Math 5364
Data Mining 2
Homework 27
Mary Barker

1. The data set math5305Lab6Data.txt contains 4 columns, Y, X1, X2, and X3 respectively. Perform the following using SAS.;

```
data math5305lab2;
    infile '/folders/myshortcuts/sas_folder/math5305Lab6Data.txt' dlm=',';
    input Y X1 X2 X3;
proc print data=math5305lab2;
run;
```

   (a) Fit the multiple regression model

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \epsilon_i;$$

```
proc reg data=math5305lab2;
    model Y=X1 X2 X3;
    output out = mult_reg_model
    r = mult_reg_e
    predicted=mult_reg_pred;
run;

proc print data=math5305lab2;
run;
```

   (b) What are the estimates $\hat{\beta}_1, \hat{\beta}_2$, and $\hat{\beta}_3$?
   The estimated values for $\hat{\beta}_i$ for $i = 1, 2, 3$ are 17324, -22931, and 35741 respectively.

   (c) Find the $t$-statistic and corresponding $p$-value for each of $X_1, X_2$ and $X_3$;
   The $t$-statistic and $p$-value for $X_1$ are: 13.48, and 0.0001. The $t$-statistic and $p$-value for $X_2$ are: -23.61, and 0.0001 The $t$-statistic and $p$-value for $X_3$ are: 17.71, and 0.0001

   (d) Find the t-statistic and corresponding $p$-value for testing $\mathcal{H}_0 : \beta_1 = \beta_2 = \beta_3 = 0$.

   (e) Find $R^2$ for this model
   The $R^2$ statistic for this model is 0.9066, and the adjusted $R^2$ is 0.9037.

   (f) Investigate normality of the residuals for this model using a qq-plot and the Shapiro-Wilk test.

```
proc univariate data=mult_reg_model normal;
        var mult_reg_e;
        qqplot mult_reg_e;
run;
```

   The Shapiro-Wilk test gave a $p$-value of 0.0003.

(g) Use the SPEC option to assess homoestadicity of the residuals;

```
proc reg data=math5305lab2;
        model Y=X1 X2 X3/SPEC;
run;
```

(h) Recall that $e$ is the vector of residuals and $\hat{Y}$ is the vector of predicted values. Produce the following plots:

- $Y$ vs. $X_j$, $j = 1, 2, 3$
- $Y$ vs. $\hat{Y}$
- $e$ vs. $X_j$, $j = 1, 2, 3$
- $e$ vs $\hat{Y}$

```
proc plot data=mult_reg_model;
        plot Y * X1
                Y * X2
                Y * X3
                Y * mult_reg_pred
                mult_reg_e * X1
                mult_reg_e * X2
                mult_reg_e * X3
                mult_reg_e * mult_reg_pred;
run;
```

(i) Overall, do the typical linear regression model assumptions appear to hold for this model?;

The residuals do appear to be normally distributed, but the assumption of linearity does not hold.

| Obs | Y | X1 | X2 | X3 |
|---|---|---|---|---|
| 1 | 1259406.18 | 39.0453 | 39.5333 | 20.9620 |
| 2 | 936030.31 | 28.0219 | 30.9788 | 16.4584 |
| 3 | 824255.16 | 32.6895 | 33.5424 | 12.1756 |
| 4 | 791935.54 | 26.0883 | 47.1915 | 20.8821 |
| 5 | 814142.80 | 31.8567 | 30.1321 | 10.3030 |
| 6 | 752152.99 | 14.9992 | 31.7691 | 18.7786 |
| 7 | 176651.36 | 11.6810 | 64.1199 | 20.9198 |
| 8 | 244396.44 | 30.4492 | 68.8134 | 16.1491 |
| 9 | 1004875.12 | 31.3049 | 51.1534 | 26.8269 |
| 10 | 200238.38 | 12.8959 | 51.4379 | 11.9838 |
| 11 | 101651.64 | 13.1630 | 66.5912 | 12.2385 |
| 12 | 635281.47 | 12.1653 | 30.6465 | 18.9123 |
| 13 | 725197.67 | 18.9223 | 46.3227 | 25.7313 |
| 14 | 1600049.16 | 39.2972 | 38.8604 | 29.8250 |
| 15 | 571317.10 | 23.6393 | 51.5862 | 23.2357 |
| 16 | 1005276.89 | 33.5620 | 45.0854 | 25.2475 |
| 17 | 323380.67 | 39.5396 | 61.2474 | 11.7854 |
| 18 | 779123.07 | 25.0209 | 49.6946 | 27.6566 |
| 19 | 490745.33 | 27.8990 | 54.3608 | 21.7202 |
| 20 | 886098.22 | 37.6128 | 39.7350 | 16.8526 |
| 21 | 229456.65 | 35.5826 | 68.9044 | 13.5036 |
| 22 | 337405.68 | 11.0460 | 42.3839 | 17.8423 |
| 23 | 805799.45 | 15.9490 | 40.9920 | 24.9541 |
| 24 | 765921.07 | 28.0789 | 34.7723 | 13.9258 |
| 25 | 350691.07 | 19.1326 | 57.7863 | 22.3733 |
| 26 | 1178033.78 | 19.8324 | 41.4185 | 28.2471 |
| 27 | 1024192.13 | 28.9318 | 30.3775 | 16.6190 |
| 28 | 605820.39 | 27.3136 | 45.0268 | 14.6009 |
| 29 | 1301386.30 | 32.1587 | 44.9900 | 28.2166 |
| 30 | 434518.11 | 38.0469 | 68.5078 | 22.1212 |
| 31 | 1024272.06 | 35.8362 | 48.1053 | 22.1716 |
| 32 | 1256281.77 | 35.3572 | 42.6946 | 22.7589 |
| 33 | 1016415.73 | 38.0535 | 58.8622 | 29.0498 |
| 34 | 576442.20 | 29.5157 | 44.8027 | 12.5180 |
| 35 | 1331182.91 | 18.8233 | 35.8343 | 28.4665 |
| 36 | 717640.89 | 37.1597 | 67.4827 | 29.7086 |
| 37 | 594084.23 | 38.2167 | 57.7957 | 22.6690 |
| 38 | 337520.88 | 36.0285 | 68.3880 | 22.1366 |

| Obs | Y | X1 | X2 | X3 |
|---|---|---|---|---|
| **39** | 760180.80 | 26.1705 | 38.7211 | 17.4500 |
| **40** | 908982.73 | 20.3232 | 31.3945 | 16.2521 |
| **41** | 1236511.35 | 34.4374 | 47.6237 | 27.6603 |
| **42** | 755330.74 | 30.6595 | 55.6435 | 27.4326 |
| **43** | 573772.51 | 18.4482 | 44.9645 | 20.1830 |
| **44** | 643317.00 | 24.9831 | 48.3656 | 19.7600 |
| **45** | 332318.45 | 25.1482 | 52.6470 | 15.1631 |
| **46** | 599135.77 | 33.0721 | 56.4273 | 21.2098 |
| **47** | 1120318.17 | 22.2252 | 36.5392 | 26.9252 |
| **48** | 418112.91 | 28.9907 | 68.2687 | 23.1857 |
| **49** | 531893.54 | 28.5421 | 47.0636 | 14.6195 |
| **50** | 766320.60 | 14.4073 | 34.6296 | 23.1192 |
| **51** | 859140.79 | 19.5943 | 51.2994 | 29.2793 |
| **52** | 1734004.96 | 32.2640 | 31.3606 | 25.8269 |
| **53** | 441216.12 | 14.9251 | 52.4488 | 22.1059 |
| **54** | 502163.83 | 11.6478 | 56.5560 | 27.1347 |
| **55** | 1056067.64 | 36.9109 | 46.6381 | 24.1762 |
| **56** | 783630.08 | 20.6589 | 30.0375 | 15.3360 |
| **57** | 755271.90 | 29.3215 | 45.8394 | 19.8047 |
| **58** | 438922.62 | 32.2792 | 55.4011 | 17.8385 |
| **59** | 779937.25 | 19.2996 | 44.8655 | 28.6092 |
| **60** | 850961.92 | 25.0652 | 52.8184 | 28.4792 |
| **61** | 781417.49 | 37.6999 | 69.2292 | 29.9110 |
| **62** | 1272360.48 | 32.4433 | 39.9670 | 27.4404 |
| **63** | 553085.20 | 20.0492 | 61.5211 | 27.4095 |
| **64** | 718229.09 | 22.3318 | 53.8064 | 27.4870 |
| **65** | 111243.21 | 10.0528 | 62.4303 | 16.9393 |
| **66** | 213516.80 | 37.7933 | 68.3678 | 15.2448 |
| **67** | 549111.01 | 14.6948 | 49.6832 | 27.0536 |
| **68** | 210758.46 | 29.7968 | 61.6762 | 12.7005 |
| **69** | 1043421.10 | 35.1932 | 31.1363 | 13.5069 |
| **70** | 473230.37 | 14.3290 | 58.7712 | 29.3896 |
| **71** | 478283.64 | 31.1134 | 58.0030 | 16.4953 |
| **72** | 571097.77 | 34.9896 | 55.2862 | 19.2766 |
| **73** | 347154.16 | 17.1287 | 61.1559 | 23.3314 |
| **74** | 259174.31 | 15.9392 | 63.6911 | 23.0405 |
| **75** | 1056792.27 | 35.0648 | 42.0847 | 24.4918 |
| **76** | 831176.27 | 29.4815 | 31.3584 | 15.9745 |

