Using GAMS STUDIO

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Using GAMS STUDIO
What Is It?

A multi platform (PCs with Windows, Mac, LINUX) graphical interface to run GAMS

GAMS uses two phases.

1- Text edit

First, one uses a text editor and creates a file which contains GAMS instructions.

2- File submission

Second, one submits that file to GAMS which executes those instructions causing calculations to be done, solvers to be used and a solution file of the execution results to be created.

Approaches to use GAMS.

1. More batch oriented Traditional method
   use a text editor set up the model then use DOS (or LINUX) command line instructions to find errors in and run the model.
2. GAMS STUDIO or GAMS IDE alternatives.
   Graphical interfaces to create, debug, text edit and run GAMS files.

Using GAMS STUDIO
Summary of steps to using

1. Install GAMS and STUDIO on your computer

2. Open STUDIO through the icon

3. Open or create a file by going to the file selection in the upper left corner.

4. Prepare the file so you think it is ready for execution

5. Run the file with GAMS by clicking the run button or pressing F9

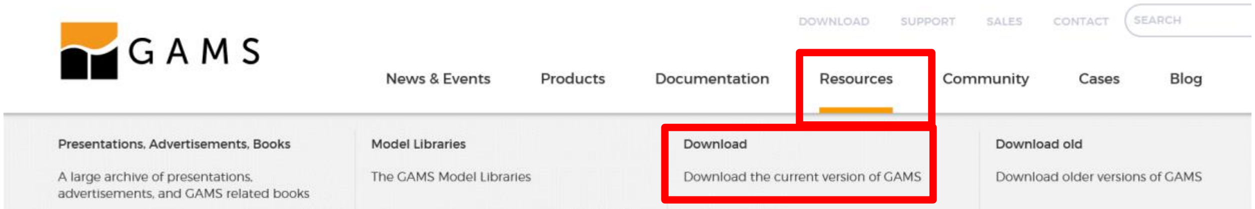
6. Open and navigate around the output

Using GAMS STUDIO
Installation

Install GAMS and STUDIO

GAMS STUDIO is automatically installed when GAMS is installed and you get the choice of whether to use STUDIO or the IDE as primary editor. To install whole GAMS system including STUDIO do the following steps

a. Download the GAMS installation file from www.GAMS.com under Resources and Download

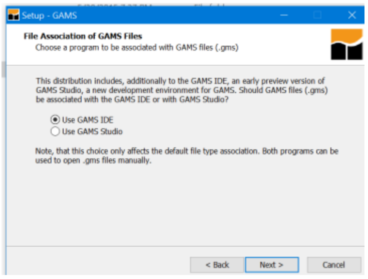

DOWNLOAD
SUPPORT
SALES
CONTACT
SEARCH
GAMS
News & Events
Products
Documentation
Resources
Community
Cases
Blog
Presentations, Advertisements, Books
A large archive of presentations, advertisements, and GAMS related books
Model Libraries
The GAMS Model Libraries
Download
Download the current version of GAMS
Download old
Download older versions of GAMS

b. Start the installation

Installer should place an icon on the desktop yielding

Using GAMS STUDIO
Using STUDIO after Installation

During the install you will find



Setup - GAMS

File Association of GAMS Files

Choose a program to be associated with GAMS files (.gms)

This distribution includes, additionally to the GAMS IDE, an early preview version of GAMS Studio, a new development environment for GAMS. Should GAMS files (.gms) be associated with the GAMS IDE or with GAMS Studio?

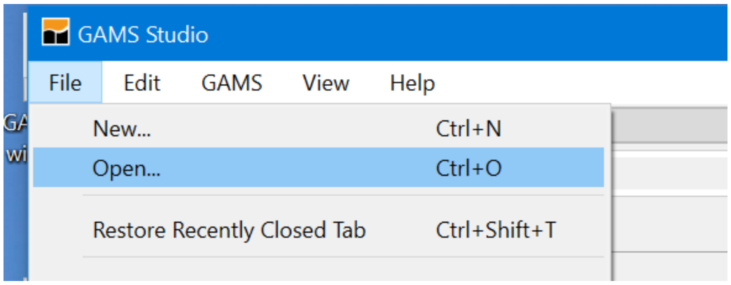
● Use GAMS IDE
○ Use GAMS Studio

Note, that this choice only affects the default file type association. Both programs can be used to open .gms files manually.

Which allows you to choose which graphical interface to use as the default. For now choose STUDIO.

Open STUDIO through the icon

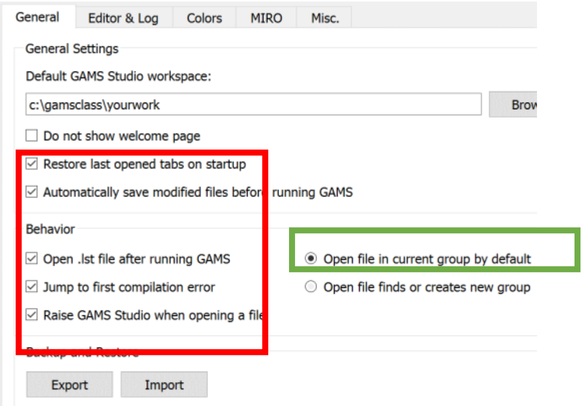
Open the File menu choice. Select a file.



Note, the file location determines where all generated files are placed (to place files elsewhere use the save as dialogue) and where GAMS looks for files when executing. I recommend that you make sure your file is in a place where you want it also making sure that place contains all associated files i.e. this is the file storage directory for this endeavor.

Using GAMS STUDIO
Using STUDIO after Installation

Fix defaults and suppress the highlighting of word under the cursor (I find it is very distracting). When first opening STUDIO go to settings and I would make sure check marks are as follows especially the checked ones in the red boxes and I would choose the green ones



General Settings

Default GAMS Studio workspace:

c:\gamsclass\yourwork

□ Do not show welcome page

☑ Restore last opened tabs on startup

☑ Automatically save modified files before running GAMS

Behavior

☑ Open .lst file after running GAMS

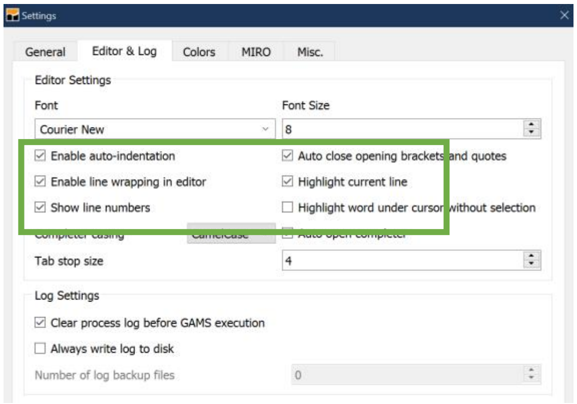
☑ Jump to first compilation error

☑ Raise GAMS Studio when opening a file

● Open file in current group by default

○ Open file finds or creates new group

Backup and Restore



Editor Settings

Font: Courier New

Font Size: 8

☑ Enable auto-indentation

☑ Enable line wrapping in editor

☑ Show line numbers

☑ Auto close opening brackets and quotes

☑ Highlight current line

□ Highlight word under cursor without selection

Completer casing: CamelCase

☑ Auto open completer

Tab stop size: 4

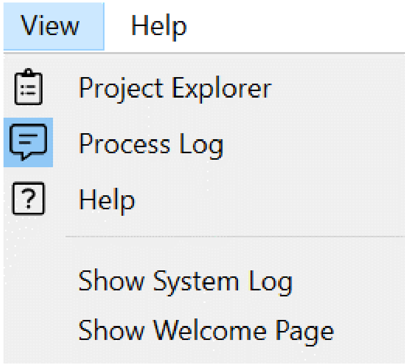
Log Settings

☑ Clear process log before GAMS execution

□ Always write log to disk

Number of log backup files: 0

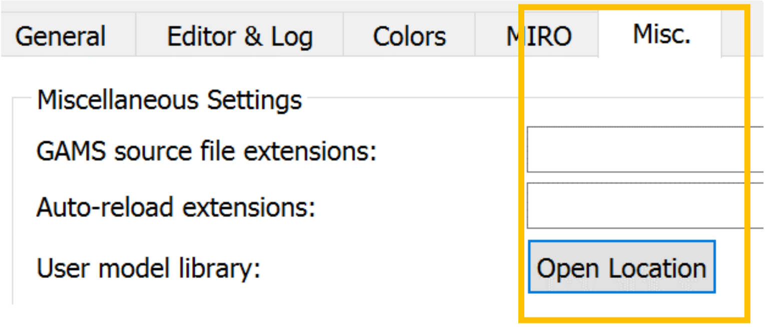
You should also select what windows that you want to see. Under view you can activate the explorer and process log



Here selecting the process log window and possibly the Explorer are of interest. The Explorer will open automatically when a file is opened and the Process Log window will open when a solve is done. I usually hide the Explorer and sometimes want to get rid of the Process window.

