

Bruce McCarl's GAMS Newsletter Number 43

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1 GAMS version 26.1.0

Within the last couple of weeks we saw a new GAMS release. Here I comment on some of its features. Note I am no longer updating the McCarl Guide so for more information see the official GAMS guide accessible on the web through the IDE of through Studio.

1.1 Implicit set definition

GAMS has now introduced a way of implicitly defining set based on the names used in data input. One does this at compile time (so the set can be used in defining domains). This is done for example by using a new syntax feature which involves inserting one or more `<`'s as follows

```
Set      I set to be implicitly defined
         J another set
* Below the < tells GAMS to draw the set elements for I and j from
*      the elements associated with data in a
Table a(I<,j<)
         J1          J2
I1      4            3
I2      7            4;
Display I,j;
```

The `<` can be used more than once in conjunction with `$onmulti` which **merges** in new entries or the new command `$onmultiR` which **replaces** the previous set definition.

1.2 Put Utility to select solver

A new `put_utility` keyword **solver** was added that allows one to select a solver for a particular model type or all possible model types. An example follows

```
Set slv solvers to use in solving the MIP /CPLEX,mosek,xpress/;
*loop solving with each of these solvers
loop(slv,
  put_utility 'solver' / 'mip' / slv.tl:0;
  solve mymodel using mip maximizing myobjective;
);
```

Additionally the command to use a solver in this case Conopt for all applicable models it can be applied to is

```
put_utility 'solver' / '*' / 'Conopt';
```

1.3 Handling of spaces in file names and commands

GAMS was altered to better accommodate spaces in file and directory names plus eliminate associated error messages. Simultaneously the reading of command-line arguments on non-Windows platforms was also changed to better accommodate spaces and eliminating the need for extra quoting.

1.4 Solver updates

A lot of solver updates were added with what appears to me to be significant new features or improvements added for Baron, Conopt 4, Kestrel, Knitro, Lindo/LindoGlobal, LocalSolver, OdhCplex, Path, Scip, SoPlex and Xpress. Also a new solver called Selkie was introduced which is an EMP problem type solver that implements decomposition methods for multi-agent equilibrium and related models.

2 A new release of GAMS Studio

The most recent release contains a substantial upgrade of GAMS Studio. Below I discuss what I consider to be important elements of this version of Studio.

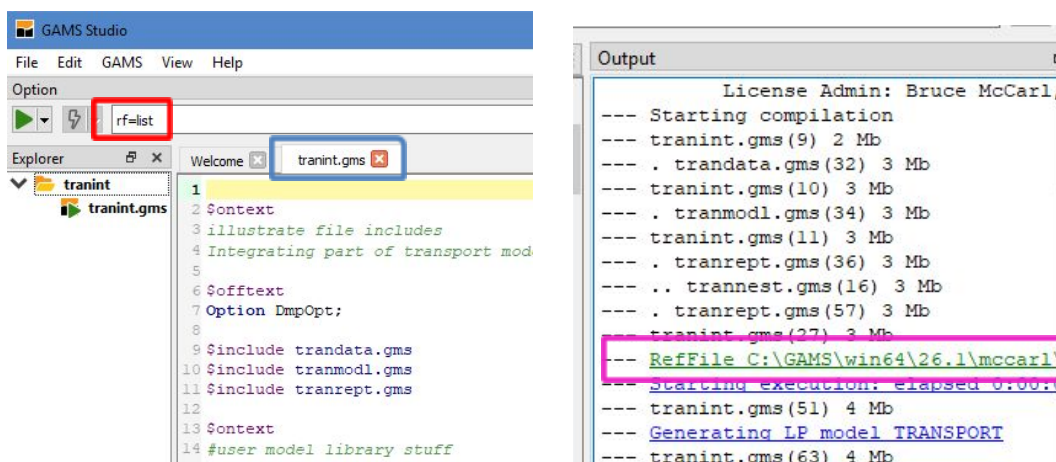
2.1 Includes a reference file viewer

A few years ago I worked with the GAMS staff to create a viewing/navigation procedure to help a user unravel the location and use of parameters, sets, variable, etc. This was designed for use in the context of a GAMS implementation with multiple include files and was implemented in the IDE. As of this release, Studio contains this feature. The basics function is discussed in the Studio or GAMS IDE documentation under the topic Reference File Viewer or more extensively in the McCarl Guide under the topic Refreader. To access the McCarl guide treatment go to <https://www.gams.com/fileadmin/community/contrib/doc/mccarlgamsuserguide.pdf> and use search to find Refreader.