| Obs | Y | X1 | X2 | X3 |
|---|---|---|---|---|
| **77** | 231397.28 | 20.8011 | 56.3855 | 14.4185 |
| **78** | 418711.30 | 13.6223 | 41.0289 | 12.8001 |
| **79** | 527233.05 | 24.5111 | 50.3137 | 17.4720 |
| **80** | 764304.22 | 39.9908 | 46.6062 | 16.0165 |
| **81** | 773714.81 | 29.7744 | 48.1206 | 21.6132 |
| **82** | 461181.59 | 15.0893 | 47.6912 | 19.5957 |
| **83** | 471837.04 | 32.1322 | 49.7682 | 13.9803 |
| **84** | 720949.51 | 27.5739 | 44.1710 | 19.4321 |
| **85** | 537535.97 | 20.7796 | 45.2531 | 20.4768 |
| **86** | 569564.74 | 34.9490 | 61.2257 | 23.6398 |
| **87** | 748416.94 | 22.5883 | 36.8303 | 15.7133 |
| **88** | 502261.03 | 23.7121 | 45.9259 | 12.7609 |
| **89** | 380120.00 | 10.6510 | 62.5630 | 26.5546 |
| **90** | 851262.25 | 12.6378 | 42.1794 | 27.3303 |
| **91** | 217574.53 | 12.9634 | 66.5161 | 22.7152 |
| **92** | 599542.56 | 37.5201 | 57.5624 | 24.6593 |
| **93** | 229270.37 | 29.0588 | 64.5441 | 11.7357 |
| **94** | 1272801.89 | 29.5933 | 31.0164 | 23.5361 |
| **95** | 1395360.80 | 33.2722 | 30.5763 | 22.4219 |
| **96** | 605525.96 | 31.1426 | 57.6391 | 23.4427 |
| **97** | 431882.46 | 21.3066 | 62.4051 | 23.9503 |
| **98** | 664524.15 | 17.2731 | 46.0183 | 23.2666 |
| **99** | 1608001.43 | 29.4377 | 41.8730 | 29.3302 |
| **100** | 1199470.60 | 30.5792 | 40.4430 | 25.5269 |

# The REG Procedure
## Model: MODEL1
## Dependent Variable: Y

| | |
|---|---|
| **Number of Observations Read** | 100 |
| **Number of Observations Used** | 100 |

**Analysis of Variance**

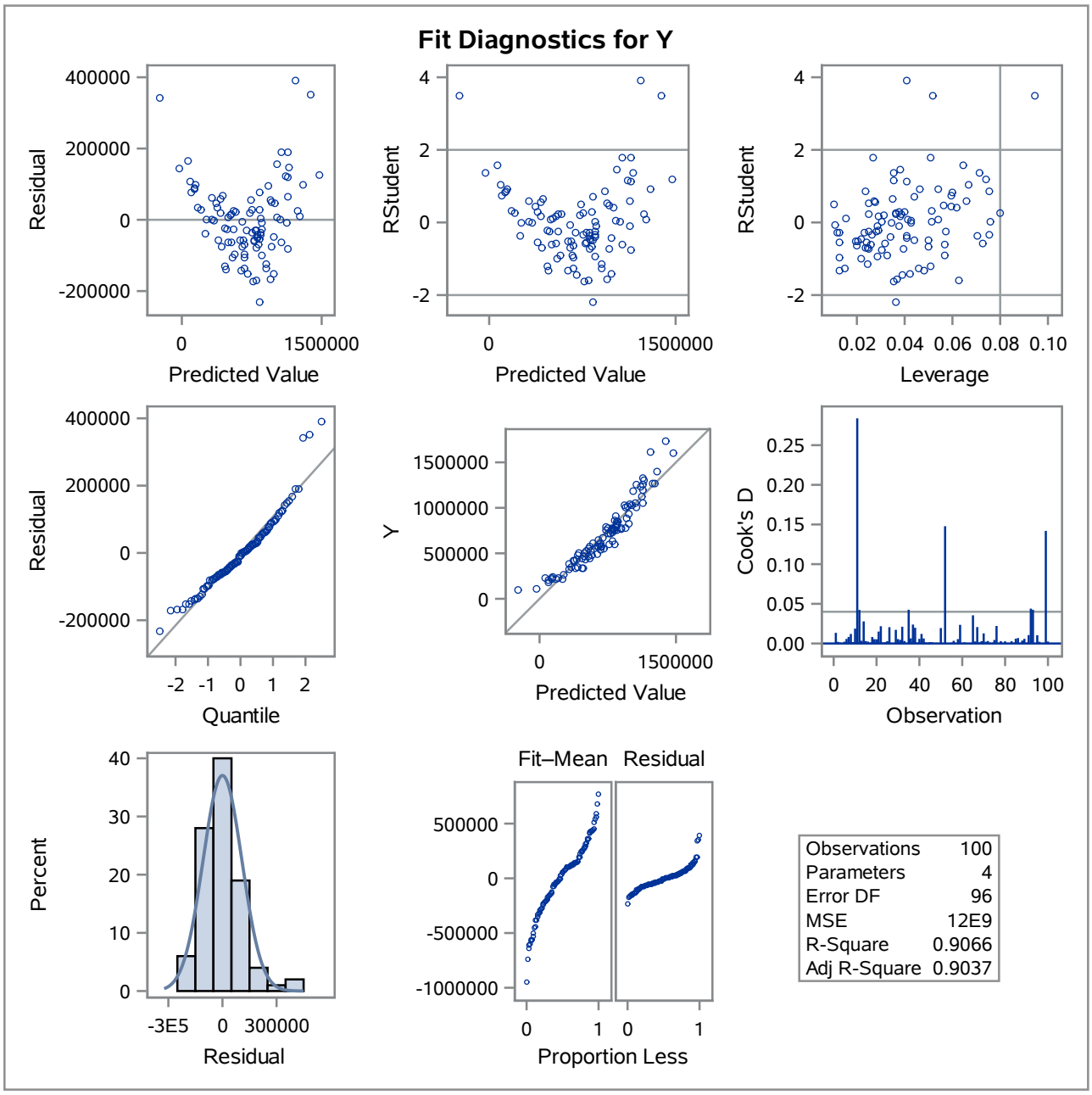
| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| **Model** | 3 | 1.114325E13 | 3.714417E12 | 310.54 | <.0001 |
| **Error** | 96 | 1.148277E12 | 11961222055 | | |
| **Corrected Total** | 99 | 1.229153E13 | | | |

| | | | |
|---|---|---|---|
| **Root MSE** | 109367 | **R-Square** | 0.9066 |
| **Dependent Mean** | 705093 | **Adj R-Sq** | 0.9037 |
| **Coeff Var** | 15.51106 | | |