Using GAMS STUDIO
Using STUDIO after Installation

You should also add the mccarl library that is in the file c:\gamsclass\examples\modlib.glb. to do this we need to copy that directory to the location identified in the Misc tab



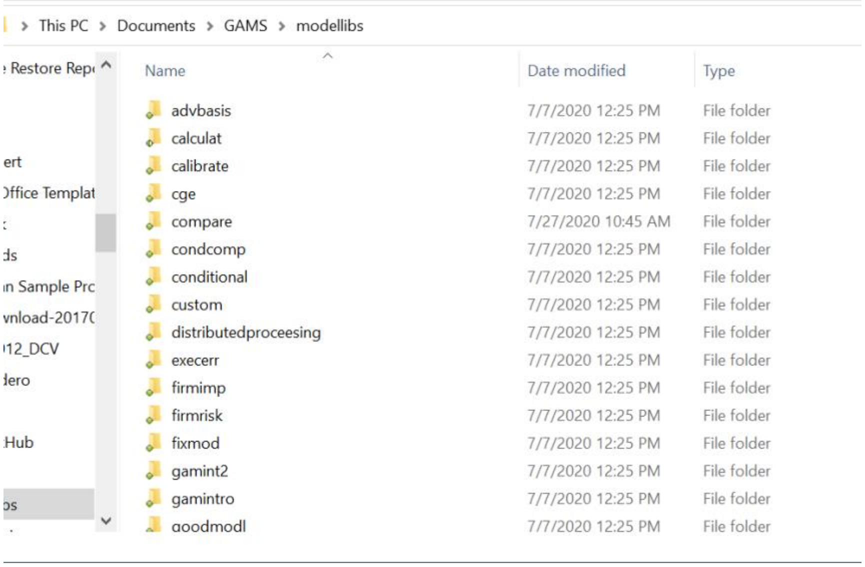
Miscellaneous Settings

GAMS source file extensions:

Auto-reload extensions:

User model library: Open Location

When that is clicked you should see the following if the install was done properly



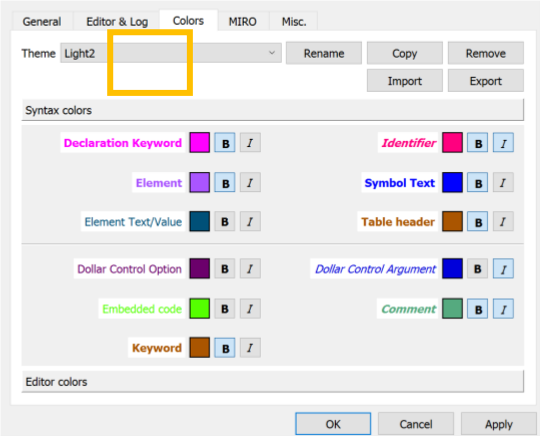
This PC > Documents > GAMS > modellibs

Name	Date modified	Type
advbasis	7/7/2020 12:25 PM	File folder
calculat	7/7/2020 12:25 PM	File folder
calibrate	7/7/2020 12:25 PM	File folder
cge	7/7/2020 12:25 PM	File folder
compare	7/27/2020 10:45 AM	File folder
condcomp	7/7/2020 12:25 PM	File folder
conditional	7/7/2020 12:25 PM	File folder
custom	7/7/2020 12:25 PM	File folder
distributedproceesing	7/7/2020 12:25 PM	File folder
execerr	7/7/2020 12:25 PM	File folder
firmimp	7/7/2020 12:25 PM	File folder
firmrisk	7/7/2020 12:25 PM	File folder
fixmod	7/7/2020 12:25 PM	File folder
gamint2	7/7/2020 12:25 PM	File folder
gamintro	7/7/2020 12:25 PM	File folder
goodmodl	7/7/2020 12:25 PM	File folder

Note the library is stored on a windows machine in C:\Users\mccarl\Documents\GAMS\modellibs

Using GAMS STUDIO
Using STUDIO after Installation

You can also manipulate the syntax coloring being used in STUDIO. Go to settings and select COLORS and the window below will show up



Theme Light2

In turn you can manipulate the text coloring, bolding and italicizing in STUDIO for GAMS declaration keywords (set, parameter, Variables etc.), other keywords (set, solve etc), elements in sets, and other things.

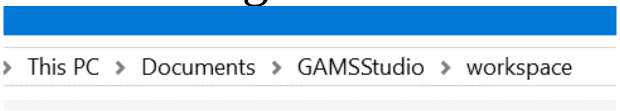
I especially do this for comments as it shows me active and inactive code.

Using GAMS STUDIO
Getting Started
Create or open an existing GMS file

Several cases are possible

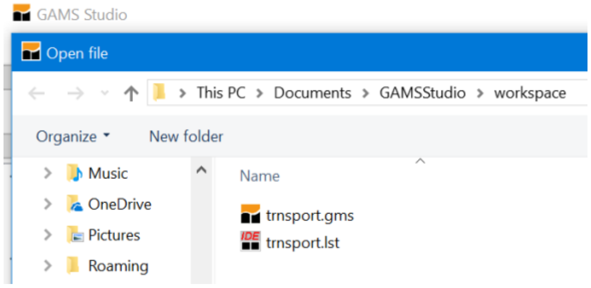
a. Create a new file (covered later)

b. Open an existing file – at first this will be in



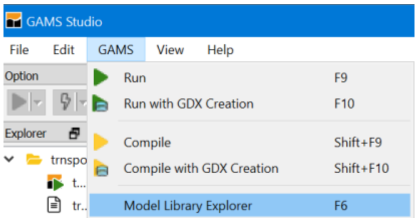
This PC > Documents > GAMSStudio > workspace

then you see something like



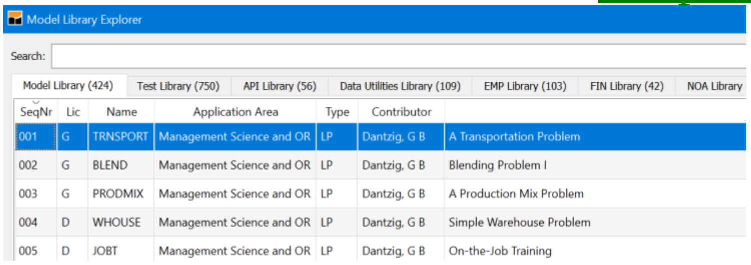
trnsport.gms
trnsport.lst

c. Open the GAMS model library explorer under the GAMS tab or press F6 (this is the simplest for first time users and the one we will use)



GAMS Studio
File
Edit
GAMS
View
Help
Option
Explorer
trnspo
t...
tr..
Run F9
Run with GDX Creation F10
Compile Shift+F9
Compile with GDX Creation Shift+F10
Model Library Explorer F6

Select a model like trnsport.gms

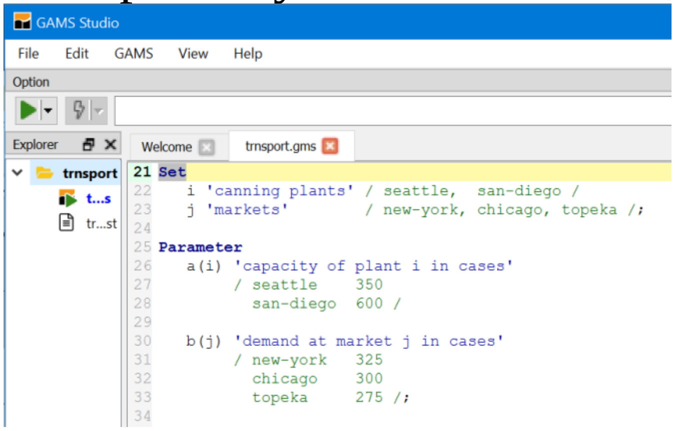


SeqNr	Lic	Name	Application Area	Type	Contributor	
001	G	TRNSPORT	Management Science and OR	LP	Dantzig, G B	A Transportation Problem
002	G	BLEND	Management Science and OR	LP	Dantzig, G B	Blending Problem I
003	G	PRODMIX	Management Science and OR	LP	Dantzig, G B	A Production Mix Problem
004	D	WHOUSE	Management Science and OR	LP	Dantzig, G B	Simple Warehouse Problem
005	D	JOBT	Management Science and OR	LP	Dantzig, G B	On-the-Job Training

It will be automatically saved in the last directory you used or in the STUDIO default Workspace directory.

