Data File Used in this Analysis:

```
# Houtot, Tartris, et. al., Groundwater electromagnetic imaging...
# Geophysics 2002, from Navidi (2006)
#
# conc. of chemical and conductivity measurements in Gittaz Lake, France
#  y = conductivity (10^(-2) S / m)
# x1 = conc. magnesium (mmol / L)
# x2 = conc. calcium (mmol / L)
#
y  x1  x2
2.77 0.037 1.342
3.03 0.041 1.500
3.09 0.215 1.332
3.29 0.166 1.609
3.37 0.100 1.627
0.88 0.031 0.382
0.77 0.012 0.364
0.97 0.017 0.467
1.10 0.027 0.487
1.11 0.039 0.497
2.57 0.168 1.093
3.27 0.172 1.480
2.28 0.044 1.093
3.32 0.069 1.754
3.93 0.188 1.974
4.62 0.211 2.103
```

MacAnova Session:

```
                    M A C A N O V A   4.13


      An Interactive Program for Statistical Analysis and Matrix Algebra
          For information on major features, type 'help(macanova)'
        For information on linear models and GLM's, type 'help(glm)'
            For latest information on changes, type 'help(news)'
        For information on Macintosh version, type 'help(macintosh)'
               Version of 01/15/03 (Power Macintosh [CW5])
           Type 'help(copyright)' for copyright and warranty info
        Copyright (C) 1994 - 2003 Gary W. Oehlert and Christopher Bingham
             MacAnova home page: http://www.stat.umn.edu/macanova
```

```
Cmd> a <- readdata("")
# Houtot, Tartris, et. al., Groundwater electromagnetic imaging...
# Geophysics 2002, from Navidi (2006)
#
# conc. of chemical and conductivity measurements in Gittaz lake, France
#  y = conductivity (10^(-2) S / m)
# x1 = conc. magnesium (mmol / L)
# x2 = conc. calcium (mmol / L)
#
Read from file "Macintosh HD:Textures:M3080_s05:M3080DataFiles:M3080_lake_cond"
Column 1 saved as REAL vector y
Column 2 saved as REAL vector x1
Column 3 saved as REAL vector x2


Cmd> ma <- hconcat(y,x1,x2)

Cmd> tabs(ma,all:T)
component: mean
(1)       2.5231      0.096063        1.194
component: var
(1)       1.4522      0.0058131      0.34715
component: count
(1)           16            16           16
component: stddev
(1)       1.2051      0.076244      0.58919
component: min
(1)        0.77        0.012         0.364
component: max
(1)        4.62        0.215         2.103
component: sum
(1)       40.37        1.537        19.104
component: prod
(1)   2.6654e+05   1.2547e-19       1.4203

Cmd> c1 <- (x1-.096063)/.076244

Cmd> c2 <- (x2-1.194)/.58919

Cmd> c3 <- c1^2

Cmd> c4 <- c1*c2

Cmd> c5 <- c2^2

Cmd> mmodel1 <- "y=c1+c2+c3+c4+c5"
```

```
Cmd> regress("y=c1+c2+c3+c4+c5",pvals:T,marginals:T)
Model used is y=c1+c2+c3+c4+c5
                 Coef        StdErr            t      P-Value
CONSTANT        2.5046      0.081438       30.755     < 1e-08
c1              0.1166      0.066248         1.76     0.10891
c2              1.0913      0.050035        21.81     < 1e-08
c3            0.079836      0.082831      0.96383     0.35786
c4            0.036647       0.12282      0.29838     0.77152
c5           -0.085726       0.10464     -0.81923     0.43175


N: 16, MSE: 0.013666, DF: 10, R^2: 0.97961
Regression F(5,10): 96.093, P-value: 4.0282e-08, Durbin-Watson: 1.9179
To see the ANOVA table type 'anova()'

Cmd> anova(mmodel1,fstats:T,pvals:T,marginals:T)
Model used is y=c1+c2+c3+c4+c5
WARNING: SS are Type III sums of squares
               DF           SS           MS            F      P-value
CONSTANT        1       12.926       12.926    945.87076     < 1e-08
c1              1      0.04233      0.04233      3.09756     0.10891
c2              1       6.5005       6.5005    475.67929     < 1e-08
c3              1     0.012695     0.012695      0.92897     0.35786
c4              1    0.0012167    0.0012167      0.08903     0.77152
c5              1    0.0091715    0.0091715      0.67113     0.43175
ERROR1         10      0.13666     0.013666

Cmd> resid()
          Depvar    StdResids          HII      Cook's D      t-stats
(1)         2.77      0.48981      0.34893       0.02143      0.47035
(2)         3.03      0.40795      0.36357      0.015845      0.39027
(3)         3.09     -0.95541      0.75682       0.47347     -0.95082
(4)         3.29      -1.3977      0.28103       0.12727      -1.4782
(5)         3.37       1.0473      0.30504      0.080243        1.053
(6)         0.88       0.4198      0.32284      0.014003      0.40181
(7)         0.77     -0.53696      0.29629      0.020233     -0.51691
(8)         0.97     -0.68037      0.23763      0.024048     -0.66094
(9)          1.1       0.2686        0.174      0.002533      0.25574
(10)        1.11      0.25459      0.21494     0.0029576      0.24231
(11)        2.57      0.93874      0.47127       0.13091      0.93261
(12)        3.27      0.42894      0.27095      0.011397      0.41073
(13)        2.28     0.033397       0.3893     0.0001185     0.031685
(14)        3.32      -1.3859      0.61369       0.50855      -1.4628
(15)        3.93       -1.918      0.32483       0.29499      -2.2886
(16)        4.62       2.7156      0.62886        2.0825       5.0275
```