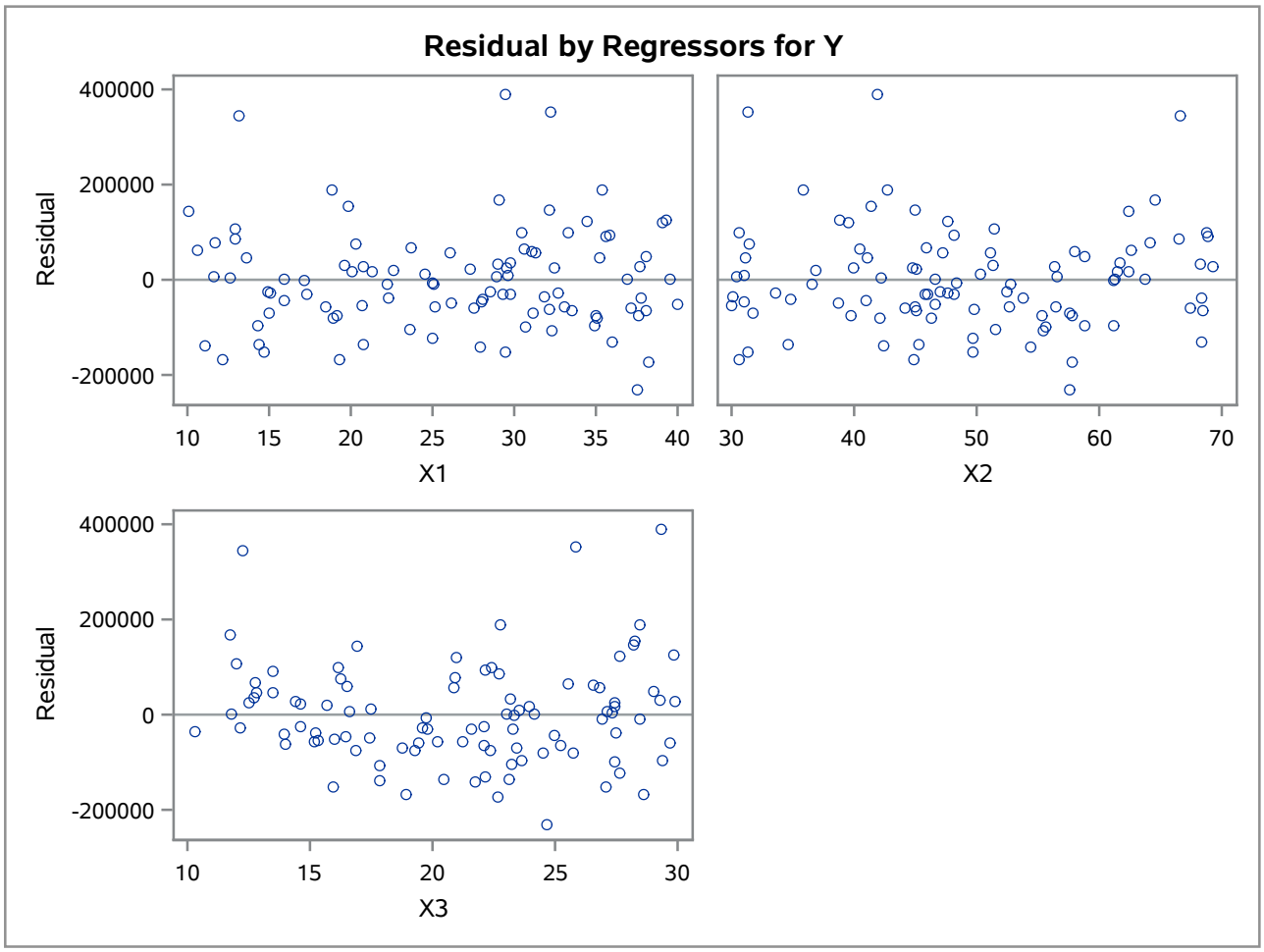
**Parameter Estimates**

| Variable | DF | Parameter Estimate | Standard Error | t Value | Pr > \|t\| |
|---|---|---|---|---|---|
| **Intercept** | 1 | 620077 | 69959 | 8.86 | <.0001 |
| **X1** | 1 | 17324 | 1284.92073 | 13.48 | <.0001 |
| **X2** | 1 | -22931 | 971.27842 | -23.61 | <.0001 |
| **X3** | 1 | 35741 | 2018.01609 | 17.71 | <.0001 |

**The REG Procedure**
**Model: MODEL1**
**Dependent Variable: Y**



**The REG Procedure**
**Model: MODEL1**
**Dependent Variable: Y**



| Obs | Y | X1 | X2 | X3 |
|---|---|---|---|---|
| 1 | 1259406.18 | 39.0453 | 39.5333 | 20.9620 |
| 2 | 936030.31 | 28.0219 | 30.9788 | 16.4584 |
| 3 | 824255.16 | 32.6895 | 33.5424 | 12.1756 |
| 4 | 791935.54 | 26.0883 | 47.1915 | 20.8821 |
| 5 | 814142.80 | 31.8567 | 30.1321 | 10.3030 |
| 6 | 752152.99 | 14.9992 | 31.7691 | 18.7786 |
| 7 | 176651.36 | 11.6810 | 64.1199 | 20.9198 |
| 8 | 244396.44 | 30.4492 | 68.8134 | 16.1491 |
| 9 | 1004875.12 | 31.3049 | 51.1534 | 26.8269 |
| 10 | 200238.38 | 12.8959 | 51.4379 | 11.9838 |
| 11 | 101651.64 | 13.1630 | 66.5912 | 12.2385 |
| 12 | 635281.47 | 12.1653 | 30.6465 | 18.9123 |
| 13 | 725197.67 | 18.9223 | 46.3227 | 25.7313 |
| 14 | 1600049.16 | 39.2972 | 38.8604 | 29.8250 |
| 15 | 571317.10 | 23.6393 | 51.5862 | 23.2357 |
| 16 | 1005276.89 | 33.5620 | 45.0854 | 25.2475 |
| 17 | 323380.67 | 39.5396 | 61.2474 | 11.7854 |
| 18 | 779123.07 | 25.0209 | 49.6946 | 27.6566 |
| 19 | 490745.33 | 27.8990 | 54.3608 | 21.7202 |
| 20 | 886098.22 | 37.6128 | 39.7350 | 16.8526 |
| 21 | 229456.65 | 35.5826 | 68.9044 | 13.5036 |
| 22 | 337405.68 | 11.0460 | 42.3839 | 17.8423 |
| 23 | 805799.45 | 15.9490 | 40.9920 | 24.9541 |
| 24 | 765921.07 | 28.0789 | 34.7723 | 13.9258 |
| 25 | 350691.07 | 19.1326 | 57.7863 | 22.3733 |
| 26 | 1178033.78 | 19.8324 | 41.4185 | 28.2471 |
| 27 | 1024192.13 | 28.9318 | 30.3775 | 16.6190 |
| 28 | 605820.39 | 27.3136 | 45.0268 | 14.6009 |
| 29 | 1301386.30 | 32.1587 | 44.9900 | 28.2166 |
| 30 | 434518.11 | 38.0469 | 68.5078 | 22.1212 |
| 31 | 1024272.06 | 35.8362 | 48.1053 | 22.1716 |
| 32 | 1256281.77 | 35.3572 | 42.6946 | 22.7589 |
| 33 | 1016415.73 | 38.0535 | 58.8622 | 29.0498 |
| 34 | 576442.20 | 29.5157 | 44.8027 | 12.5180 |
| 35 | 1331182.91 | 18.8233 | 35.8343 | 28.4665 |
| 36 | 717640.89 | 37.1597 | 67.4827 | 29.7086 |
| 37 | 594084.23 | 38.2167 | 57.7957 | 22.6690 |
| 38 | 337520.88 | 36.0285 | 68.3880 | 22.1366 |

| Obs | Y | X1 | X2 | X3 |
|---|---|---|---|---|
| **39** | 760180.80 | 26.1705 | 38.7211 | 17.4500 |
| **40** | 908982.73 | 20.3232 | 31.3945 | 16.2521 |
| **41** | 1236511.35 | 34.4374 | 47.6237 | 27.6603 |
| **42** | 755330.74 | 30.6595 | 55.6435 | 27.4326 |
| **43** | 573772.51 | 18.4482 | 44.9645 | 20.1830 |
| **44** | 643317.00 | 24.9831 | 48.3656 | 19.7600 |
| **45** | 332318.45 | 25.1482 | 52.6470 | 15.1631 |
| **46** | 599135.77 | 33.0721 | 56.4273 | 21.2098 |
| **47** | 1120318.17 | 22.2252 | 36.5392 | 26.9252 |
| **48** | 418112.91 | 28.9907 | 68.2687 | 23.1857 |
| **49** | 531893.54 | 28.5421 | 47.0636 | 14.6195 |
| **50** | 766320.60 | 14.4073 | 34.6296 | 23.1192 |
| **51** | 859140.79 | 19.5943 | 51.2994 | 29.2793 |
| **52** | 1734004.96 | 32.2640 | 31.3606 | 25.8269 |
| **53** | 441216.12 | 14.9251 | 52.4488 | 22.1059 |
| **54** | 502163.83 | 11.6478 | 56.5560 | 27.1347 |
| **55** | 1056067.64 | 36.9109 | 46.6381 | 24.1762 |
| **56** | 783630.08 | 20.6589 | 30.0375 | 15.3360 |
| **57** | 755271.90 | 29.3215 | 45.8394 | 19.8047 |
| **58** | 438922.62 | 32.2792 | 55.4011 | 17.8385 |
| **59** | 779937.25 | 19.2996 | 44.8655 | 28.6092 |
| **60** | 850961.92 | 25.0652 | 52.8184 | 28.4792 |
| **61** | 781417.49 | 37.6999 | 69.2292 | 29.9110 |
| **62** | 1272360.48 | 32.4433 | 39.9670 | 27.4404 |
| **63** | 553085.20 | 20.0492 | 61.5211 | 27.4095 |
| **64** | 718229.09 | 22.3318 | 53.8064 | 27.4870 |
| **65** | 111243.21 | 10.0528 | 62.4303 | 16.9393 |
| **66** | 213516.80 | 37.7933 | 68.3678 | 15.2448 |
| **67** | 549111.01 | 14.6948 | 49.6832 | 27.0536 |
| **68** | 210758.46 | 29.7968 | 61.6762 | 12.7005 |
| **69** | 1043421.10 | 35.1932 | 31.1363 | 13.5069 |
| **70** | 473230.37 | 14.3290 | 58.7712 | 29.3896 |
| **71** | 478283.64 | 31.1134 | 58.0030 | 16.4953 |
| **72** | 571097.77 | 34.9896 | 55.2862 | 19.2766 |
| **73** | 347154.16 | 17.1287 | 61.1559 | 23.3314 |
| **74** | 259174.31 | 15.9392 | 63.6911 | 23.0405 |
| **75** | 1056792.27 | 35.0648 | 42.0847 | 24.4918 |
| **76** | 831176.27 | 29.4815 | 31.3584 | 15.9745 |