Using GAMS STUDIO
Prepare file for execution

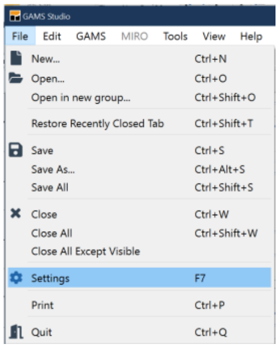
When using model library trnsport.gms should now appear as part of your STUDIO screen



```
Set
   i 'canning plants' / seattle,  san-diego /
   j 'markets'        / new-york, chicago, topeka /;

Parameter
   a(i) 'capacity of plant i in cases'
        / seattle    350
          san-diego  600 /

   b(j) 'demand at market j in cases'
        / new-york   325
          chicago    300
          topeka     275 /;
```

The STUDIO contains a full-featured editor. Go through the file and change what you want.

You can also customize the appearance somewhat through the settings choice under the File menu

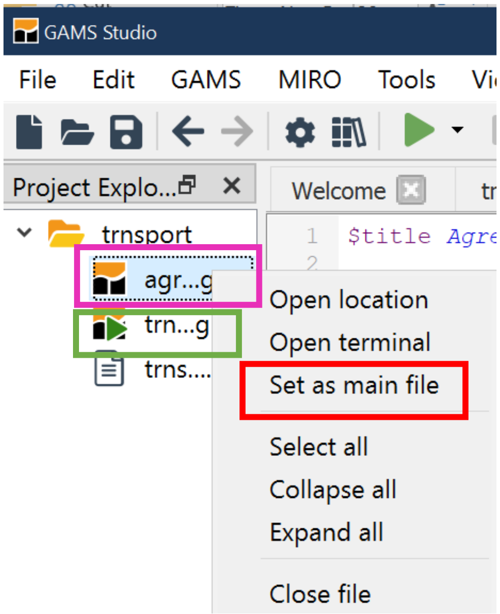


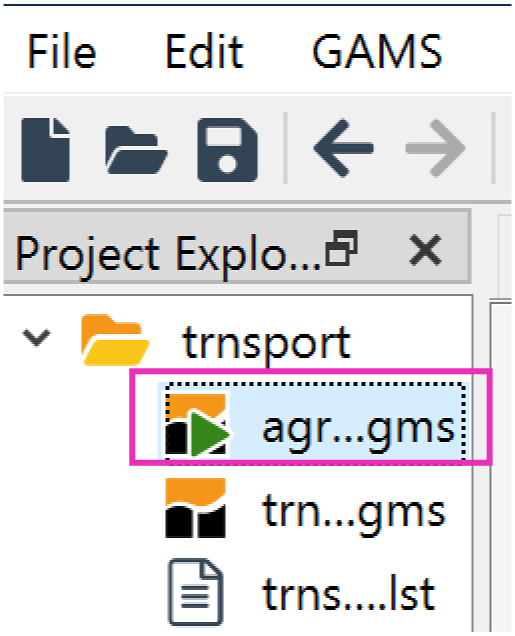
There you can change font size (under editor), tabs, default file location (called workspace) and some other features on how GAMS runs. For now leave it alone

Using GAMS STUDIO
Getting Started
Make sure right file is executed

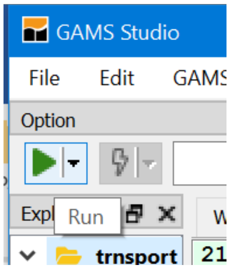
Unlike many other programs, STUDIO does not necessarily execute the file you have been working on rather executing what it calls the "main" file.

In particular, if you activate the explorer view then the main file is the one marked with a green triangle as below. If the triangle is not marking the file to be run you need to right click on that file and then choose Set as main file. In turn the triangle will move.



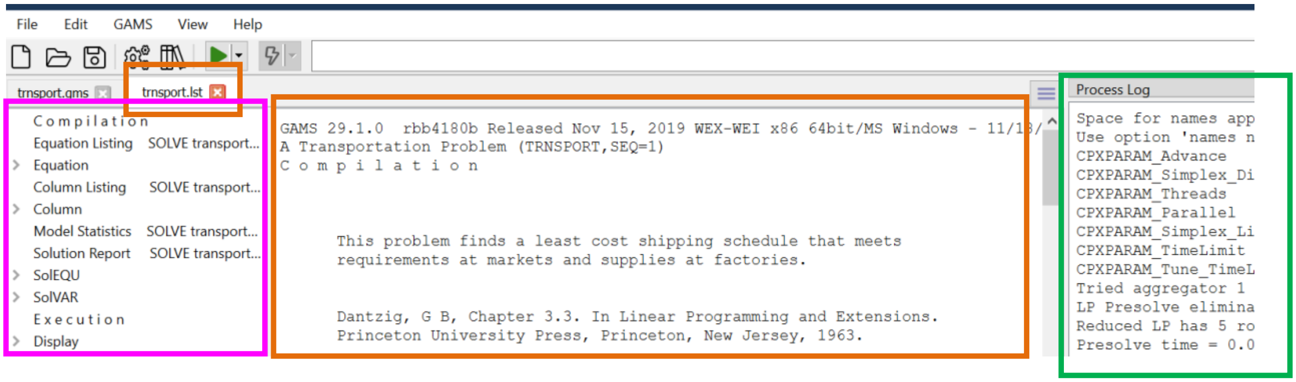


Using GAMS STUDIO
Getting Started
Run GAMS by clicking the run ▶ button



The so called Process log window will then appear which logs the steps executed in running the model. The LST file and the navigation window also appear. Note to save space I would close the Explorer window and drag the Process Log window to the bottom or the right hand side.

The Process Log window on the right is illustrated here and it is on the right side on the next page.



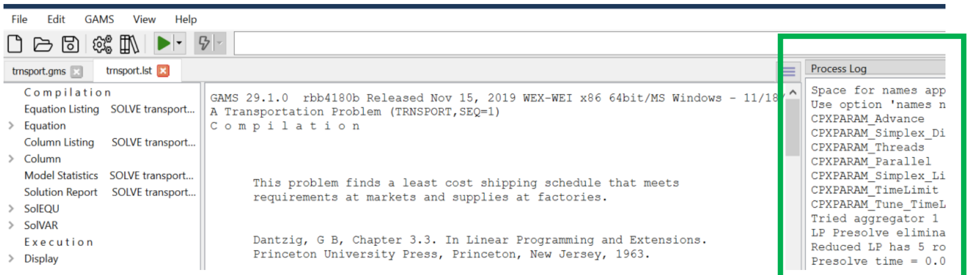
```
Compilation
Equation Listing    SOLVE transport...
Equation
Column Listing      SOLVE transport...
Column
Model Statistics    SOLVE transport...
Solution Report     SOLVE transport...
SolEQU
SolVAR
Execution
Display
```

```
GAMS 29.1.0  rbb4180b Released Nov 15, 2019 WEX-WEI x86 64bit/MS Windows - 11/1
A Transportation Problem (TRNSPORT,SEQ=1)
C o m p i l a t i o n



     This problem finds a least cost shipping schedule that meets
     requirements at markets and supplies at factories.


     Dantzig, G B, Chapter 3.3. In Linear Programming and Extensions.
     Princeton University Press, Princeton, New Jersey, 1963.
```

```
Space for names app
Use option 'names n
CPXPARAM_Advance
CPXPARAM_Simplex_Di
CPXPARAM_Threads
CPXPARAM_Parallel
CPXPARAM_Simplex_Li
CPXPARAM_TimeLimit
CPXPARAM_Tune_TimeL
Tried aggregator 1
LP Presolve elimina
Reduced LP has 5 ro
Presolve time = 0.0
```

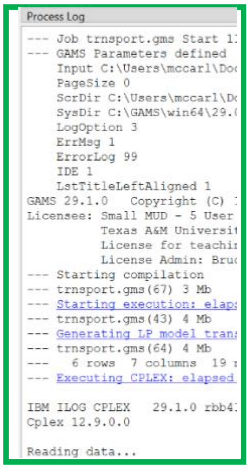
Using GAMS STUDIO
Getting Started

Here it is after reconfiguring by dragging the process Log window up and to the right then resizing and repositioning


