May 5, 2009 change in the 25Jul2008b macros and not in the 25Jul2008 macros. All macros now produce a basic option list and one or more basic code samples when you specify "?" or "help" as the first argument. The following example illustrates:

```
%mktruns(help)
```

The results are as follows:

```
Option                          Description

list                            (positional) numbers of levels of all the factors
interact=interaction-list       interaction terms
max=n <m> <f>                   largest design sizes to try
n=n                             design size to evaluate
maxlev=n                        maximum number of levels
maxoa=n                         maximum number of orthogonal arrays
options=justparse               used by other Mkt macros to parse the list
options=multiple                allow terms to be counted multiple times
options=multiple2               option=multiple and more detailed output
options=noprint                 suppress the display of all output
options=nosat                   suppress the saturated design from the design list
options=source                  displays source of numbers in design sizes
options=512                     adds some designs in 512 runs
out=SAS-data-set                data set with the suggested sizes
outorth=SAS-data-set            data set with orthogonal array list
toobig=n                        specifies problem that is too big


%mktruns(2 2 2 3 3 3 3)

%mktruns(2**10 3**3, interact=11|12|13@2)
```

May 5, 2009 change in the 25Jul2008b `%MktLab` macro and not in the 25Jul2008 macro. The `%MktLab` macro now accepts input values that are not all positive integers. The following example illustrates:

```
%mktex(2 ** 3, n=4, levels=c)

proc print; run;

%mktlab(data=design, values=1 -1)

proc print; run;
```

The results are as follows:

Obs	x1	x2	x3
1	-0.5	-0.5	-0.5
2	-0.5	0.5	0.5
3	0.5	-0.5	0.5
4	0.5	0.5	-0.5

Obs	x1	x2	x3
1	1	1	1
2	1	-1	-1
3	-1	1	-1
4	-1	-1	1

July 13, 2009 change in the 25Jul2008b `%MktLab` macro.
The preceding fix only worked in SAS 9.2 and caused an error on the TIES= option in PROC RANK in previous SAS releases. Now the code has reverted back to its old way of working for SAS releases prior to 9.2. The new code for handling nonconsecutive integers works in 9.2 and is skipped in previous releases because it relies on a new 9.2 option in PROC RANK.

May 5, 2009 change in the 25Jul2008b `%MktEx` macro and not in the 25Jul2008 macro.
The behavior of the `examine=aliasing=` option has changed with this release. The `%MktEx` macro `examine=` option now has the following capabilities:

examine= < I > < V > < aliasing=*n* > < full > < main >

specifies the matrices that you want to examine. The option `examine=I` displays the information matrix, $\mathbf{X}'\mathbf{X}$; `examine=V` displays the variance matrix, $(\mathbf{X}'\mathbf{X})^{-1}$; and `examine=I V` displays both. By default, these matrices are not displayed.

Specify `examine=aliasing=`*n* to examine the aliasing structure of the design. If you specify `examine=aliasing=2`, `%MktEx` will display the terms in the model and how they are aliased with up to two-factor interactions. More generally, with `examine=aliasing=`*n*, up to *n*-factor interactions are displayed. You can also specify `full` (e.g. `examine=aliasing=2 full`) to see the full (and often much more complicated) aliasing structure that PROC GLM produces directly. You can also specify `main` to see only the estimable functions that begin with main effects, and not the ones that begin with interactions. Interactions are still used with `examine=aliasing=2 main` and larger values of `aliasing=`. This option just removes some of the output.

Note that the `aliasing=`*n* option is resource intensive for larger problems. For some large problems, one of the underlying procedures might detect that the problem is too big, immediately issue an error, and quit. For other large problems, it might simply take a very long time before completing or printing an error due to insufficient resources. The number of two-way interaction terms is a quadratic function of the number of main effects, so it is not possible to print the aliasing structure even for some very reasonably sized main-effects designs.