| Obs | Y | X1 | X2 | X3 |
|---|---|---|---|---|
| **77** | 231397.28 | 20.8011 | 56.3855 | 14.4185 |
| **78** | 418711.30 | 13.6223 | 41.0289 | 12.8001 |
| **79** | 527233.05 | 24.5111 | 50.3137 | 17.4720 |
| **80** | 764304.22 | 39.9908 | 46.6062 | 16.0165 |
| **81** | 773714.81 | 29.7744 | 48.1206 | 21.6132 |
| **82** | 461181.59 | 15.0893 | 47.6912 | 19.5957 |
| **83** | 471837.04 | 32.1322 | 49.7682 | 13.9803 |
| **84** | 720949.51 | 27.5739 | 44.1710 | 19.4321 |
| **85** | 537535.97 | 20.7796 | 45.2531 | 20.4768 |
| **86** | 569564.74 | 34.9490 | 61.2257 | 23.6398 |
| **87** | 748416.94 | 22.5883 | 36.8303 | 15.7133 |
| **88** | 502261.03 | 23.7121 | 45.9259 | 12.7609 |
| **89** | 380120.00 | 10.6510 | 62.5630 | 26.5546 |
| **90** | 851262.25 | 12.6378 | 42.1794 | 27.3303 |
| **91** | 217574.53 | 12.9634 | 66.5161 | 22.7152 |
| **92** | 599542.56 | 37.5201 | 57.5624 | 24.6593 |
| **93** | 229270.37 | 29.0588 | 64.5441 | 11.7357 |
| **94** | 1272801.89 | 29.5933 | 31.0164 | 23.5361 |
| **95** | 1395360.80 | 33.2722 | 30.5763 | 22.4219 |
| **96** | 605525.96 | 31.1426 | 57.6391 | 23.4427 |
| **97** | 431882.46 | 21.3066 | 62.4051 | 23.9503 |
| **98** | 664524.15 | 17.2731 | 46.0183 | 23.2666 |
| **99** | 1608001.43 | 29.4377 | 41.8730 | 29.3302 |
| **100** | 1199470.60 | 30.5792 | 40.4430 | 25.5269 |

## The UNIVARIATE Procedure
## Variable: mult_reg_e (Residual)

| Moments | | | |
|---|---|---|---|
| **N** | 100 | **Sum Weights** | 100 |
| **Mean** | 0 | **Sum Observations** | 0 |
| **Std Deviation** | 107697.543 | **Variance** | 1.15988E10 |
| **Skewness** | 1.02729692 | **Kurtosis** | 2.30908572 |
| **Uncorrected SS** | 1.14828E12 | **Corrected SS** | 1.14828E12 |
| **Coeff Variation** | . | **Std Error Mean** | 10769.7543 |

| Basic Statistical Measures | | | |
|---|---|---|---|
| **Location** | | **Variability** | |
| **Mean** | 0.00 | **Std Deviation** | 107698 |
| **Median** | -7978.69 | **Variance** | 1.15988E10 |
| **Mode** | . | **Range** | 621756 |
| | | **Interquartile Range** | 120730 |

| Tests for Location: Mu0=0 | | | | |
|---|---|---|---|---|
| **Test** | **Statistic** | | **p Value** | |
| **Student's t** | **t** | 0 | **Pr > \|t\|** | 1.0000 |
| **Sign** | **M** | -3 | **Pr >= \|M\|** | 0.6173 |
| **Signed Rank** | **S** | -221 | **Pr >= \|S\|** | 0.4501 |

| Tests for Normality | | | | |
|---|---|---|---|---|
| **Test** | **Statistic** | | **p Value** | |
| **Shapiro-Wilk** | **W** | 0.942319 | **Pr < W** | 0.0003 |
| **Kolmogorov-Smirnov** | **D** | 0.083089 | **Pr > D** | 0.0881 |
| **Cramer-von Mises** | **W-Sq** | 0.150516 | **Pr > W-Sq** | 0.0234 |
| **Anderson-Darling** | **A-Sq** | 1.067692 | **Pr > A-Sq** | 0.0083 |

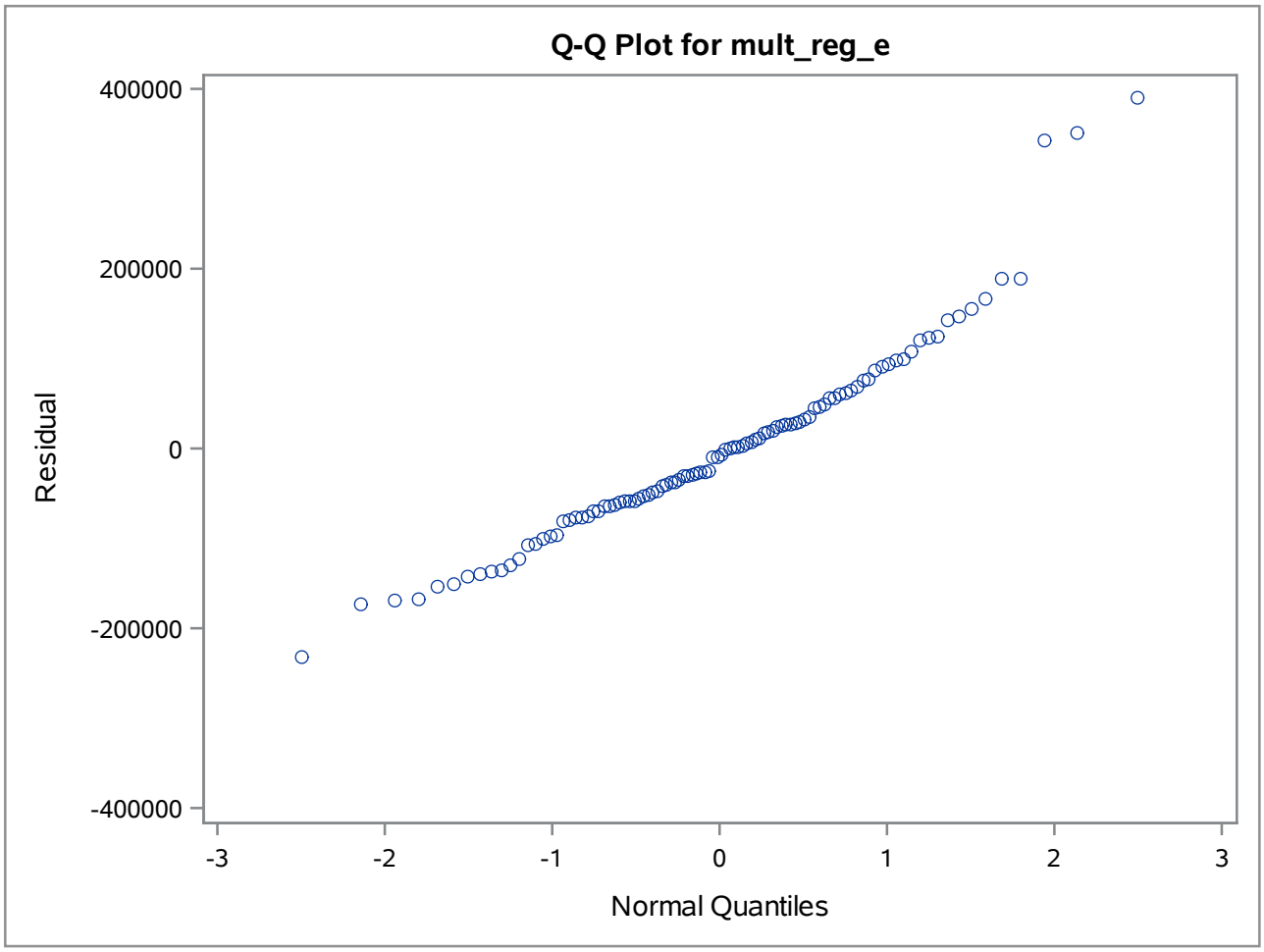
| Quantiles (Definition 5) | |
|---|---|
| **Level** | **Quantile** |
| **100% Max** | 389854.74 |
| **99%** | 370451.53 |
| **95%** | 177850.94 |
| **90%** | 123821.01 |
| **75% Q3** | 56189.93 |
| **50% Median** | -7978.69 |
| **25% Q1** | -64539.84 |

## The UNIVARIATE Procedure
## Variable: mult_reg_e (Residual)

| Quantiles (Definition 5) | |
|---|---|
| **Level** | **Quantile** |
| **10%** | -132615.92 |
| **5%** | -152329.55 |
| **1%** | -202423.03 |
| **0% Min** | -231901.08 |

| Extreme Observations | | | |
|---|---|---|---|
| **Lowest** | | **Highest** | |
| **Value** | **Obs** | **Value** | **Obs** |
| -231901 | 92 | 189295 | 32 |
| -172945 | 37 | 189315 | 35 |
| -168733 | 12 | 343135 | 11 |
| -168189 | 59 | 351048 | 52 |
| -153166 | 67 | 389855 | 99 |

**The UNIVARIATE Procedure**



# The REG Procedure
## Model: MODEL1
## Dependent Variable: Y

| | |
|---|---|
| **Number of Observations Read** | 100 |
| **Number of Observations Used** | 100 |

