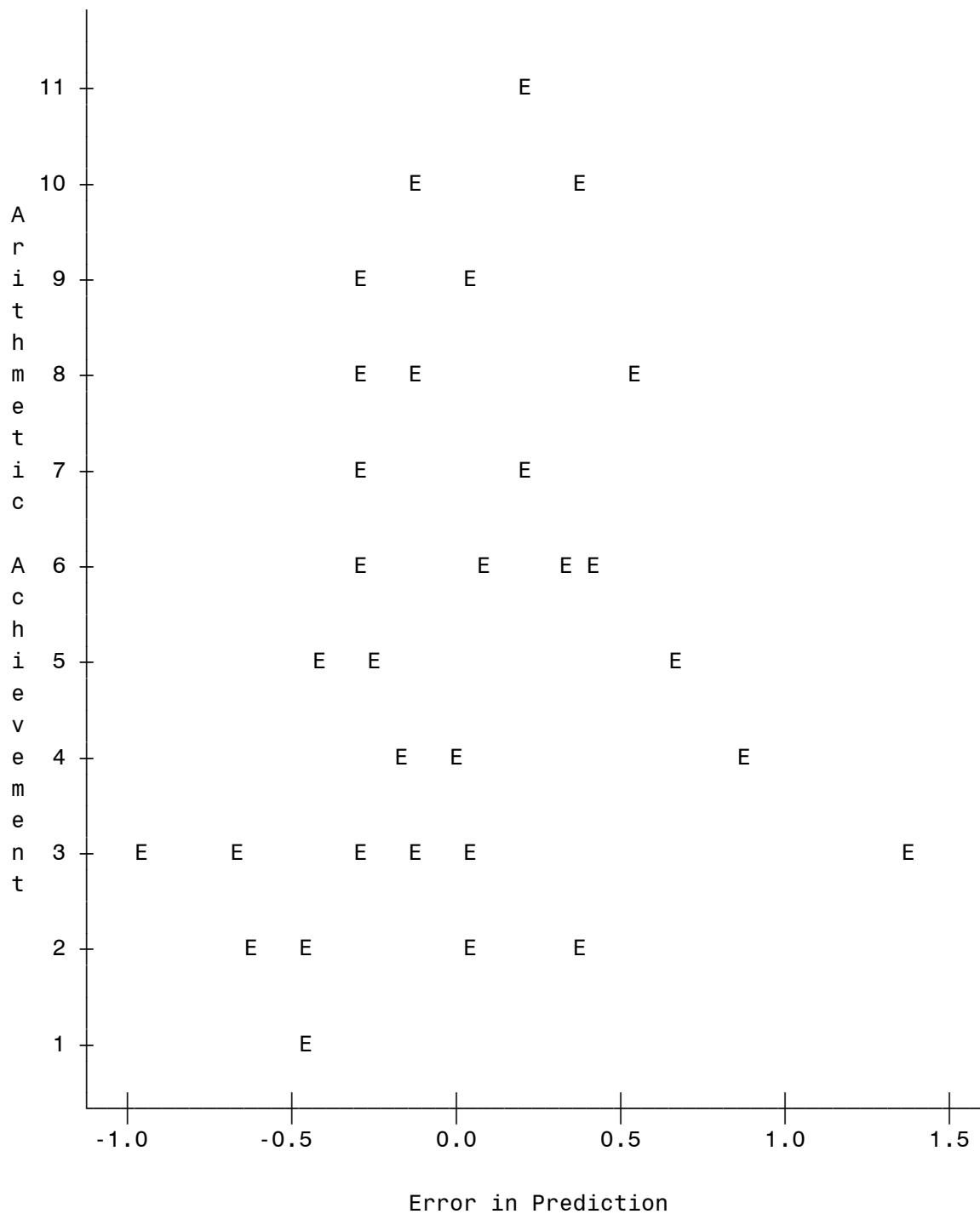
Plot of Y*YHAT. Symbol used is 'P'.



