```
/*  SAS program for two-way AOV, with unbalanced   */
/*  design and interaction.  Data are from Kutner  */
/*  (1974) American Statistician 28:98-100.  The   */
/*  program is an example in the SAS documentation */
/*  for the GLM procedure.                         */
options nocenter ls=72;
data;
  input drug disease @;
  do i=1 to 6;
    input y @;
    output;
  end;
  cards;
  1 1 42 44 36 13 19 22
  1 2 33  . 26  . 33 21
  1 3 31 -3  . 25 25 24
  2 1 28  . 23 34 42 13
  2 2  . 34 33 31  . 36
  2 3  3 26 28 32  4 16
  3 1  .  .  1 29  . 19
  3 2  . 11  9  7  1 -6
  3 3 21  1  .  9  3  .
  4 1 24  .  9 22 -2 15
  4 2 27 12 12 -5 16 15
  4 3 22  7 25  5 12  .
  ;
proc glm;
  class drug disease;
  model y=drug disease drug*disease / ss1 ss2 ss3;
  means drug*disease;
  output out=new1 predicted=yhat1 residual=res1;
proc plot;
  plot yhat1*disease=drug;
proc glm;
  class drug disease;
  model y=drug disease;
  means drug;
  contrast '1 vs 2' drug 1 -1  0  0;
  contrast '1 vs 3' drug 1  0 -1  0;
  contrast '1 vs 4' drug 1  0  0 -1;
  contrast '2 vs 3' drug 0  1 -1  0;
  contrast '2 vs 4' drug 0  1  0 -1;
  contrast '3 vs 4' drug 0  0  1 -1;
  output out=new0 predicted=yhat0 residual=res0;
  proc plot;
    plot res0*yhat0;
run;
```

The GLM Procedure

Class Level Information

Class	Levels	Values
drug	4	1 2 3 4
disease	3	1 2 3

Number of observations 72

NOTE: Due to missing values, only 58 observations can be used in this analysis.

Dependent Variable: y

Source	DF	Sum of Squares	Mean Square	F Value
Model	11	4259.338506	387.212591	3.51
Error	46	5080.816667	110.452536	
Corrected Total	57	9340.155172		

Source	Pr > F
Model	0.0013
Error	
Corrected Total	

R-Square	Coeff Var	Root MSE	y Mean
0.456024	55.66750	10.50964	18.87931

Source	DF	Type I SS	Mean Square	F Value
drug	3	3133.238506	1044.412835	9.46
disease	2	418.833741	209.416870	1.90
drug*disease	6	707.266259	117.877710	1.07

Source	Pr > F
drug	<.0001
disease	0.1617
drug*disease	0.3958

Source	DF	Type II SS	Mean Square	F Value
drug	3	3063.432863	1021.144288	9.25
disease	2	418.833741	209.416870	1.90

Source	Pr > F
drug	<.0001
disease	0.1617

The GLM Procedure

Dependent Variable: y

Source	DF	Type II SS	Mean Square	F Value
drug*disease	6	707.266259	117.877710	1.07