**Analysis of Variance**

| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
|---|---|---|---|---|---|
| **Model** | 3 | 1.114325E13 | 3.714417E12 | 310.54 | <.0001 |
| **Error** | 96 | 1.148277E12 | 11961222055 | | |
| **Corrected Total** | 99 | 1.229153E13 | | | |

| | | | |
|---|---|---|---|
| **Root MSE** | 109367 | **R-Square** | 0.9066 |
| **Dependent Mean** | 705093 | **Adj R-Sq** | 0.9037 |
| **Coeff Var** | 15.51106 | | |

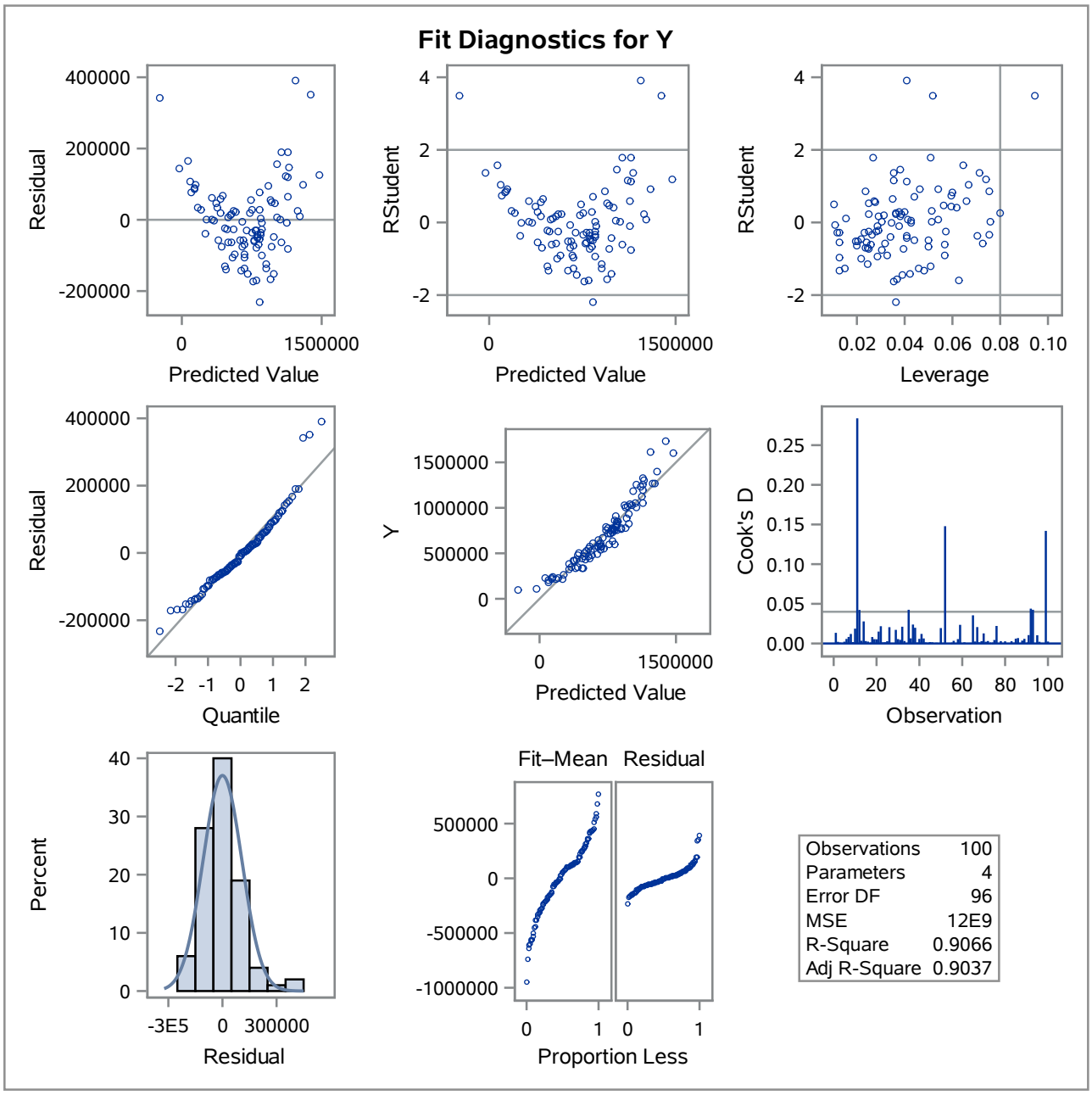
**Parameter Estimates**

| Variable | DF | Parameter Estimate | Standard Error | t Value | Pr > \|t\| |
|---|---|---|---|---|---|
| **Intercept** | 1 | 620077 | 69959 | 8.86 | <.0001 |
| **X1** | 1 | 17324 | 1284.92073 | 13.48 | <.0001 |
| **X2** | 1 | -22931 | 971.27842 | -23.61 | <.0001 |
| **X3** | 1 | 35741 | 2018.01609 | 17.71 | <.0001 |

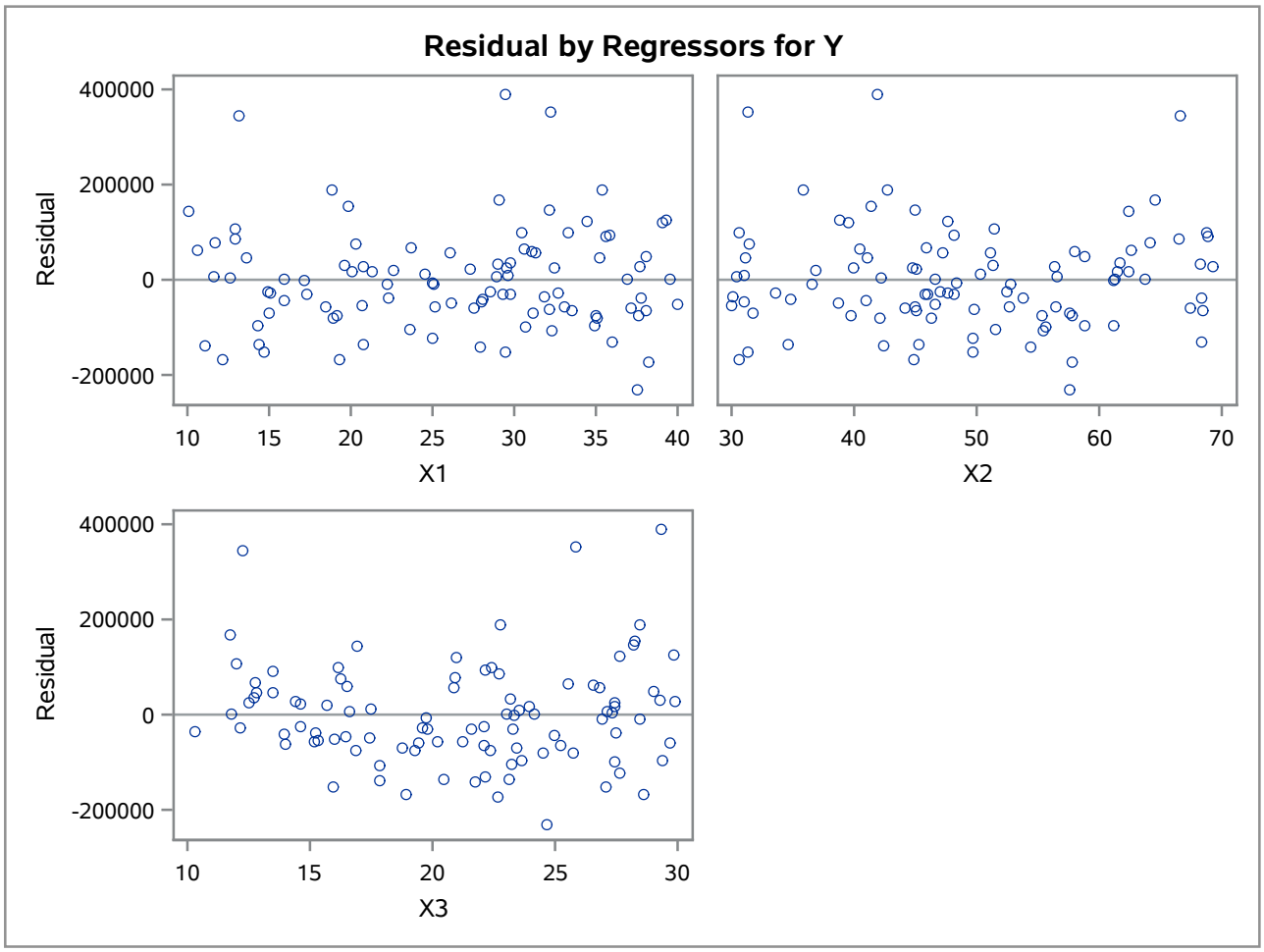
**The REG Procedure**
**Model: MODEL1**
**Dependent Variable: Y**

| Test of First and Second Moment Specification | | |
|---|---|---|
| DF | Chi-Square | Pr > ChiSq |
| 9 | 13.12 | 0.1571 |