File
Edit
GAMS
View
Help
trnsport.gms
trnsport.lst
Compilation
Equation Listing SOLVE transport...
Equation
Column Listing SOLVE transport...
Column
Model Statistics SOLVE transport...
Solution Report SOLVE transport...
SolEQU
SolVAR
Execution
Display
Process Log

```
GAMS 29.1.0  rbb4180b Released Nov 15, 2019 WEX-WEI x86 64bit/MS Windows - 11/18
A Transportation Problem (TRNSPORT,SEQ=1)
C o m p i l a t i o n


     This problem finds a least cost shipping schedule that meets
     requirements at markets and supplies at factories.


     Dantzig, G B, Chapter 3.3. In Linear Programming and Extensions.
     Princeton University Press, Princeton, New Jersey, 1963.
```

```
Space for names app
Use option 'names n
CPXPARAM_Advance
CPXPARAM_Simplex_Di
CPXPARAM_Threads
CPXPARAM_Parallel
CPXPARAM_Simplex_Li
CPXPARAM_TimeLimit
CPXPARAM_Tune_TimeL
Tried aggregator 1
LP Presolve elimina
Reduced LP has 5 ro
Presolve time = 0.0
```



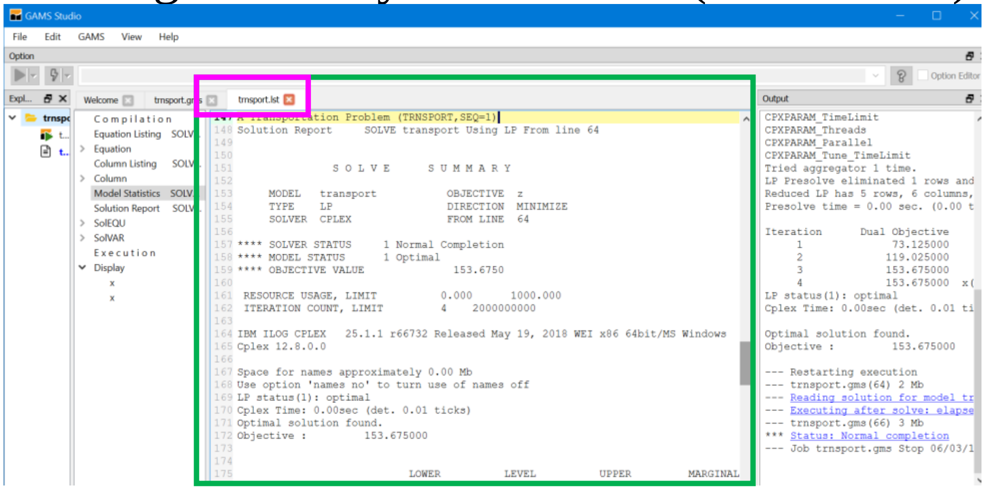
```
--- Job trnsport.gms Start 11
--- GAMS Parameters defined
    Input C:\Users\mccarl\Doc
    PageSize 0
    ScrDir C:\Users\mccarl\Do
    SysDir C:\GAMS\win64\29.(
    LogOption 3
    ErrMsg 1
    ErrorLog 99
    IDE 1
    LstTitleLeftAligned 1
GAMS 29.1.0   Copyright (C) 1
Licensee: Small MUD - 5 User
          Texas A&M Universit
          License for teachin
          License Admin: Bruc
--- Starting compilation
--- trnsport.gms(67) 3 Mb
--- Starting execution: elaps
--- trnsport.gms(43) 4 Mb
--- Generating LP model trans
--- trnsport.gms(64) 4 Mb
---   6 rows  7 columns  19 r
--- Executing CPLEX: elapsed

IBM ILOG CPLEX   29.1.0 rbb41
Cplex 12.9.0.0

Reading data...
```

Now use the process window to navigate the LST file or open created files. By double clicking on lines in that window you access the LST file at particular locations or open created files. What and where you access is determined by the color of the line you click on

Color of Line	Function and Destination When Double Clicked
Blue line	Opens LST file and jumps to corresponding place. Blue lines also open put and other files created in run.
Non-bolded black line	Control click on this takes you to LST file. Coble click on error message takes you to spot in LST file.
Red line	Marks errors encountered. Cursor is positioned at first red line. When clicked on cursor jumps to Source (GMS) file location of error. Control click takes you to error location in LST file. Error description text is in execution process (output) window and in LST file. You can use a little red icon in source to jump to error message in LST file or a green arrow in the LST to go to error location in source.
Green Line	Causes STUDIO to open a file that was created during the run like a GDX, PUT or REF file

Using GAMS STUDIO
Getting Started
Navigate with process window

After double-clicking on any non-red line, or if we used the automatically open LST file option our main editing window is augmented by the LST file (see the tabs)

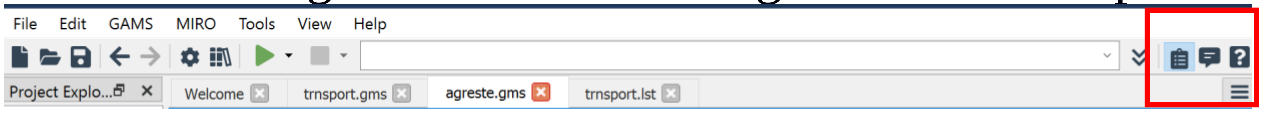


```
A Transportation Problem (TRNSPORT,SEQ=1)
Solution Report     SOLVE transport Using LP From line 64


               S O L V E      S U M M A R Y

     MODEL   transport           OBJECTIVE  z
     TYPE    LP                  DIRECTION  MINIMIZE
     SOLVER  CPLEX               FROM LINE  64

**** SOLVER STATUS     1 Normal Completion
**** MODEL STATUS      1 Optimal
**** OBJECTIVE VALUE              153.6750

 RESOURCE USAGE, LIMIT          0.000      1000.000
 ITERATION COUNT, LIMIT         4    2000000000

IBM ILOG CPLEX   25.1.1 r66732 Released May 19, 2018 WEI x86 64bit/MS Windows
Cplex 12.8.0.0

Space for names approximately 0.00 Mb
Use option 'names no' to turn use of names off
LP status(1): optimal
Cplex Time: 0.00sec (det. 0.01 ticks)
Optimal solution found.
Objective :         153.675000


                              LOWER          LEVEL          UPPER         MARGINAL
```

```
CPXPARAM_TimeLimit
CPXPARAM_Threads
CPXPARAM_Parallel
CPXPARAM_Tune_TimeLimit
Tried aggregator 1 time.
LP Presolve eliminated 1 rows and
Reduced LP has 5 rows, 6 columns,
Presolve time = 0.00 sec. (0.00 t

Iteration      Dual Objective
     1              73.125000
     2             119.025000
     3             153.675000
     4             153.675000  x(
LP status(1): optimal
Cplex Time: 0.00sec (det. 0.01 ti

Optimal solution found.
Objective :          153.675000

--- Restarting execution
--- trnsport.gms(64) 2 Mb
--- Reading solution for model tr
--- Executing after solve: elapse
--- trnsport.gms(66) 3 Mb
*** Status: Normal completion
--- Job trnsport.gms Stop 06/03/1
```

We can navigate as we would with an editor or word processor, as we are automatically in STUDIO text editor.

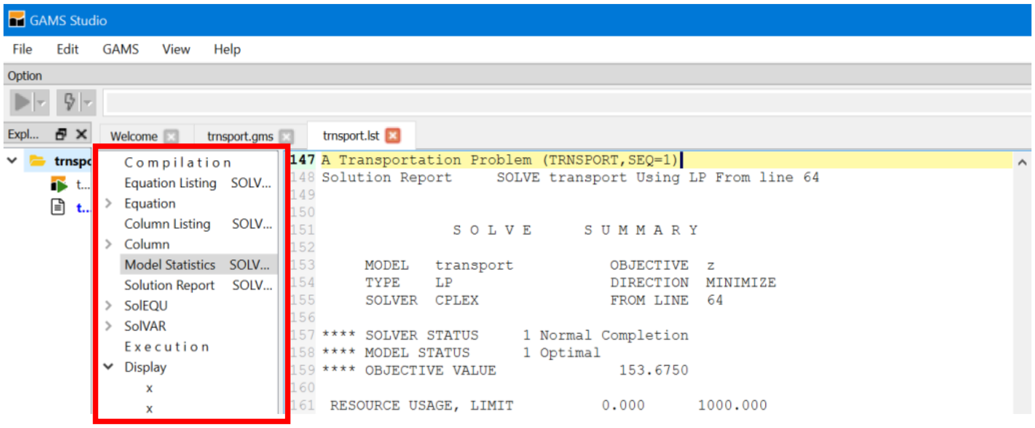
Sometimes I want to get the process window and explorer out of the way. I can do this through the view window and also through the icons on the right side of the top bar



Clicking on these opens and closes the explorer and process windows.