The following example illustrates the `examine=aliasing=2` option:

```
%mktex(3 ** 4, n=9, examine=aliasing=2)
```

The preceding step produces the following results:

```
                                  Aliasing Scheme
Estimable  Aliased
Effect     Effects

Intercept

x1         x2*x3 x2*x4 x3*x4

x2         x1*x3 x1*x4 x3*x4

x3         x1*x2 x1*x4 x2*x4

x4         x1*x2 x1*x3 x2*x3

NOTE: Some parameters in the estimable effects are aliased with some parameters
 in the aliased effects.  For effects with more than two levels, the aliasing
 scheme displayed here is potentially partial.  Specify EXAMINE=FULL ALIASING=n
 to see the full aliasing structure.
```

These results show that one or both of the two parameters in each of `x1-x4` are aliased with one or more of the $(3-1) \times (3-1) = 4$ parameters in the each of three two-way interactions that do not involve the estimable effect.

You can get the full results as follows:

```
%mktex(3 ** 4, n=9, examine=aliasing=2 full)
```

The full aliasing results involving the `x1` main effect are as follows:

```
x11 - x21x32 - x22x31 + 0.5*x21x41 - 0.5*x21x42 + 0.5*x22x41 + 1.5*x22x42 +
   0.5*x31x41 - 0.5*x31x42 - 0.5*x32x41 - 1.5*x32x42

x12 - 0.3333*x21x31 + x22x32 - 0.1667*x21x41 - 0.5*x21x42 + 0.5*x22x41 -
   0.5*x22x42 + 0.1667*x31x41 + 0.5*x31x42 + 0.5*x32x41 - 0.5*x32x42
```

These results show that the level 1 parameter of `x1` cannot be estimated independently of the interaction term involving `x2` level 1 and `x3` level 2, the interaction term involving `x2` level 2 and `x3` level 1, the interaction term involving `x2` level 1 and `x4` level 1, the interaction term involving `x2` level 1 and `x4` level 2, the interaction term involving `x2` level 2 and `x4` level 1, and so on.

Note, however, that even these results are not really the full results because only two-way interactions are included. To really see the full extent of the aliasing, you need to add all three-way and the four-way interaction as follows:

```
%mktex(3 ** 4, n=9, examine=aliasing=4 full)
```

The first part of the full aliasing structure is as follows:

```
                              Aliasing Structure

  Intercept - 0.6667*x11x21x32 - 0.6667*x11x22x31 - 0.6667*x12x21x31 +
     2*x12x22x32 + 0.3333*x11x21x41 - 0.3333*x11x21x42 + 0.3333*x11x22x41 +
     x11x22x42 - 0.3333*x12x21x41 - x12x21x42 + x12x22x41 - x12x22x42 +
     0.3333*x11x31x41 - 0.3333*x11x31x42 - 0.3333*x11x32x41 - x11x32x42 +
     0.3333*x12x31x41 + x12x31x42 + x12x32x41 - x12x32x42 + 0.3333*x21x31x41 -
     0.3333*x21x31x42 + 0.3333*x21x32x41 + x21x32x42 - 0.3333*x22x31x41 -
     x22x31x42 + x22x32x41 - x22x32x42

  x11 - x21x32 - x22x31 + 0.3333*x11x21x31 - x11x22x32 + x12x21x32 + x12x22x31 +
     0.5*x21x41 - 0.5*x21x42 + 0.5*x22x41 + 1.5*x22x42 + 0.1667*x11x21x41 +
     0.5*x11x21x42 - 0.5*x11x22x41 + 0.5*x11x22x42 - 0.5*x12x21x41 +
     0.5*x12x21x42 - 0.5*x12x22x41 - 1.5*x12x22x42 + 0.5*x31x41 - 0.5*x31x42 -
     0.5*x32x41 - 1.5*x32x42 - 0.1667*x11x31x41 - 0.5*x11x31x42 - 0.5*x11x32x41 +
     0.5*x11x32x42 - 0.5*x12x31x41 + 0.5*x12x31x42 + 0.5*x12x32x41 +
     1.5*x12x32x42 + 0.3333*x11x21x31x41 - 0.3333*x11x21x31x42 +
     0.3333*x11x21x32x41 + x11x21x32x42 - 0.3333*x11x22x31x41 - x11x22x31x42 +
     x11x22x32x41 - x11x22x32x42

  x12 - 0.3333*x21x31 + x22x32 + 0.3333*x11x21x32 + 0.3333*x11x22x31 -
     0.3333*x12x21x31 + x12x22x32 - 0.1667*x21x41 - 0.5*x21x42 + 0.5*x22x41 -
     0.5*x22x42 - 0.1667*x11x21x41 + 0.1667*x11x21x42 - 0.1667*x11x22x41 -
     0.5*x11x22x42 - 0.1667*x12x21x41 - 0.5*x12x21x42 + 0.5*x12x22x41 -
     0.5*x12x22x42 + 0.1667*x31x41 + 0.5*x31x42 + 0.5*x32x41 - 0.5*x32x42 -
     0.1667*x11x31x41 + 0.1667*x11x31x42 + 0.1667*x11x32x41 + 0.5*x11x32x42 +
     0.1667*x12x31x41 + 0.5*x12x31x42 + 0.5*x12x32x41 - 0.5*x12x32x42 +
     0.3333*x12x21x31x41 - 0.3333*x12x21x31x42 + 0.3333*x12x21x32x41 +
     x12x21x32x42 - 0.3333*x12x22x31x41 - x12x22x31x42 + x12x22x32x41 -
     x12x22x32x42
```

