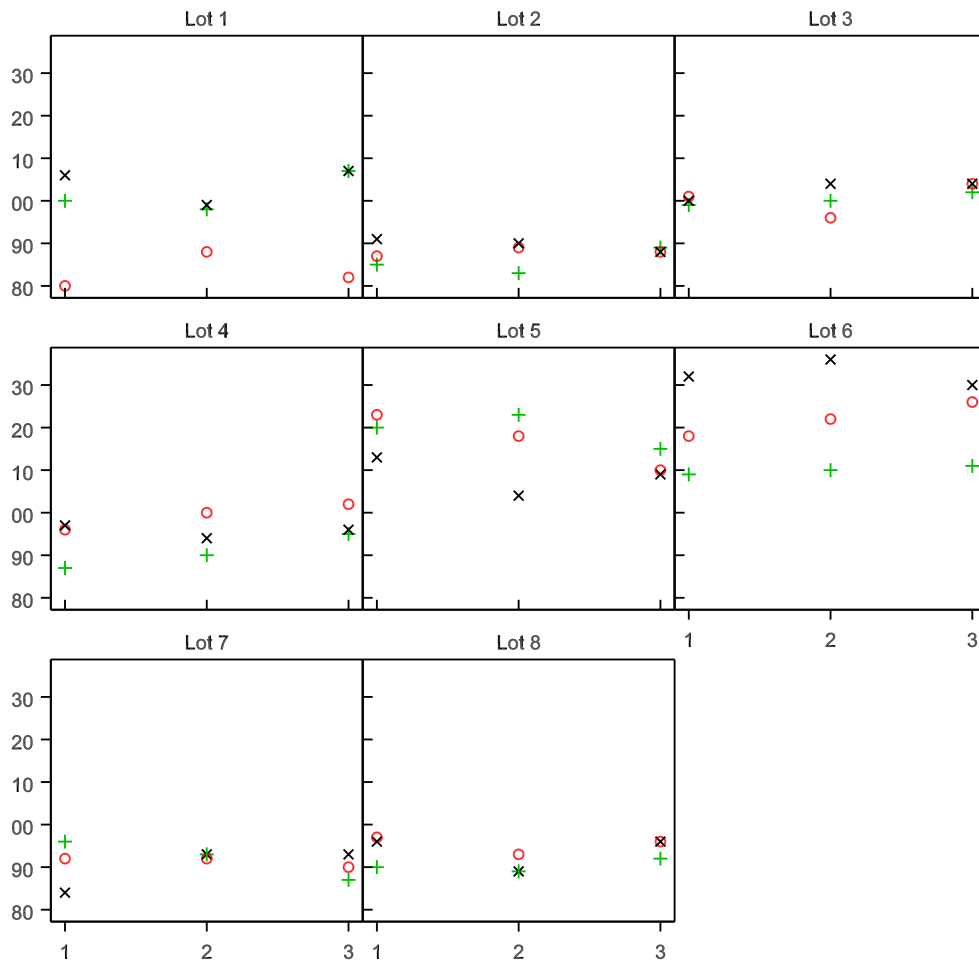# GenStat test

We will analyze a dataset with 72 observations discussed in Littel *et. al*, *SAS System for Mixed Models*. Ee have 72 observations of oxide thickness in a semiconductor manufacturing process. We run 4 lots with each of two suppliers, with three wafers per lot. Oxide thickness is then measured at three sites.

Here is a glance at the data for each lot:

```
GS> TRELLIS [GROUPS=Lot; PENGROUP=Wafer;  FIRSTPICTURE=top] \
GS>     Y=Thickness; X=Site; METHOD=Point
```


Here is an analysis based on the multi-stratum error structure that GenStat is famous for.

```
GS> BLOCK Lot/Wafer
GS> TREATMENTS Source*Site
GS> ANOVA [PRINT=aovtable,information,means; FPROB=yes; PSE=diff]  Thickness

47...........................................................................
```

```
Analysis of variance
====================

Variate: Thickness

Source of variation     d.f.      s.s.       m.s.    v.r.  F pr.
```

```
Lot stratum
Source                        1      1830.12      1830.12    1.53  0.263
Residual                      6      7195.19      1199.20    9.98


Lot.Wafer stratum            16      1922.67       120.17    9.98


Lot.Wafer.*Units* stratum
Site                          2        15.44         7.72    0.64  0.531
Source.Site                   2        58.33        29.17    2.42  0.100
Residual                     44       529.56        12.04


Total                        71     11551.32


* MESSAGE: the following units have large residuals.

Lot 1     Wafer 2           -13.00    s.e. 5.17
Lot 6     Wafer 1            11.11    s.e. 5.17
Lot 6     Wafer 3           -11.56    s.e. 5.17


Lot 5     Wafer 2     *units* 3            -6.39   s.e. 2.71
Lot 7     Wafer 1     *units* 1            -6.64   s.e. 2.71


Tables of means
===============


Variate: Thickness


Grand mean  2000.15

   Source        1        2
           1995.11  2005.19


    Site        1        2        3
           1999.96  1999.71  2000.79


   Source     Site        1        2        3
        1            1994.08  1994.25  1997.00
        2            2005.83  2005.17  2004.58


Standard errors of differences of means
---------------------------------------

Table             Source         Site      Source
                                             Site
rep.                  36           24          12
s.e.d.             8.162        1.001       8.244
d.f.                   6           44        6.24
Except when comparing means with the same level(s) of
Source                                      1.416
d.f.                                           44
```