Using GAMS STUDIO
Getting Started

Navigate with LXI window



```
A Transportation Problem (TRNSPORT,SEQ=1)
Solution Report     SOLVE transport Using LP From line 64


               S O L V E      S U M M A R Y

     MODEL   transport           OBJECTIVE  z
     TYPE    LP                  DIRECTION  MINIMIZE
     SOLVER  CPLEX               FROM LINE  64

**** SOLVER STATUS     1 Normal Completion
**** MODEL STATUS      1 Optimal
**** OBJECTIVE VALUE              153.6750

 RESOURCE USAGE, LIMIT          0.000      1000.000
```

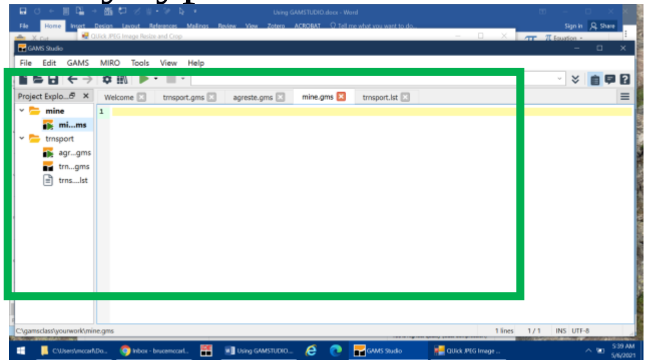
Navig. Line	Function and Destination When Clicked.
Compilation	Jumps to top of echo print in LST file
Error Mess.	Jumps to list of error messages when errors present
Equat. listing	Jumps to list of equation contents
Equation	Expandable allowing jump list of equation contents
Variab. listing	Jumps to list of variable
Variable	Expandable allowing jump to list of variable contents
Model stat.	Jumps to model statistics part of LST file
Solut.Report	Jumps to model summary solution report
SolEQU	Expandable allowing jump solution for each equation
SolVAR	Expandable allowing jump to solution for variable
Execution	Jumps to beginning of post solve execution
Display	Jump to displays of specific parameters and other items

Using GAMS STUDIO
Working with your own file

Now you are ready to work with your own files. You may already have a file or you may need to create one.

Creating a new file - Two principal ways

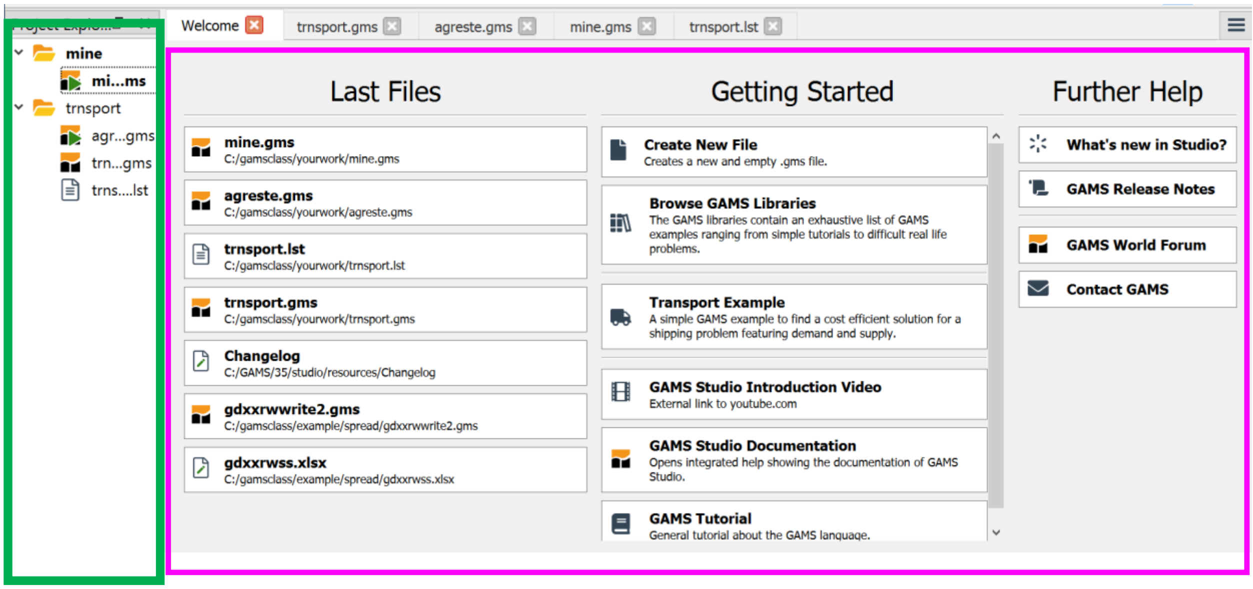
1. Open an existing file through the library or from your hard disk. Then use the save as dialogue in file menu to change its name. Now modify contents. You may cut and paste as in other programs.
2. Open the file menu and use the new option. You will then be prompted for a name (I called it mine) with the extension .gms and then have a blank screen into which you may type GAMS instructions



Save that file wherever you want and reopen it that will become the new default directory (this only occurs upon an open not a save as) and any subsequent non library opens, simple includes or saves will go there. Imports from the library go to the default workspace.

Using GAMS STUDIO
The Welcome and Explorer Windows

STUDIO can show a "Welcome" window (activated under the View menu) that remembers previous files plus gives access to documentation.



Last Files

- **mine.gms** C:/gamsclass/yourwork/mine.gms
- **agreste.gms** C:/gamsclass/yourwork/agreste.gms
- **trnsport.lst** C:/gamsclass/yourwork/trnsport.lst
- **trnsport.gms** C:/gamsclass/yourwork/trnsport.gms
- **Changelog** C:/GAMS/35/studio/resources/Changelog
- **gdxxrwwrite2.gms** C:/gamsclass/example/spread/gdxxrwwrite2.gms
- **gdxxrwss.xlsx** C:/gamsclass/example/spread/gdxxrwss.xlsx

Getting Started

- **Create New File** Creates a new and empty .gms file.
- **Browse GAMS Libraries** The GAMS libraries contain an exhaustive list of GAMS examples ranging from simple tutorials to difficult real life problems.
- **Transport Example** A simple GAMS example to find a cost efficient solution for a shipping problem featuring demand and supply.
- **GAMS Studio Introduction Video** External link to youtube.com
- **GAMS Studio Documentation** Opens integrated help showing the documentation of GAMS Studio.
- **GAMS Tutorial** General tutorial about the GAMS language.

Further Help

- **What's new in Studio?**
- **GAMS Release Notes**
- **GAMS World Forum**
- **Contact GAMS**

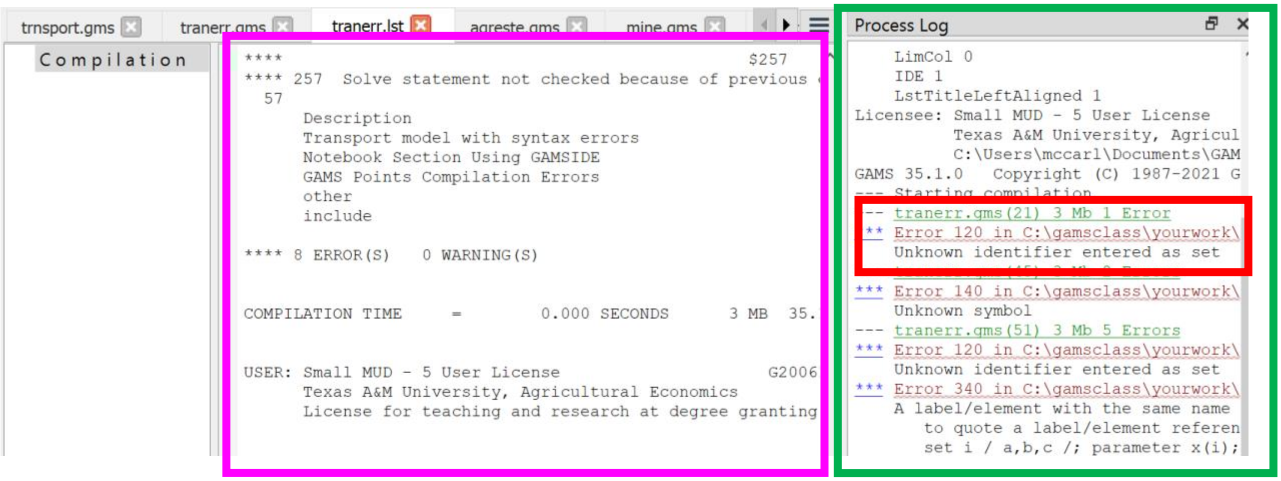
There as of now you get links to files recently used, and links to some documentation.