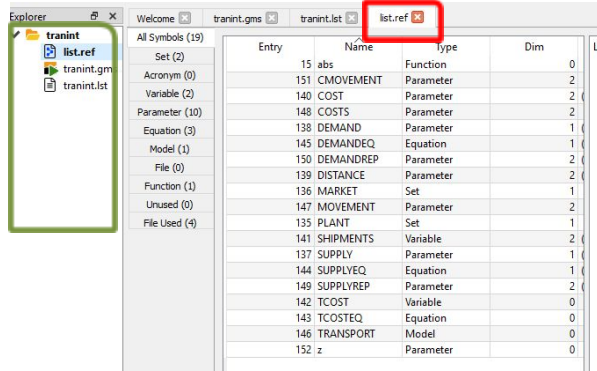
Briefly one accesses this feature by

1. Running a job with the added command line instruction `rf=myname` which creates the file `myname.ref`. Note the file name is chosen by the use so `rf=list` is also possible resulting in the file `list.ref`. GAMS adds the ref extension if it is not in the file name.
2. Opening the ref file by clicking on a blue line in the output window that starts with `RefFile`. This can also be directly opened using the file open dialogue.
3. Navigates the files included in the model using a window like that below (where the run used the GAMS file `rf=list` yielding `list.ref`).

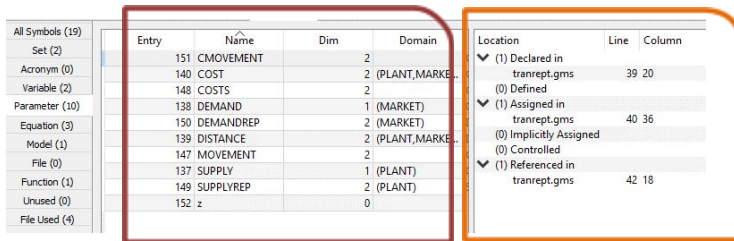
An example was created using the McCarl guide example file `transint.gms` that integrates three other files. Note the run used the GAMS command line entry `rf=list` yielding a `RefFile` named `list.ref`. On my machine the `transint.gms` file is located in `C:\GAMS\win64\26.1\mccarl`. The command line entry in Studio is pictured below as is the output file with the clickable link



Then after running one clicks on the **RefFile** entry opening the **list.ref** file as below



Within the list.ref window in Studio there are **lines** that when clicked on cause Studio to open some lists of things appearing in the model. These include a list of all symbols; lists that when opened contain information on sets, parameters etc.; a list of items that are defined but never use and finally a list of the files used. When activating these lines (tabs) the window then contains detailed **lists of items**. In the left part of the screenshot below these list all items in the model defined that are parameters. Subsequently when one clicks on an item name (in the screenshot this was the first one - CMOVEMENT) then one gets a **list of file and line locations where that item is declared, defined, assigned** etc. Clicking on that list opens the associated file to the appropriate location.



There are a couple of aspects of this meriting comment.

- The all items window is squeezed vertically and still contains the explanatory text but it is hidden. To see it one must manipulate the display widening and narrowing columns. It may be advantageous to reorder it. I would prefer the explanatory text to be just after the item name.
- As of now Studio does not have the right click option of writing a CSV file containing this information and I hope this is added as it has been useful in creating model documentation.
- Studio provides access to all the locations in a file where a category of use of an item appears. The IDE just opened the file and positioned the cursor at the first one and assumed further navigation would be done via the editor. The Studio approach may well

create long lists in some cases perhaps hindering easy navigation and may or may not turn out to be an advantage.