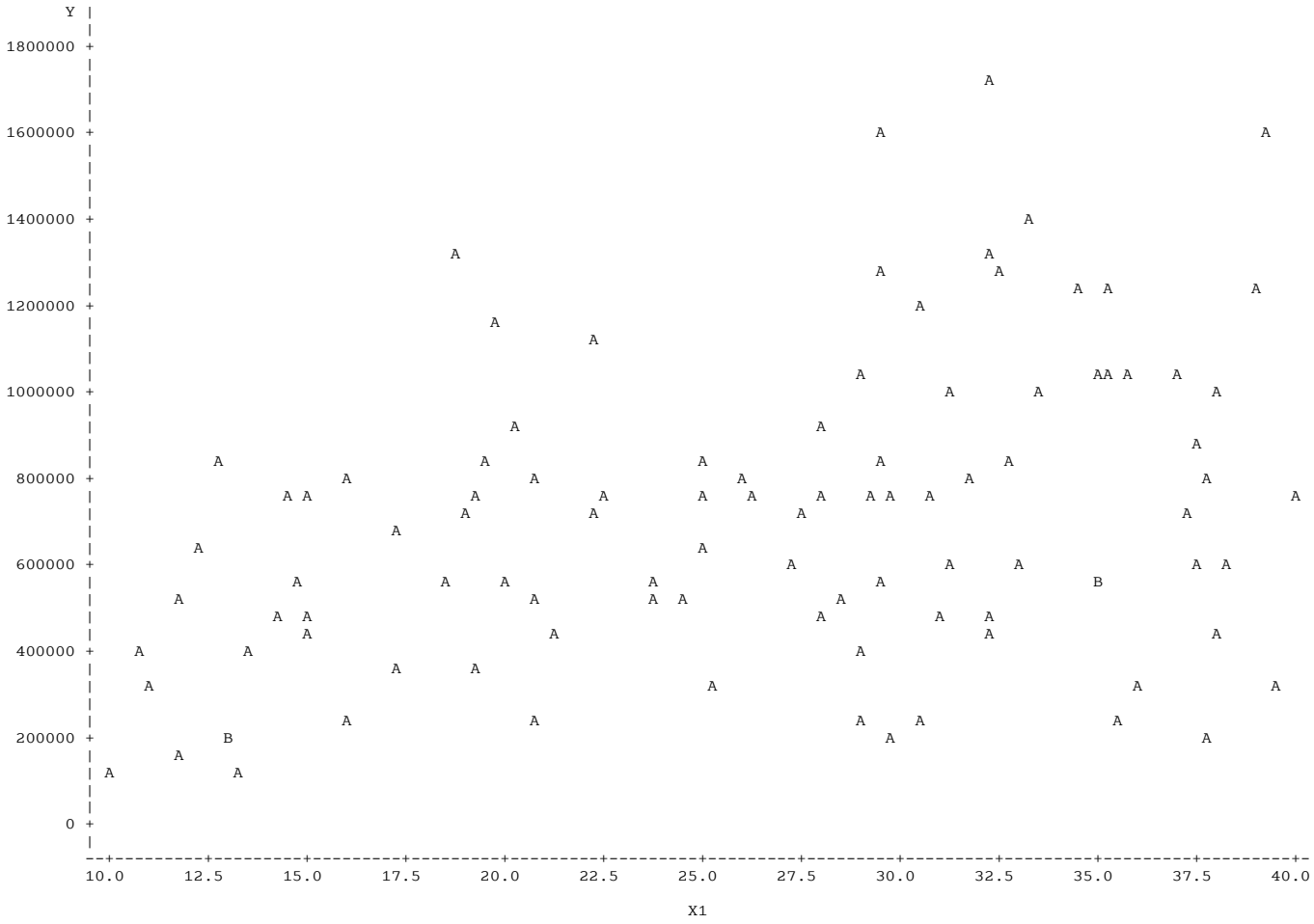
**The REG Procedure**
**Model: MODEL1**
**Dependent Variable: Y**



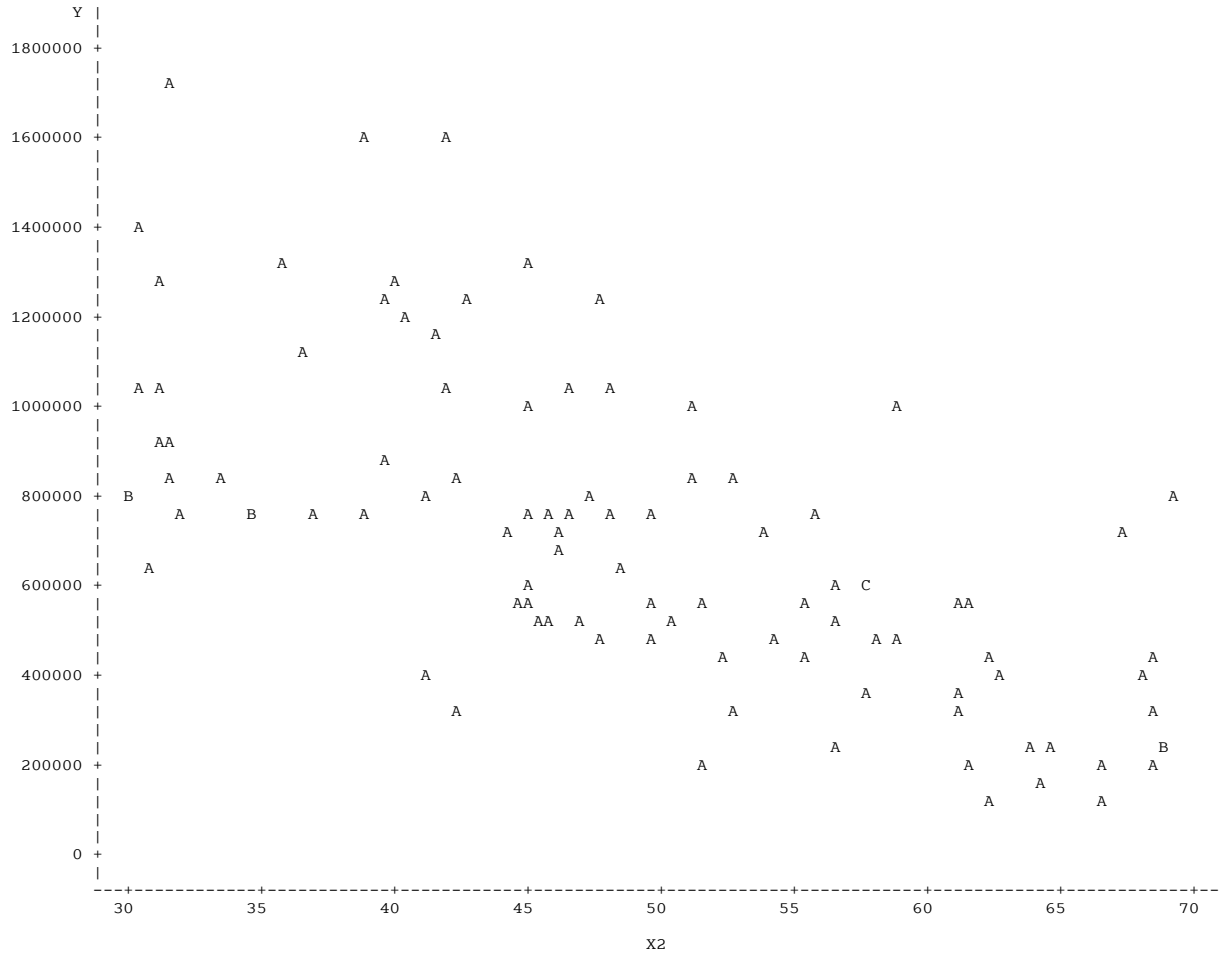
**The REG Procedure**
**Model: MODEL1**
**Dependent Variable: Y**