Also on the left hand side is an "Explorer" window that shows recent files and allows you to open by double clicking. This remains whether you are in the welcome page or editing files unless it is not checked in the View dialogue.

Using GAMS STUDIO
Fixing Compilation Errors
(tranerr.gms)

No one is perfect, errors always occur. STUDIO can help you in finding and fixing those errors.

Let’s use a file from the class library tranerr.gms to illustrate. A run yields the windows below where right part is process window positioned to show first error and the center is the lst file



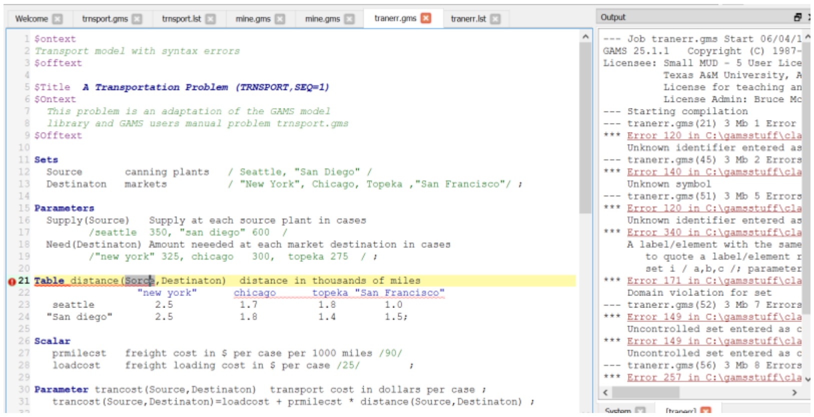
```
****                                                  $257
**** 257  Solve statement not checked because of previous
  57
      Description
      Transport model with syntax errors
      Notebook Section Using GAMSIDE
      GAMS Points Compilation Errors
      other
      include

**** 8 ERROR(S)   0 WARNING(S)


COMPILATION TIME     =        0.000 SECONDS      3 MB  35.


USER: Small MUD - 5 User License                     G2006
      Texas A&M University, Agricultural Economics
      License for teaching and research at degree granting
```

```
    LimCol 0
    IDE 1
    LstTitleLeftAligned 1
Licensee: Small MUD - 5 User License
          Texas A&M University, Agricul
          C:\Users\mccarl\Documents\GAM
GAMS 35.1.0   Copyright (C) 1987-2021 G
--- Starting compilation
--- tranerr.gms(21) 3 Mb 1 Error
*** Error 120 in C:\gamsclass\yourwork\
    Unknown identifier entered as set
*** Error 140 in C:\gamsclass\yourwork\
    Unknown symbol
--- tranerr.gms(51) 3 Mb 5 Errors
*** Error 120 in C:\gamsclass\yourwork\
    Unknown identifier entered as set
*** Error 340 in C:\gamsclass\yourwork\
    A label/element with the same name
       to quote a label/element referen
       set i / a,b,c /; parameter x(i);
```

The red lines in the process window mark errors with error messages just below. To see where the errors occurred click on the very first red line which opens the source file or click on the black error message line just below the red error marking line to look at the LST file where the error appears and the exact placement will be marked with a $.

Using GAMS STUDIO
Fixing Compilation Errors
(tranerr.gms)

A click on the red line takes you to the place in the source where the error was made. The tip here is always start at the top of the process file when doing this and STUDIO now starts there.

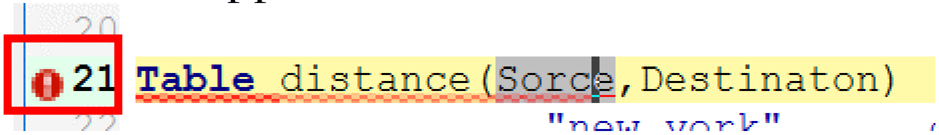


```
$ontext
Transport model with syntax errors
$offtext

$Title  A Transportation Problem (TRNSPORT,SEQ=1)
$Ontext
  This problem is an adaptation of the GAMS model
  library and GAMS users manual problem trnsport.gms
$Offtext

Sets
  Source        canning plants   / Seattle, "San Diego" /
  Destinaton    markets          / "New York", Chicago, Topeka ,"San Francisco"/ ;

Parameters
  Supply(Source)   Supply at each source plant in cases
          /seattle  350, "san diego" 600  /
  Need(Destinaton) Amount neeeded at each market destination in cases
          /"new york" 325, chicago   300,  topeka 275  / ;

Table distance(Sorce,Destinaton)  distance in thousands of miles
                   "new york"       chicago       topeka "San Francisco"
   seattle            2.5            1.7           1.8        1.0
  "San diego"         2.5            1.8           1.4        1.5;

Scalar
   prmilecst   freight cost in $ per case per 1000 miles /90/
   loadcost    freight loading cost in $ per case /25/         ;

Parameter trancost(Source,Destinaton)  transport cost in dollars per case ;
   trancost(Source,Destinaton)=loadcost + prmilecst * distance(Source,Destinaton) ;
```

```
--- Job tranerr.gms Start 06/04/1
GAMS 25.1.1   Copyright (C) 1987-
Licensee: Small MUD - 5 User Lice
          Texas A&M University, A
          License for teaching an
          License Admin: Bruce Mc
--- Starting compilation
--- tranerr.gms(21) 3 Mb 1 Error
*** Error 120 in C:\gamsstuff\cla
    Unknown identifier entered as
--- tranerr.gms(45) 3 Mb 2 Errors
*** Error 140 in C:\gamsstuff\cla
    Unknown symbol
--- tranerr.gms(51) 3 Mb 5 Errors
*** Error 120 in C:\gamsstuff\cla
    Unknown identifier entered as
*** Error 340 in C:\gamsstuff\cla
    A label/element with the same
       to quote a label/element r
       set i / a,b,c /; parameter
*** Error 171 in C:\gamsstuff\cla
    Domain violation for set
--- tranerr.gms(52) 3 Mb 7 Errors
*** Error 149 in C:\gamsstuff\cla
    Uncontrolled set entered as c
*** Error 149 in C:\gamsstuff\cla
    Uncontrolled set entered as c
--- tranerr.gms(56) 3 Mb 8 Errors
*** Error 257 in C:\gamsstuff\cla
```

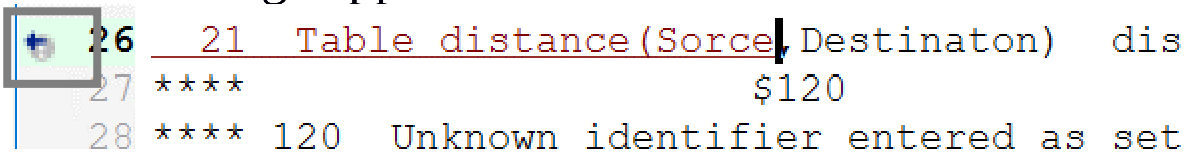
A double click on a black line takes you to the error location in the LST file.

Also in the source file window note the small red circle that appears on the line with the error



```
Table distance(Sorce,Destinaton)
                   "new york"
```

Clicking on that transfers you to the LST file where the error message appears.