- There is an aspect of the reference file design that influences the contents of the list of files used that affects the output in both the IDE and Studio. In particular if a file is included without any GAMS keywords it will not be listed. For example the file **dataforimport** in the example below would not be in the list of files.

```
Parameter datatoimport(mysets) /
$include dataforimport
/;
```

2.2 An improved version of GDX viewer

The GDX file viewer in Studio is now improved with inclusion of a table viewer and some manipulation possibilities. This supports user directed opening of a **GDX file** and facilitates examination of its contents. On selection of an item in the GDX file the viewer generates a list or a table based representation (depending on whether list or table view is chosen at bottom). Under table view only items with 2 or more dimensions are displayed with the last dimension put into the header of the table. The IDE capabilities of dragging and dropping of items and reordering where sets appear is not currently available, but is planned for the future. As in the last version, Items can be sorted alphabetically or from small to large by clicking on the **tabs as in the windows explorer**.

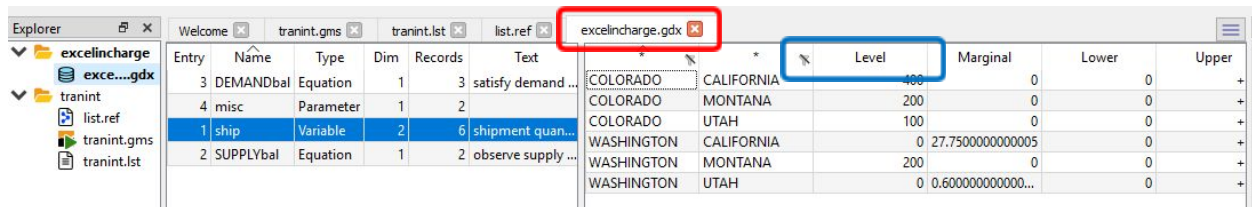




Table view also permits columns to be reordered via drag and drop. Additionally in List view one can choose to suppress display of set elements using the  symbol and when elements are suppressed they do not appear in the Table view. Finally a right click allows writing of a selected section of the list or table view to CSV files.

2.3 Solver choice, license status information moved

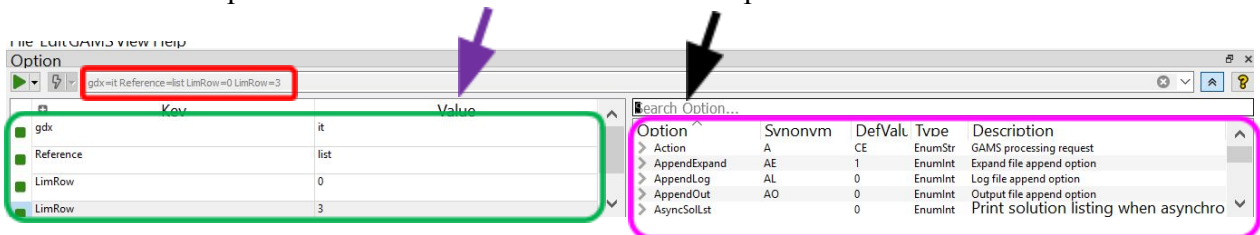
In the IDE one chose solvers and found license information under file and settings it is now in the Help>About GAMS dialogue with solver choice under the solvers tab. In the IDE different setups could be used across projects. This is not possible within Studio and would need to be embedded in model specific files.

2.4 Command line editor

GAMS contains many possible command line entries. A new feature that has been added to Studio is the command file editor. This is accessed by pressing the box labeled with  that appears on the right-hand side of the Studio window