The aliasing scheme, which is the new summary, is as follows:

```
                              Aliasing Scheme
Estimable  Aliased
Effect     Effects

Intercept  x1*x2*x3 x1*x2*x4 x1*x3*x4 x2*x3*x4

x1         x2*x3 x2*x4 x3*x4 x1*x2*x3 x1*x2*x4 x1*x3*x4 x1*x2*x3*x4

x2         x1*x3 x1*x4 x3*x4 x1*x2*x3 x1*x2*x4 x2*x3*x4 x1*x2*x3*x4

x3         x1*x2 x1*x4 x2*x4 x1*x2*x3 x1*x3*x4 x2*x3*x4 x1*x2*x3*x4

x4         x1*x2 x1*x3 x2*x3 x1*x2*x4 x1*x3*x4 x2*x3*x4 x1*x2*x3*x4

NOTE: Some parameters in the estimable effects are aliased with some parameters
 in the aliased effects.  For effects with more than two levels, the aliasing
 scheme displayed here is potentially partial.  Specify EXAMINE=FULL ALIASING=n
 to see the full aliasing structure.
```

For the complicated designs that we use in practice, particularly for choice models, the aliasing structure and aliasing scheme are often very long and complicated. In many cases, they cannot be displayed because the size of the model gets unwieldy with m main effect parameters, $m(m-1)/2$ two-way interaction parameters, and so on.

We can use the `%MktEx` macro to create a resolution IV design (all main effects are estimable free of each other and free of all two-factor interactions, but some two-factor interactions are confounded with other two-factor interactions), for m two-level factors (where m is a multiple of 4), and evaluate it as follows:

```
%let m = 12;
%mktorth(range=n=2 * &m, options=lineage dups, maxlev=&m)

%mktex(2 ** &m, n=2 * &m, examine=aliasing=2,
       cat=mktdeslev(where=(index(compbl(design), "2 ** &m &m ** 1"))))
```

This example uses the `%MktOrth` macro to create the instructions for creating all designs in $2m$ runs, and then sends the `%MktEx` macro instructions for just the design with m two-level factors and an m-level factor, which produces the desired design. Often, the `%MktEx` macro has many ways to make a specified design and will not choose the one you have in mind unless you give it specific instructions such as we did here. This step creates a design from the first m columns of a design of the form:

$$\begin{array}{rl} \mathbf{H}_m & \ell_m \\ -\mathbf{H}_m & \ell_m \end{array}$$