3

```
Cmd> screen(mmodel1,mbest:32)
Model used is y=c1+c2+c3+c4+c5
Error variance set to full model mse, penalty factor is 2
  p    C(p)  Adj R^2  R^2    Model
  3    2.360 0.9911 0.9922 c1 c2
  4    3.638 0.9909 0.9927 c1 c2 c5
  4    3.870 0.9907 0.9926 c1 c2 c3
  5    4.089 0.9914 0.9937 c1 c2 c3 c5
  4    4.136 0.9905 0.9924 c1 c2 c4
  5    4.671 0.9909 0.9933 c1 c2 c3 c4
  5    4.929 0.9907 0.9931 c1 c2 c4 c5
  4    5.872 0.9891 0.9913 c2 c3 c5
  6    6.000 0.9906 0.9937 c1 c2 c3 c4 c5
  5    7.098 0.9888 0.9918 c2 c3 c4 c5
  4    7.962 0.9875 0.9900 c2 c3 c4
  3    8.344 0.9867 0.9885 c2 c3
  4    9.405 0.9864 0.9891 c2 c4 c5
  2   18.600 0.9794 0.9808 c2
  3   19.519 0.9786 0.9815 c2 c4
  3   20.016 0.9783 0.9812 c2 c5
  5  479.679 0.5845 0.6953 c1 c3 c4 c5
  4  493.812 0.6065 0.6852 c1 c4 c5
  4  514.910 0.5899 0.6719 c1 c3 c4
  3  520.812 0.6158 0.6670 c1 c3
  4  522.805 0.5837 0.6670 c1 c3 c5
  3  555.517 0.5906 0.6452 c1 c4
  3  613.381 0.5487 0.6089 c1 c5
  2  640.047 0.5617 0.5909 c1
  4 1292.339 -0.0197 0.1842 c3 c4 c5
  3 1295.622 0.0549 0.1809 c3 c4
  3 1301.880 0.0503 0.1770 c3 c5
  3 1428.666 -0.0414 0.0974 c4 c5
  2 1478.548 -0.0019 0.0649 c3
  2 1486.468 -0.0072 0.0599 c5
  2 1558.212 -0.0555 0.0149 c4
```

```
Cmd> anova("y=c1+c2",fstats:T,pvals:T,marginals:T)
Model used is y=c1+c2
WARNING: SS are Type III sums of squares
              DF          SS          MS            F       P-value
CONSTANT       1       101.86      101.86   7839.83800      < 1e-08
c1             1      0.24928     0.24928     19.18617   0.00074433
c2             1       8.7418      8.7418    672.83717      < 1e-08
ERROR1        13       0.1689    0.012992

Cmd> regress("y=c1+c2+c5",pvals:T,marginals:T)
Model used is y=c1+c2+c5
              Coef       StdErr            t      P-Value
CONSTANT     2.5533     0.045281       56.387      < 1e-08
c1           0.18096    0.041572        4.353    0.0009398
c2           1.0609     0.042243       25.115      < 1e-08
c5          -0.032158   0.037288     -0.86244      0.40535

N: 16, MSE: 0.013254, DF: 12, R^2: 0.98189
Regression F(3,12): 216.82, P-value: < 1e-08, Durbin-Watson: 1.877
To see the ANOVA table type 'anova()'

Cmd> regress("y=c1+c2+c5",fstats:T,pvals:T,marginals:T)
ERROR: fstats is not valid keyword for regress()

Cmd> anova("y=c1+c2+c3+c4+c5",fstats:T,pvals:T,marginals:T)
Model used is y=c1+c2+c3+c4+c5
WARNING: SS are Type III sums of squares
              DF          SS          MS            F       P-value
CONSTANT       1       12.926      12.926    945.87076      < 1e-08
c1             1      0.04233     0.04233      3.09756      0.10891
c2             1       6.5005      6.5005    475.67929      < 1e-08
c3             1     0.012695    0.012695      0.92897      0.35786
c4             1    0.0012167   0.0012167      0.08903      0.77152
c5             1    0.0091715   0.0091715      0.67113      0.43175
ERROR1        10      0.13666    0.013666

Cmd> resvsrankits()

Cmd> addlines(vector(-2,2),vector(-2,2),linetype:63)

Cmd>
#Output Window saved Thu Mar 11 00:04:08 2010
#-----------------------------------------

Cmd>
```

Standardized Residuals vs Normal Scores