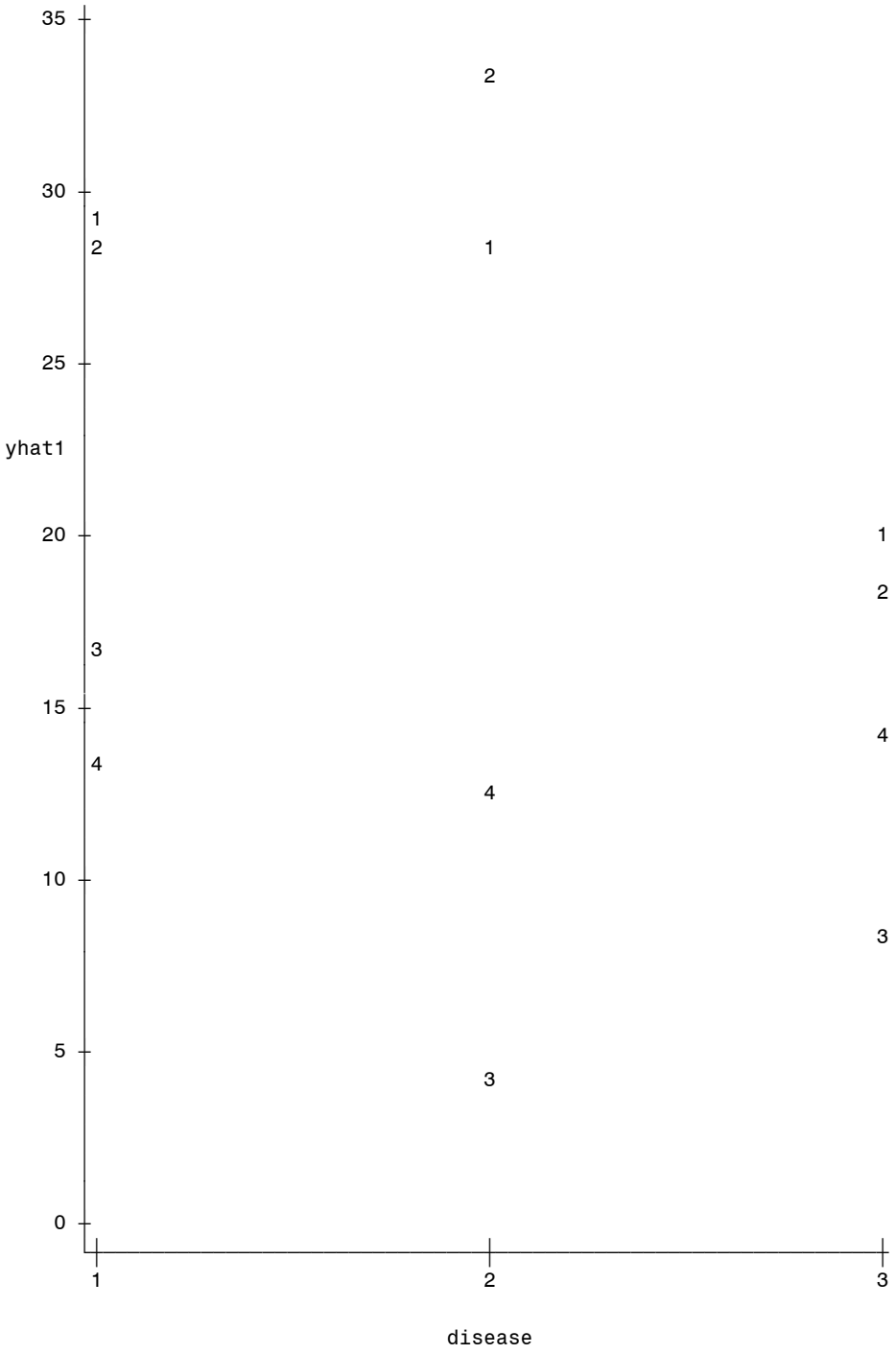
Source	Pr > F
drug*disease	0.3958

Source	DF	Type III SS	Mean Square	F Value
drug	3	2997.471860	999.157287	9.05
disease	2	415.873046	207.936523	1.88
drug*disease	6	707.266259	117.877710	1.07

Source	Pr > F
drug	<.0001
disease	0.1637
drug*disease	0.3958

Level of drug	Level of disease	N	y Mean	y Std Dev
1	1	6	29.3333333	13.0179363
1	2	4	28.2500000	5.8523500
1	3	5	20.4000000	13.3716117
2	1	5	28.0000000	10.9772492
2	2	4	33.5000000	2.0816660
2	3	6	18.1666667	12.5286339
3	1	3	16.3333333	14.1891978
3	2	5	4.4000000	6.9137544
3	3	4	8.5000000	9.0000000
4	1	5	13.6000000	10.5498815
4	2	6	12.8333333	10.3424691
4	3	5	14.2000000	8.9274856

Plot of yhat1*disease. Symbol is value of drug.



NOTE: 60 obs hidden.

The GLM Procedure

Class Level Information

Class	Levels	Values
drug	4	1 2 3 4
disease	3	1 2 3

Number of observations 72

NOTE: Due to missing values, only 58 observations can be used in this analysis.

The GLM Procedure

Dependent Variable: y

Source	DF	Sum of Squares	Mean Square	F Value
Model	5	3552.072246	710.414449	6.38
Error	52	5788.082926	111.309287	
Corrected Total	57	9340.155172		

Source	Pr > F
Model	0.0001
Error	
Corrected Total	

R-Square	Coeff Var	Root MSE	y Mean
0.380301	55.88298	10.55032	18.87931

Source	DF	Type I SS	Mean Square	F Value
drug	3	3133.238506	1044.412835	9.38
disease	2	418.833741	209.416870	1.88

Source	Pr > F
drug	<.0001
disease	0.1626

Source	DF	Type III SS	Mean Square	F Value
drug	3	3063.432863	1021.144288	9.17
disease	2	418.833741	209.416870	1.88