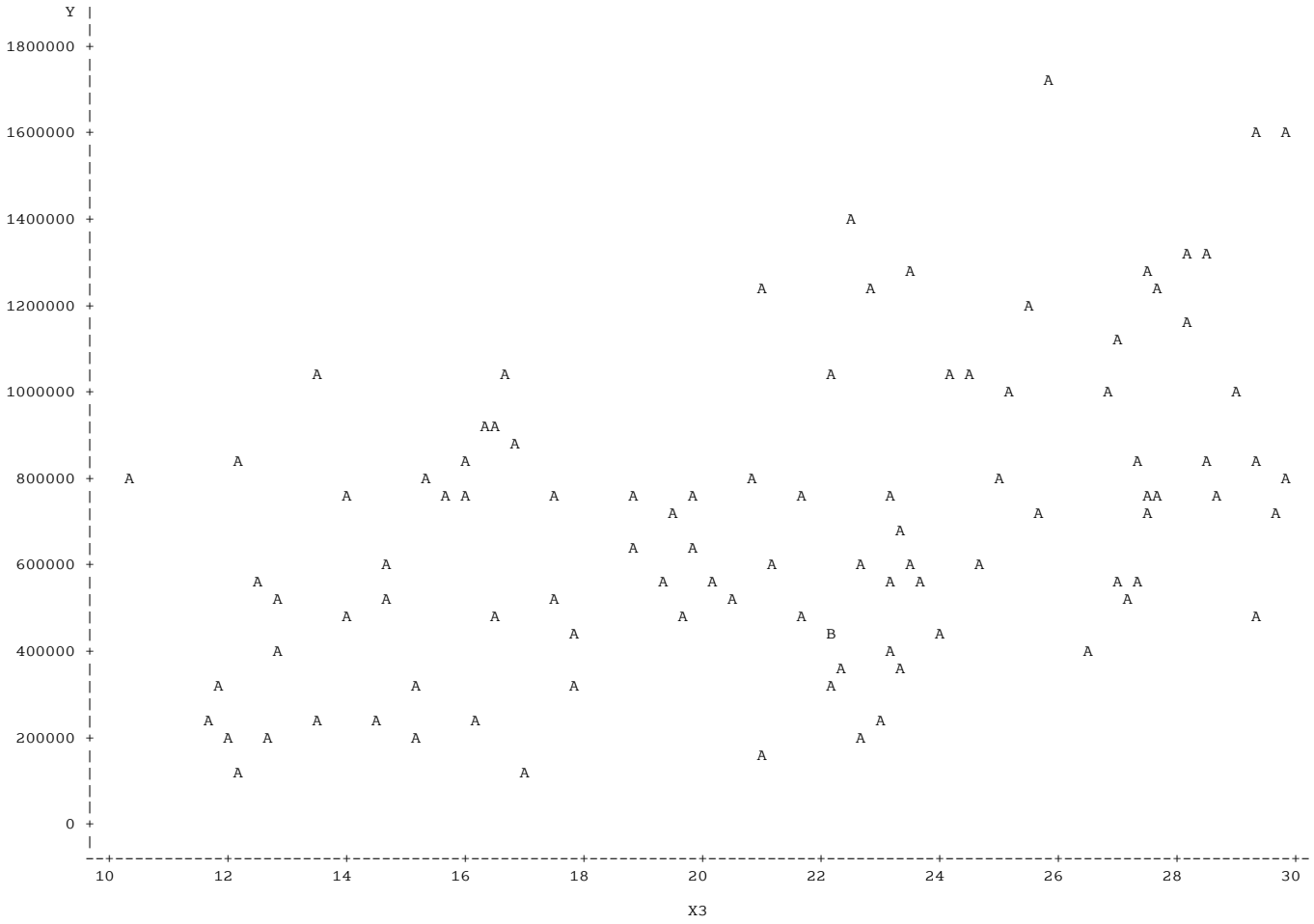
Plot of Y*X1. Legend: A = 1 obs, B = 2 obs, etc.



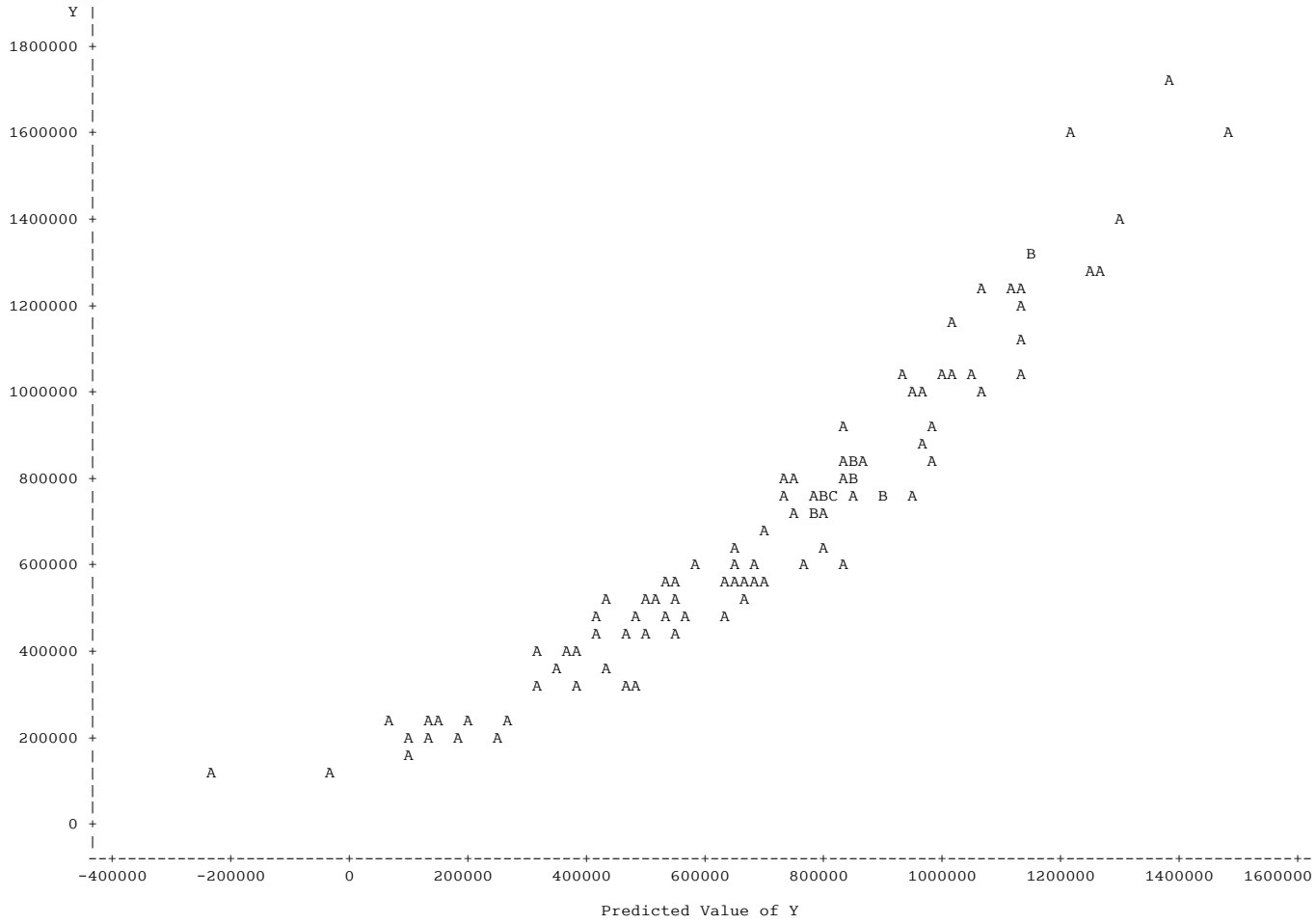
Plot of Y*X2. Legend: A = 1 obs, B = 2 obs, etc.



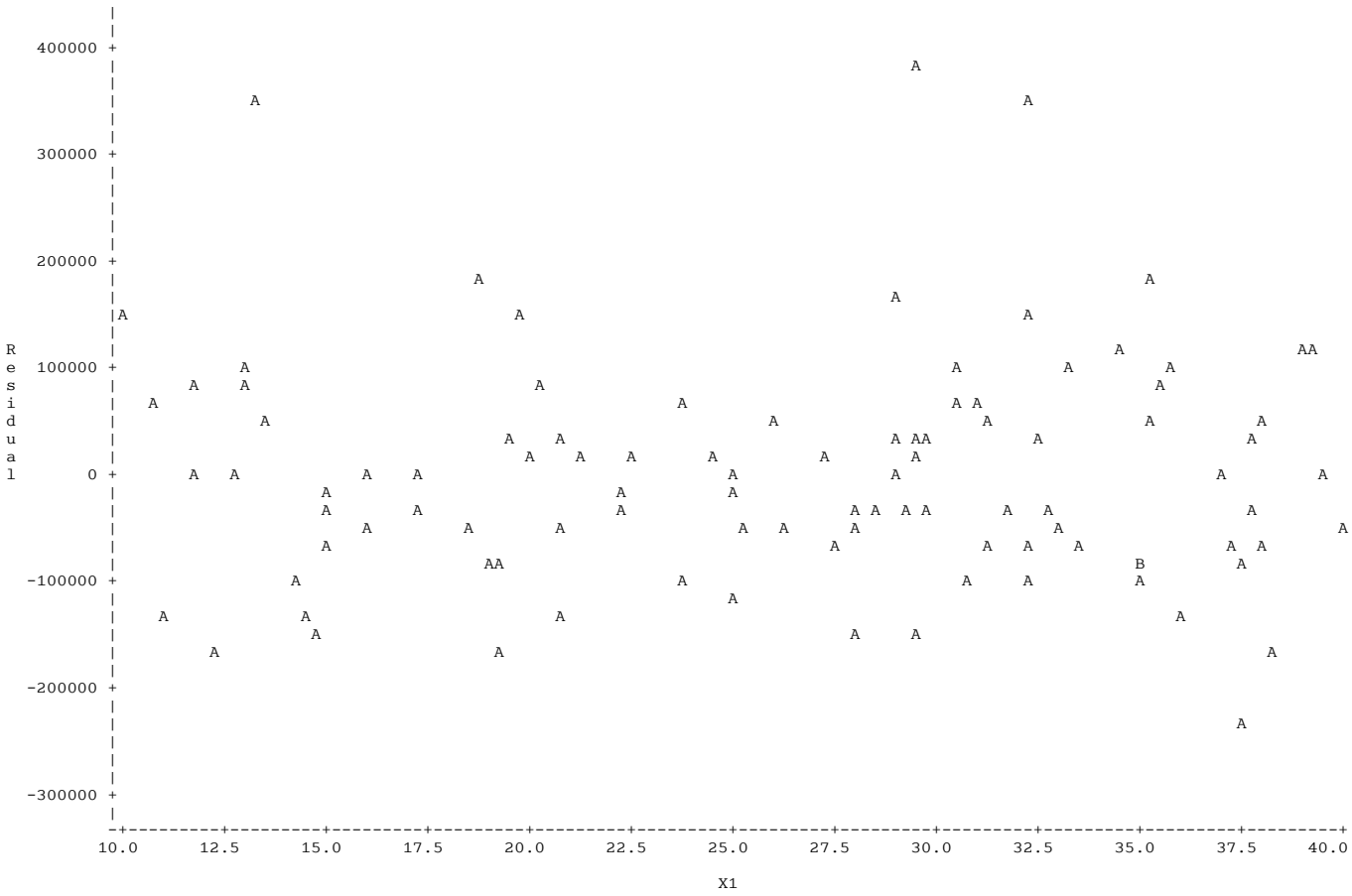
Plot of Y*X3. Legend: A = 1 obs, B = 2 obs, etc.