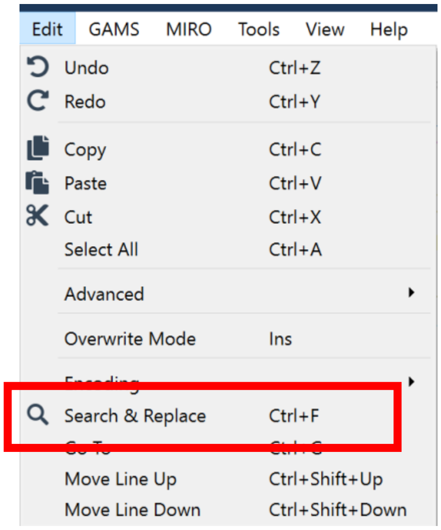


```
  21  Table distance(Sorce,Destinaton)   dis
****                         $120
**** 120  Unknown identifier entered as set
```

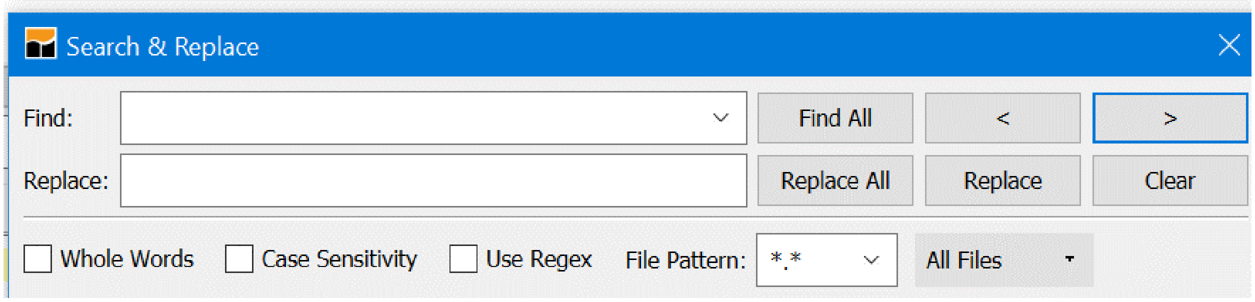
And there a small gray circle with an arrow in it that when clicked on will transfer you back to the source file

Using GAMS STUDIO
Ways to find and/or replace text strings

For finding you can use the search menu under the Edit tab or control F



Subsequently you get



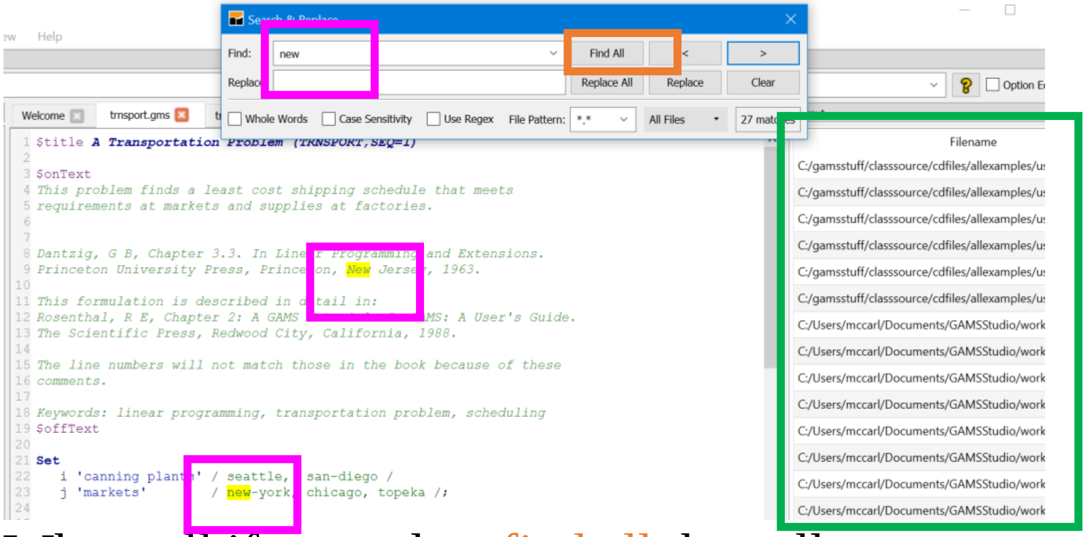
Which allows both search and replace. As of now this opens with the last option you used and may start with initially with an all files setting.

Note much to my dismay there is no find in files with a directory named and this is currently keeping me on the IDE as my main editor.

Using GAMS STUDIO

Ways to find and/or replace text strings

After the search you find



Find: new

Replace:

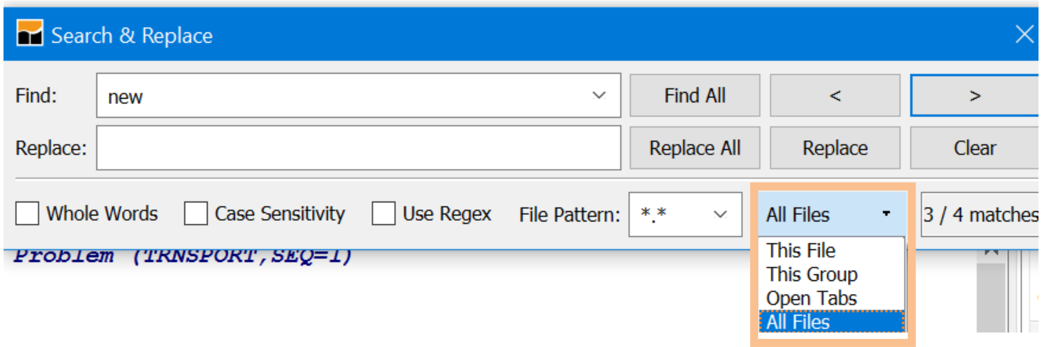
☐ Whole Words ☐ Case Sensitivity ☐ Use Regex File Pattern: *.* All Files 27 matches

```
$title A Transportation Problem (TRNSPORT,SEQ=1)

$onText
This problem finds a least cost shipping schedule that meets
requirements at markets and supplies at factories.


Dantzig, G B, Chapter 3.3. In Linear Programming and Extensions.
Princeton University Press, Princeton, New Jersey, 1963.

This formulation is described in detail in:
Rosenthal, R E, Chapter 2: A GAMS             MS: A User's Guide.
The Scientific Press, Redwood City, California, 1988.

The line numbers will not match those in the book because of these
comments.

Keywords: linear programming, transportation problem, scheduling
$offText

Set
   i 'canning plants' / seattle,  san-diego /
   j 'markets'        / new-york, chicago, topeka /;
```

Filename
C:/gamsstuff/classsource/cdfiles/allexamples/u
C:/gamsstuff/classsource/cdfiles/allexamples/u
C:/gamsstuff/classsource/cdfiles/allexamples/u
C:/gamsstuff/classsource/cdfiles/allexamples/u
C:/gamsstuff/classsource/cdfiles/allexamples/u
C:/gamsstuff/classsource/cdfiles/allexamples/u
C:/Users/mccarl/Documents/GAMSStudio/work
C:/Users/mccarl/Documents/GAMSStudio/work
C:/Users/mccarl/Documents/GAMSStudio/work
C:/Users/mccarl/Documents/GAMSStudio/work
C:/Users/mccarl/Documents/GAMSStudio/work
C:/Users/mccarl/Documents/GAMSStudio/work
C:/Users/mccarl/Documents/GAMSStudio/work
C:/Users/mccarl/Documents/GAMSStudio/work

Where all if you select find all then all occurrences of the search term in the current file are highlighted and to the right there is a list of all files that contain that search term in all of the files opened in the explorer.

The search dialogue is straight forward with arrow keys to jump to next (F3 also works for forward and shift F3 for backward) and the all files can be manipulated as shown.



Find: new

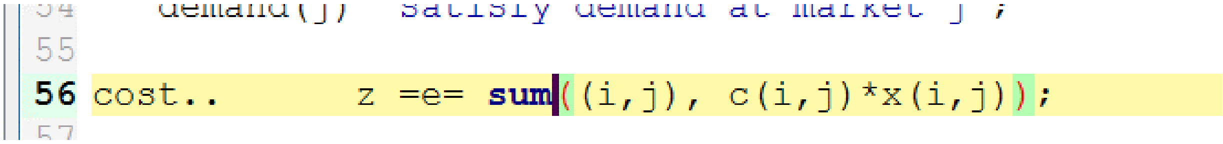
Replace:

☐ Whole Words ☐ Case Sensitivity ☐ Use Regex File Pattern: *.* All Files 3 / 4 matches

```
Problem (TRNSPORT,SEQ=1)
```

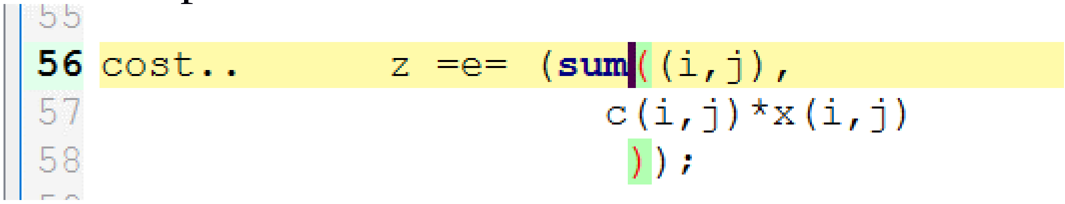
Using GAMS STUDIO
Matching Parentheses
(tranport.gms)