When that box is pressed then the command line editor expands as follows

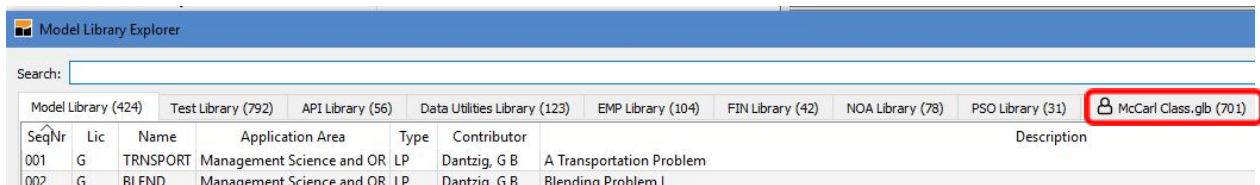


where the commands that are now being used in the command line box appear in the left side of the window and the possible command line entries are listed within the right window. Also if one goes into the box labeled search option and starts typing characters then the commands listed in the right-hand window will only be those which contain those characters. Once an option has been found if it is selected and F1 is pressed then documentation on that option is displayed. Also if one wishes to change the value for it then when it has a prepecified set of choices a gray > symbol will appear beside it. In turn, when that is clicked on a dropdown menu of alternative values and their meaning appears. Then when one double clicks on a choice or the option name as it is designated as a changed option and is placed in the left hand box and in the command line. In the left-hand box one can select the value in the cells underneath the value column and change it if desired. I found the mouse operations a little strange to work with but if you restrict your operations to the cells falling under the value column and either make choices or start typing then you can make changes.

2.5 Defining your own library


In my teaching I find it valuable to have my own library of examples. Years ago I participated with GAMS staff in the development of a way that a user could set up their own library creating a "glb" file then permit access to it through the IDE. This is discussed in the document [Creating a User Library for use in the IDE](#). This is now supported in Studio. To provide access one needs to place the glb file in a specific file location that varies across platforms. That location can be identified by navigating through the File>Settings>Misc>Open Location dialogue then one can subsequently place the glb file there. Also note that within the GLB file there is an entry for `LibraryName` which is the name that will be used to identify the library in the GAMS Library Explorer.

```
Version = 5
LibraryName = McCarl Class.glb
Columns = 4
1 = Name
2 = Notebook Section
```



I also think there is room for improvement in the Library Explorer access procedure. In particular I feel that it is unnecessary to include the glb file extension in the library name and also that it would be nice to allow the user to reorder the list of accessible libraries plus collapse items from that list that are of little interest into one aggregate "other" category. For example given the possibility I would collapse the ones from Test Library through PSO Library into an others tab and would move McCarl Class up toward the front. Such a choice would clearly differ from user to user.

2.6 Option to jump to first compilation error

For a long time I have wished that GAMS would reposition the LOG and LST files to the first error message when compilation errors appear. There is some progress in that direction in Studio with options controlling behavior in File>Settings>General although for now there seems to be a bug in this as I was told "If you check the **Jump to the first compiler error option** and uncheck **Open lst file after run**, it actually works, and you jump to the first error in the gms file. But if both are checked, nothing happens." This results in the cursor being repositioned to the place in the original GMS file where if you hover over the  then the error message appears as follows


```

25                                     s1s1a1
26
27 p      'cropping activities' / crop-02
28                                     crop-05
409 Unrecognizable item - skip to find a new statement
    looking for a ';' or a key word to get started again
    p-10
    p-15
    crop-16
    crop-17
32

```

Also I would note that I think it would be better if the log file was always repositioned to the first error message) as it allows better navigation when there are multiple relevant error messages that are not in close proximity in the GMS file.

2.7 What is in Studio?, What is not? and What could be improved?

There are a number of features in the IDE that are not in Studio or vice versa plus things I like and things in my very limited Studio use that I find annoying or potential subjects for improvement.

Those uniquely in the IDE are:

- Ones I judge to be of substantial use that I would like to see come into Studio - Option file editor; Find in files; Option to delete 225a directories; More powerful GDX viewing; Permanently visible run button and command line box (not controlled by checking the View> option line); Menu driven GDX file differencing; Ability to choose default solvers; and Means for adding default contents to command line in the File>Setting>Execute command.
- Of lesser value but still convenient - Ability to manipulate syntax coloring; Ability to use alternative GAMS versions at execution time (maybe not until Studio is stable); More context (project or default) specific solver selection menu and Ability to stop MIP solves by the user through the process window. I also found occasional value in Menu driven Text differencing; and Spell checking.
- Things I am glad are gone – Script recording (the scripts never worked right for me due to possible project changes) and Chart creation in the GDXviewer (I thought it did not work well or give enough user control).

Those uniquely in Studio are:

- Ones of substantial use: Help integration through the F1 key; Automatic insertion of closing character for brackets and quotes; Command line parameter editor; Option to jump to first compilation error (as covered above); Writing of less files to disk (optionally

no LOG); GDX viewer sorting/element suppression; and Use of the lightning bolt to stop MIPs in process when user says to do it.