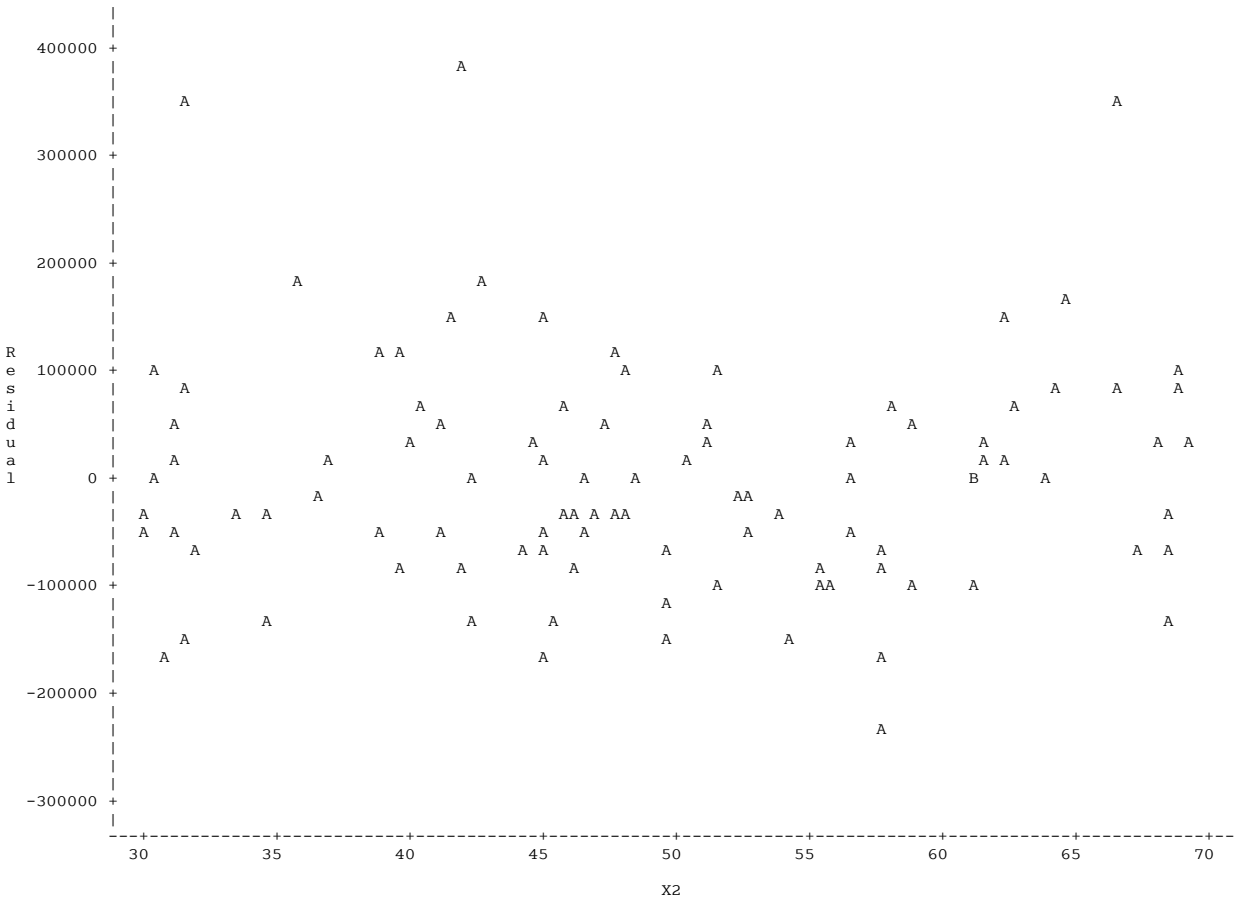
Plot of Y*mult_reg_pred. Legend: A = 1 obs, B = 2 obs, etc.



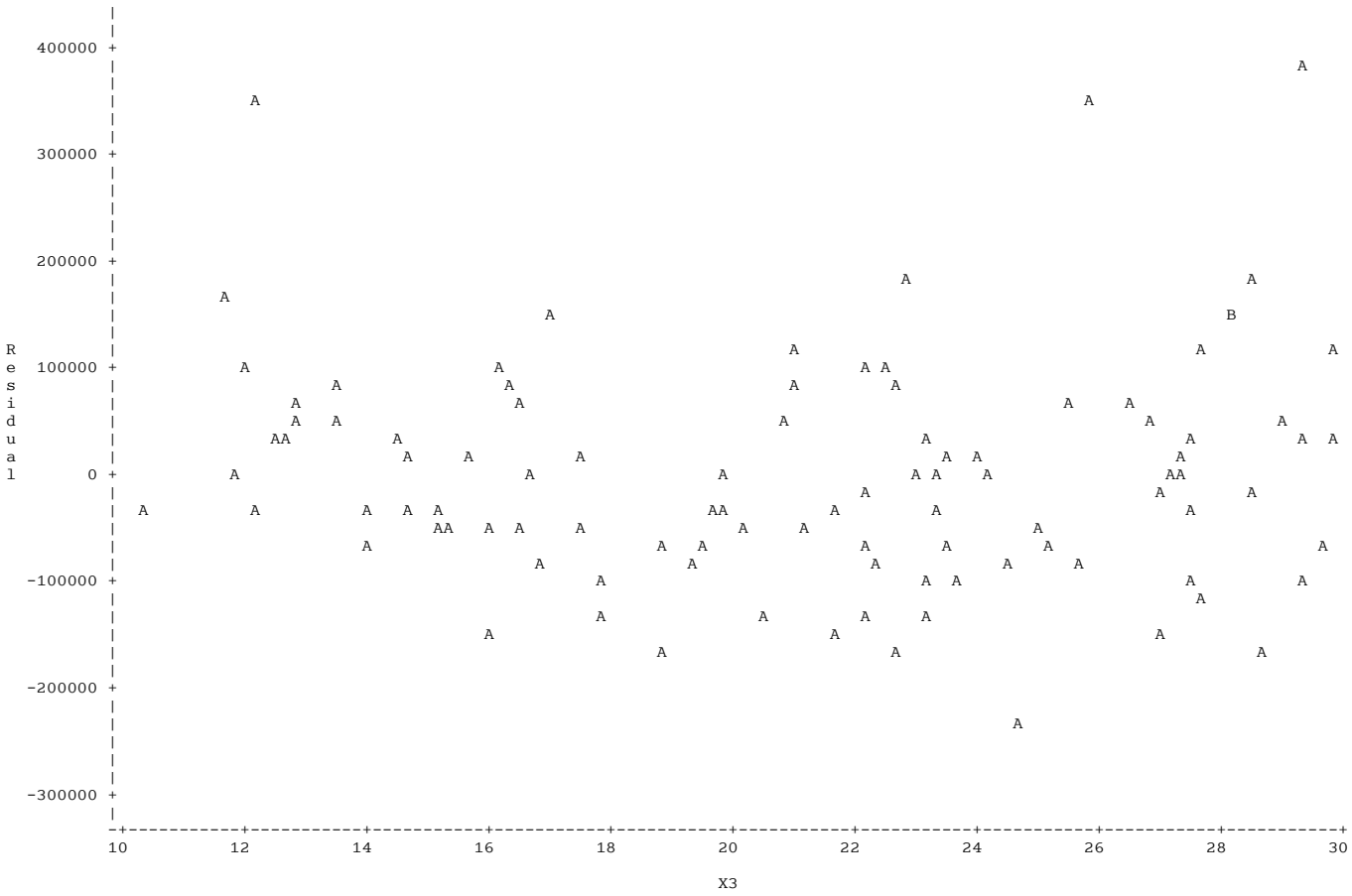
Plot of mult_reg_e*X1. Legend: A = 1 obs, B = 2 obs, etc.



Plot of mult_reg_e*X2. Legend: A = 1 obs, B = 2 obs, etc.



Plot of mult_reg_e*X3. Legend: A = 1 obs, B = 2 obs, etc.



Plot of mult_reg_e*mult_reg_pred. Legend: A = 1 obs, B = 2 obs, etc.