NOTE: 2 obs hidden.

Bivariate Plots

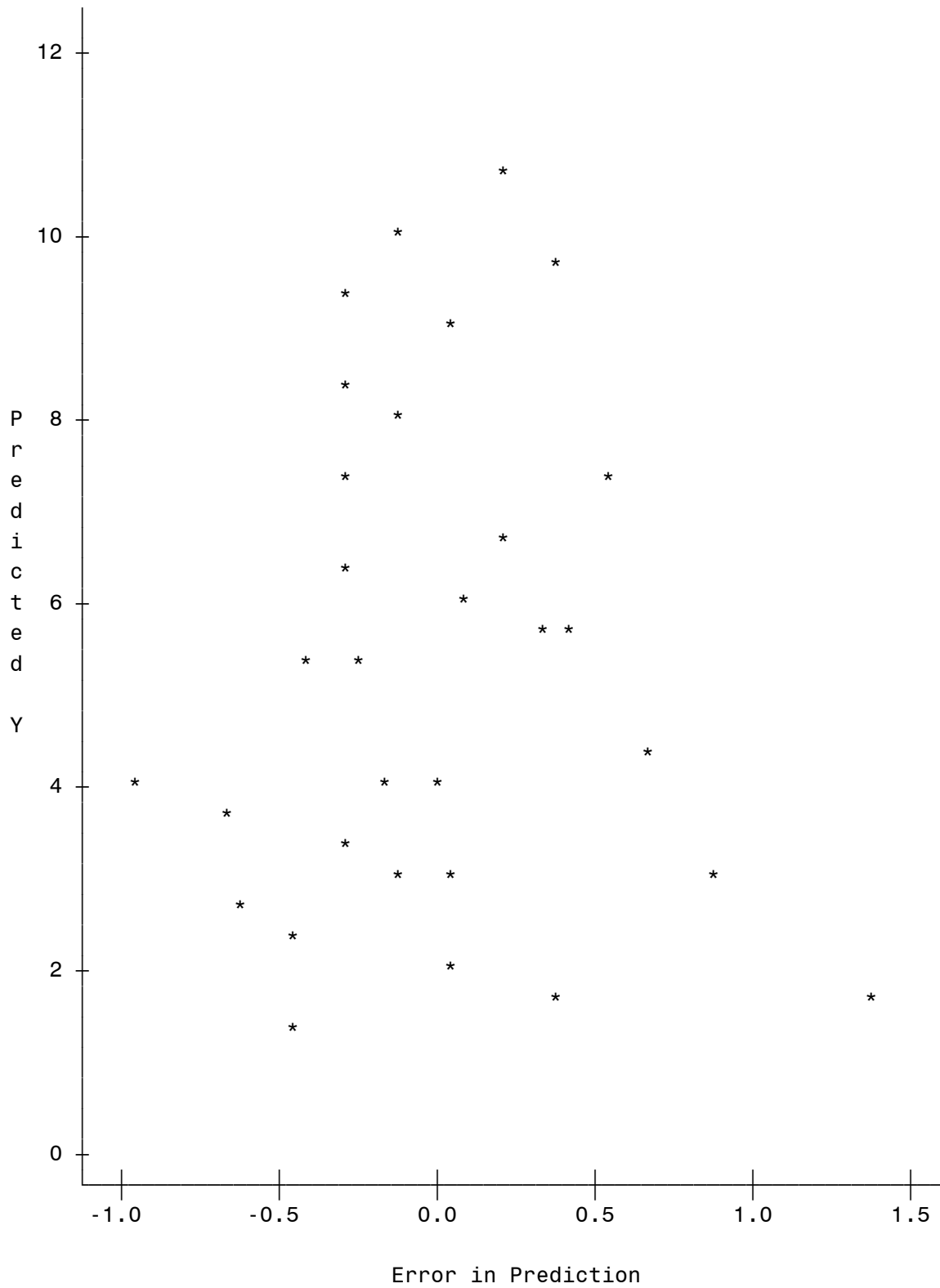
Plot of Y*E. Symbol used is 'E'.