- Another that has some benefit: Option for automatic GDX file creation

Things in Studio I wish would be improved

Beauty is in the eye of the beholder and in my eye I think there is room to make some improvements. I have been told some of these are in process (see the ** below). In particular I would like to see in terms of: Elimination of option to hide command line box and run button**;

Better implementing documentation view (as discussed below); Adding a solver option file editor**;

Expanding capabilities of the GDX file viewer**;

Putting in a choice or action to replace tabs with spaces when files are opened or when cut paste occurs;

Providing less cumbersome access to McCarl guide;

Adding a library of McCarl guide and User guide examples;

Allowing one to hide some of the over supply of libraries in the Library Explorer as discussed above;

Implementing something that could clean up extraneous files (Unneeded LXI, LST, LOG, 225a, GDX, and maybe put utility);

Improving the documentation search so it can find more things (right now it fails to find refreader and <);

and Improve the prioritization of search results as I find many to be irrelevant and that the important ones often appear lower in lists.

Things that differ that I am unsure about:

- Project files versus Explorer Groups

2.8 A difficulty I had in using Studio

I opened documentation access through Help and it docked the documentation window at the top of my screen with the top bar inaccessible. This made it impossible to use that bar to close or move the documentation window. Also I found that window was restricted to always be on top which located it in front of the Studio editing window so initially I could not access the rest of Studio. Furthermore, I found that despite using the control f2 sequence discussed below that on my machine the docking that hides the top bar occurs every time I open the documentation and use a maximize command to make the document fall outside the Studio desktop. In turn despite closing and reopening the Studio I initially could not figure out how to get rid of the documentation window, nor could I get into the editing part of the Studio. Later I figured out I could narrow the window from side to side until I could see the view tab and uncheck the view of the Help.

Through GAMS support I was informed Control F2 resets the view closing the Help window which I now use. I was also told running Studio with command line options like **--reset-view** would work although I think this is not so useful as I believe it a rare user who wants to run

Studio through the command line. I hope GAMS can fix this odd docking behavior. I also find the documentation access to be rather awkward in its placement and docking behavior. I find the help sometimes goes in the main Studio window and other times in a separate window sometimes in a strange place on the desktop without me having any way of knowing which will occur. Finally I feel that the desktop undocked documentation and other such windows should be set up so they are not always on top.

2.9 Can we get better control over the font size on the documentation?

My computer in native mode wants to use high resolution and the fonts are small. This makes the Studio documentation quite hard to read for my eyes. Unfortunately, changing the resolution and blowing up the font size through Windows display options leads to some weird behavior with some software. For me I would like it if control + (really control = without the shift) would blow the font up in the documentation window like it does in browsers. I did find control shift + worked but feel it would be nice if this followed the conventions in other programs.

3 Basic, Advanced and Combined courses offered soon

This year I will again be teaching my family of GAMS courses for basic and advanced users. These courses will be offered in early June when there will still be some snow up in the high country and Arapahoe basin may even still be open for skiing. Dates, times and content are

- Basic to Advanced GAMS class June 24, 2019- June 28, 2019 (5 days) in the Colorado mountains at Dillon (near Frisco and Breckenridge). The course spans from Basic topics to an Advanced GAMS class. Details are found at https://www.gams.com/fileadmin/news-events/Basic_to_Advanced_GAMS_Modeling2019.pdf.
- Basic GAMS class June 25, 2019- June 26, 2019 (3 days) in the Colorado mountains at Dillon (near Frisco and Breckenridge). The course starts assuming no GAMS background. Details are given at https://www.gams.com/fileadmin/news-events/Basic_GAMS_Modeling2019.pdf.
- Advanced GAMS class June 26, 2019- June 28, 2019 (3 days) in the Colorado mountains at Dillon (near Frisco and Breckenridge). The course is for users who have a GAMS background. Details are found at https://www.gams.com/fileadmin/news-events/Advanced_GAMS_Modeling2019.pdf

Further information and other courses are listed on <http://www.GAMS.com/courses.htm> . Note I also give custom courses for individual groups a couple of times a year.

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