Source	Pr > F
drug	<.0001
disease	0.1626

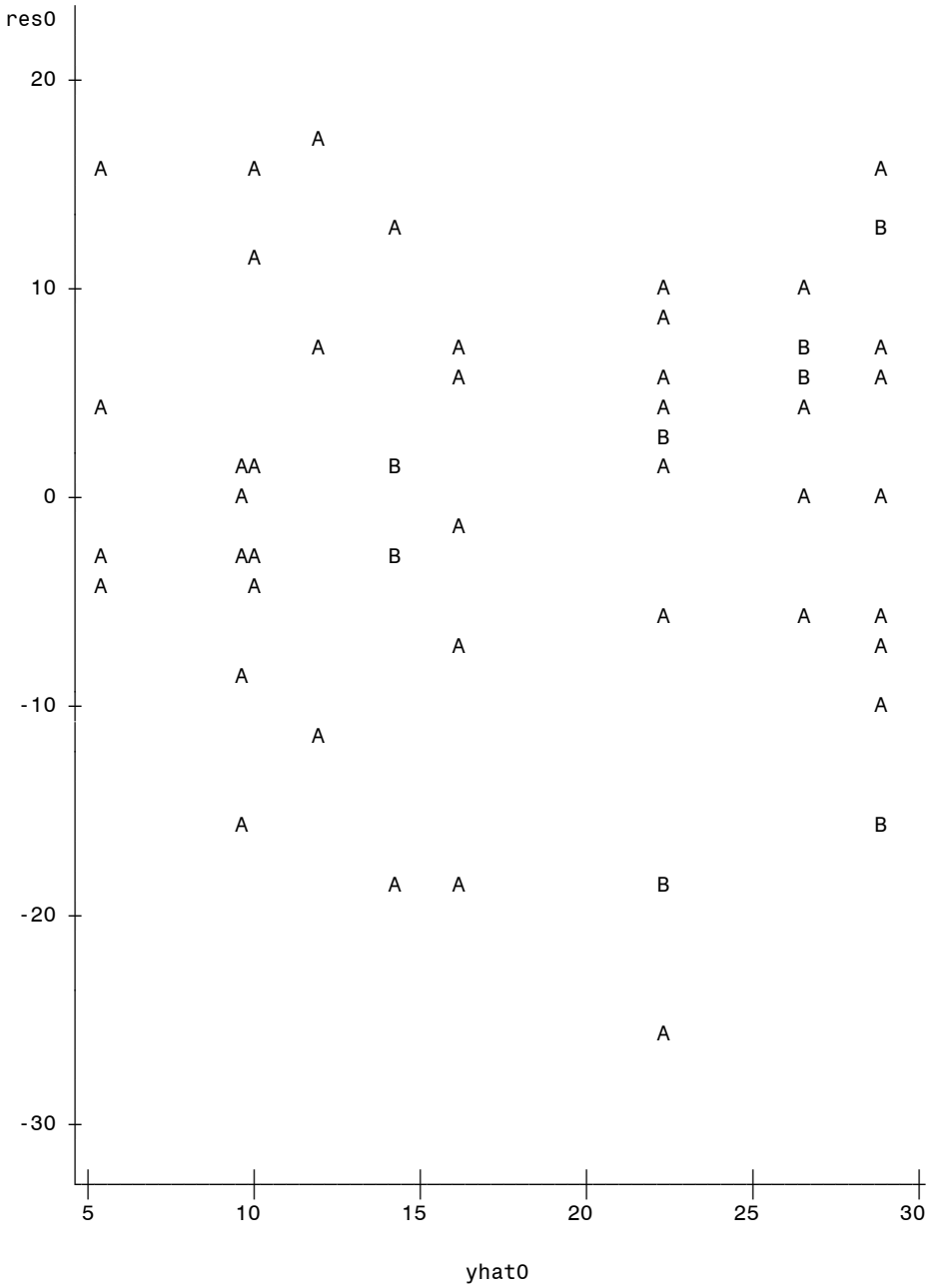
Level of drug	N	y Mean	y Std Dev
1	15	26.0666667	11.6770022
2	15	25.5333333	11.6181303
3	12	8.7500000	10.0192996
4	16	13.5000000	9.3238047

Dependent Variable: y

Contrast	DF	Contrast SS	Mean Square	F Value
1 vs 2	1	0.081457	0.081457	0.00
1 vs 3	1	1895.203303	1895.203303	17.03
1 vs 4	1	1193.846933	1193.846933	10.73
2 vs 3	1	1879.483855	1879.483855	16.89
2 vs 4	1	1174.163344	1174.163344	10.55
3 vs 4	1	140.206432	140.206432	1.26

Contrast	Pr > F
1 vs 2	0.9785
1 vs 3	0.0001
1 vs 4	0.0019
2 vs 3	0.0001
2 vs 4	0.0020
3 vs 4	0.2669

Plot of res0*yhat0. Legend: A = 1 obs, B = 2 obs, etc.



NOTE: 14 obs had missing values.