NOTE: 1 obs hidden.

Bivariate Plots

Plot of YHAT*E. Symbol used is '*'.



NOTE: 1 obs hidden.

Simple Pearson product-moment correlations

The CORR Procedure

3 Variables: Y YHAT E

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Y	32	5.37500	2.75622	172.00000	1.00000	11.00000
YHAT	32	5.37500	2.71467	172.00000	1.44895	10.80468
E	32	0	0.47678	0	-0.96711	1.38317

Simple Statistics

Variable Label

Y	Arithmetic Achievement
YHAT	Predicted Y
E	Error in Prediction

Pearson Correlation Coefficients, N = 32

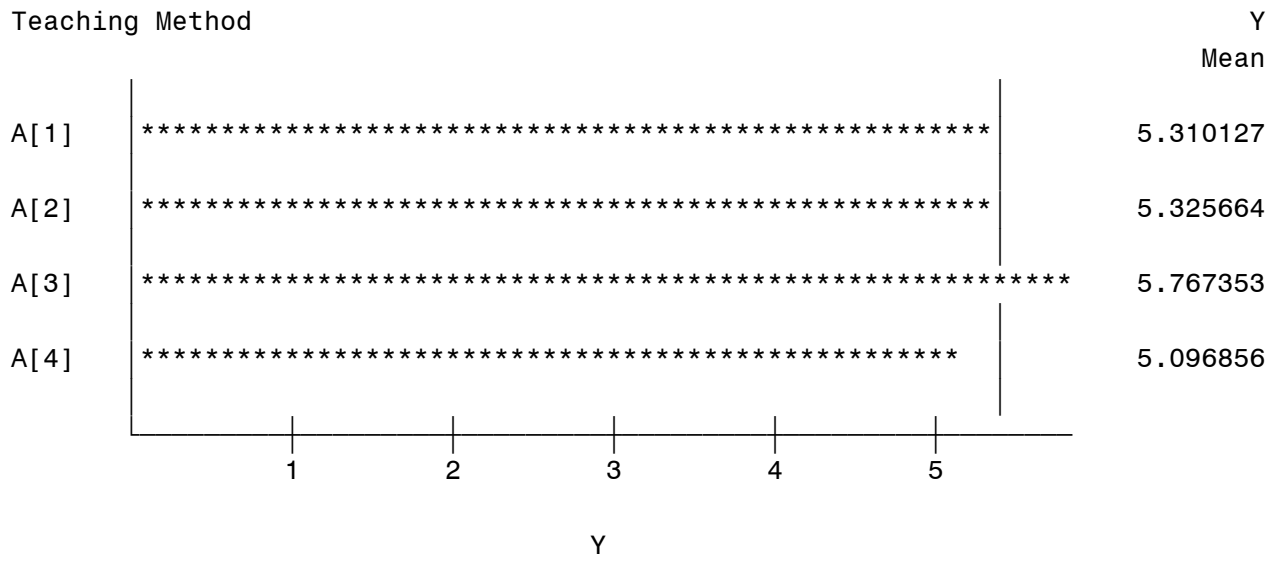
Prob > |r| under H0: Rho=0

	Y	YHAT	E
Y Arithmetic Achievement	1.00000	0.98492 <.0001	0.17298 0.3438
YHAT Predicted Y	0.98492 <.0001	1.00000	0.00000 1.0000
E Error in Prediction	0.17298 0.3438	0.00000 1.0000	1.00000

Listing of AMEANS Dataset

Teaching Method	Mean of Y
A[1]	5.31013
A[2]	5.32566
A[3]	5.76735
A[4]	5.09686

Bar Graph of A-effect Adjusted Means



Plot of A-effect Adjusted Means

Plot of LSMEAN*A. Symbol used is '*'.