$\mathbf{H}_m$ is a Hadamard matrix of order m, and ℓ_m is a column vector where $\ell'_m = [0\ 1\ 2\ ...\ m-1]$. The resulting design has m two-level factors in $2m$ runs and has the following aliasing scheme:

```
                                Aliasing Scheme
Estimable  Aliased
Effect     Effects

Intercept

x1

x2

x3

x4

x5

x6

x7

x8

x9

x10

x11

x12

x1*x2      x1*x7 x1*x8 x1*x11 x1*x12 x2*x7 x2*x8 x2*x11 x2*x12 x3*x7 x3*x8
           x3*x9 x3*x11 x3*x12 x4*x7 x4*x8 x4*x10 x4*x11 x4*x12 x5*x6 x5*x7
           x5*x8 x5*x11 x5*x12 x6*x7 x6*x8 x6*x11 x6*x12 x7*x9 x7*x10 x8*x9
           x8*x10 x9*x11 x9*x12 x10*x11 x10*x12

x1*x3      x1*x7 x1*x8 x1*x10 x1*x11 x2*x6 x2*x7 x2*x8 x2*x10 x2*x11 x3*x7
           x3*x8 x3*x10 x3*x11 x4*x7 x4*x8 x4*x10 x4*x11 x4*x12 x5*x7 x5*x8
           x5*x9 x5*x10 x5*x11 x6*x7 x6*x8 x6*x10 x6*x11 x7*x9 x7*x12 x8*x9
           x8*x12 x9*x10 x9*x11 x10*x12 x11*x12

x1*x4      x1*x7 x1*x9 x1*x10 x1*x11 x2*x7 x2*x9 x2*x10 x2*x11 x2*x12 x3*x6
           x3*x7 x3*x9 x3*x10 x3*x11 x4*x7 x4*x9 x4*x10 x4*x11 x5*x7 x5*x8
           x5*x9 x5*x10 x5*x11 x6*x7 x6*x9 x6*x10 x6*x11 x7*x8 x7*x12 x8*x9
           x8*x10 x8*x11 x9*x12 x10*x12 x11*x12

x1*x5      x1*x7 x1*x9 x1*x11 x1*x12 x2*x7 x2*x9 x2*x10 x2*x11 x2*x12 x3*x7
           x3*x8 x3*x9 x3*x11 x3*x12 x4*x6 x4*x7 x4*x9 x4*x11 x4*x12 x5*x7
           x5*x9 x5*x11 x5*x12 x6*x7 x6*x9 x6*x11 x6*x12 x7*x8 x7*x10 x8*x9
           x8*x11 x8*x12 x9*x10 x10*x11 x10*x12
```

```
x1*x6      x1*x8 x1*x9 x1*x10 x1*x11 x1*x12 x2*x6 x2*x8 x2*x9 x2*x10 x2*x11
           x2*x12 x3*x6 x3*x8 x3*x9 x3*x10 x3*x11 x3*x12 x4*x6 x4*x8 x4*x9
           x4*x10 x4*x11 x4*x12 x5*x6 x5*x8 x5*x9 x5*x10 x5*x11 x5*x12 x6*x7
           x7*x8 x7*x9 x7*x10 x7*x11 x7*x12

x1*x7      x1*x8 x1*x9 x1*x10 x1*x11 x1*x12 x2*x3 x2*x4 x2*x5 x2*x6 x2*x7 x2*x8
           x2*x9 x2*x10 x2*x11 x2*x12 x3*x4 x3*x5 x3*x6 x3*x7 x3*x8 x3*x9
           x3*x10 x3*x11 x3*x12 x4*x5 x4*x6 x4*x7 x4*x8 x4*x9 x4*x10 x4*x11
           x4*x12 x5*x6 x5*x7 x5*x8 x5*x9 x5*x10 x5*x11 x5*x12 x6*x7 x6*x8
           x6*x9 x6*x10 x6*x11 x6*x12 x7*x8 x7*x9 x7*x10 x7*x11 x7*x12 x8*x9
           x8*x10 x8*x11 x8*x12 x9*x10 x9*x11 x9*x12 x10*x11 x10*x12 x11*x12

NOTE: Some parameters in the estimable effects are aliased with some parameters
 in the aliased effects.  For effects with more than two levels, the aliasing
 scheme displayed here is potentially partial.  Specify EXAMINE=FULL ALIASING=n
 to see the full aliasing structure.
```

The aliasing scheme shows that we did in fact find a resolution IV design with all main effects estimable free of each other and free of all two-factor interactions. You can see by looking at the interaction terms in the estimable effects and those that are part of the `x1*x7` aliasing scheme that in this case at least part of every two-way interaction is aliased with at least part of some other two-way interactions.