The STUDIO provides you with a way of checking on how the parentheses match up in your GAMS code. This involves positioning your cursor just before an open parentheses or just after a close (Just after also works if there are not multiple parentheses). In either case the corresponding close or open is highlighted in green. Additionally positioning the cursor right before the beginning parentheses and tapping control b will lead you to the matching ending parentheses whether it be 1, 100, or 1000+ lines away and vice versa.



```
     demand(j)   satisfy demand at market j ;

cost..        z =e= sum((i,j), c(i,j)*x(i,j));
```

When the expression in parentheses carries on the several lines the marking is in multiple lines and control b will transfer position back and forth



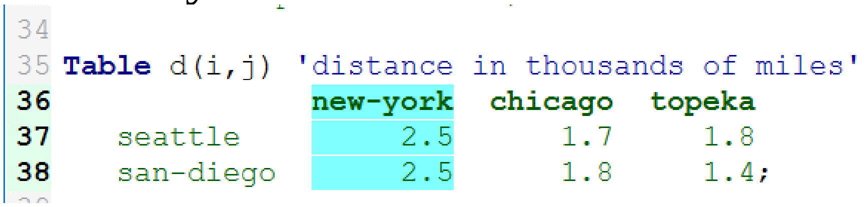
```
cost..        z =e= (sum((i,j),
                        c(i,j)*x(i,j)
                         ));
```

This feature will also match up { } or [ ] with a red marking if the types don’t match.

Using GAMS STUDIO
Moving Blocks

The STUDIO allows one to move text blocks through standard Cut and Paste Operations in two fashions.

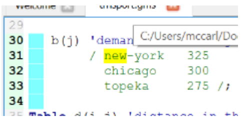
1. One can identify a continuous block of text with the mouse or the keyboard (the latter involves putting the cursor at a beginning point then hold the shift key down and use the arrow keys).
2. One can identify a column block of text with the mouse or the keyboard (these involve holding alt and shift down then moving the mouse or the cursor with the arrow keys.



```
Table d(i,j) 'distance in thousands of miles'
                 new-york   chicago   topeka
    seattle           2.5       1.7      1.8
    san-diego         2.5       1.8      1.4;
```

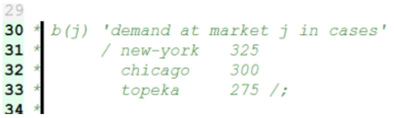
In turn copy, cut, and paste can be done with the Edit menu or with control c, x and v respectively as in normal windows. Control insert also pastes.

Also if one types with a column block highlighted than the character goes in all rows of the block and replaces what was there before



```
b(j) 'deman
     / new-york   325
       chicago    300
       topeka     275 /;
```

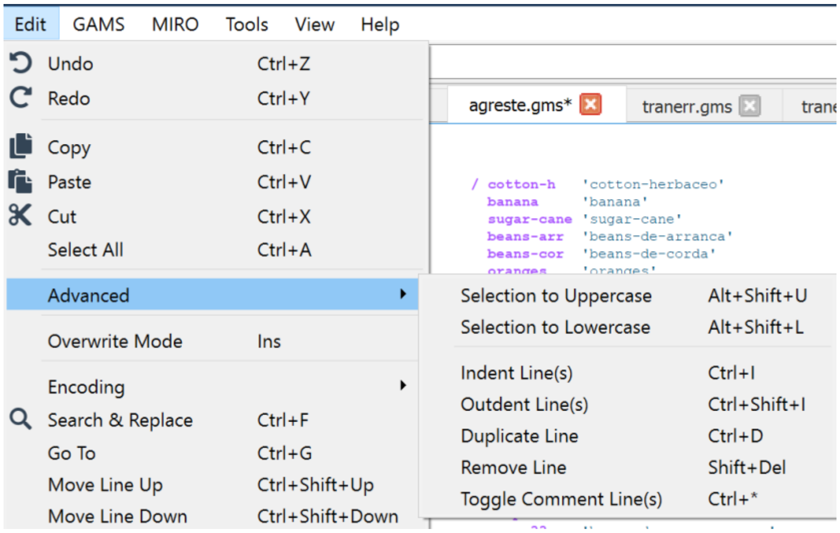
with an * typed becomes



```
*b(j) 'demand at market j in cases'
*     / new-york   325
*       chicago    300
*       topeka     275 /;
*
```

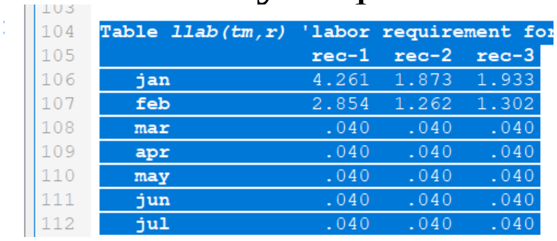
Using GAMS STUDIO
Other Editing Features

Under editing you get a few other choices that merit comment.

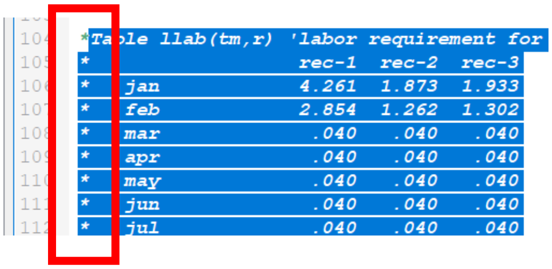


```
 / cotton-h   'cotton-herbaceo'
   banana     'banana'
   sugar-cane 'sugar-cane'
   beans-arr  'beans-de-arranca'
   beans-cor  'beans-de-corda'
   oranges    'oranges'
```

At the bottom of the edit you can see features to move lines up and down while under Advanced you can toggle case, add or remove indenting and convert a selected set of lines to or from comments. On the latter highlighting some code and typing control shift asterisk adds * to every line in column 1. Also you can reverse this or remove elsewhere by highlighting a block and pressing the same key sequence.



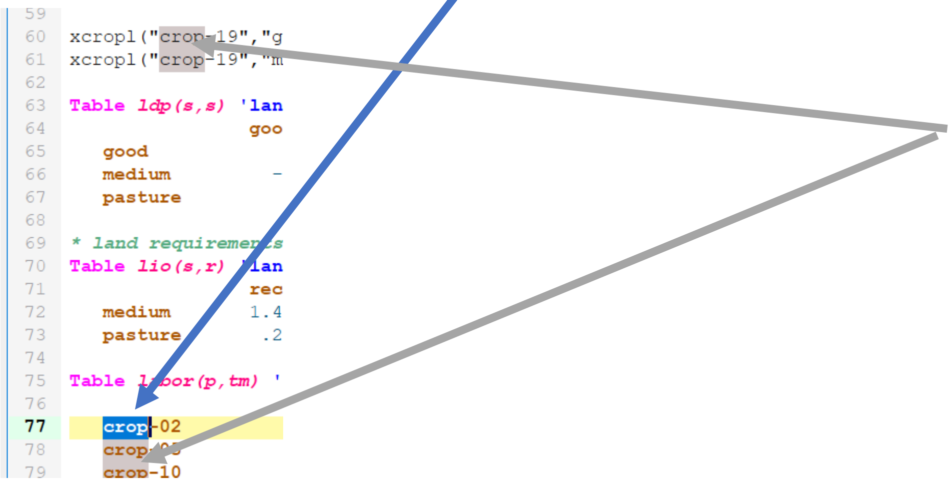
```
Table llab(tm,r) 'labor requirement for
                    rec-1  rec-2  rec-3
    jan             4.261  1.873  1.933
    feb             2.854  1.262  1.302
    mar              .040   .040   .040
    apr              .040   .040   .040
    may              .040   .040   .040
    jun              .040   .040   .040
    jul              .040   .040   .040
```



```
*Table llab(tm,r) 'labor requirement for
*                   rec-1  rec-2  rec-3
*   jan             4.261  1.873  1.933
*   feb             2.854  1.262  1.302
*   mar              .040   .040   .040
*   apr              .040   .040   .040
*   may              .040   .040   .040
*   jun              .040   .040   .040
*   jul              .040   .040   .040
```

Using GAMS STUDIO
Showing where a symbol appears

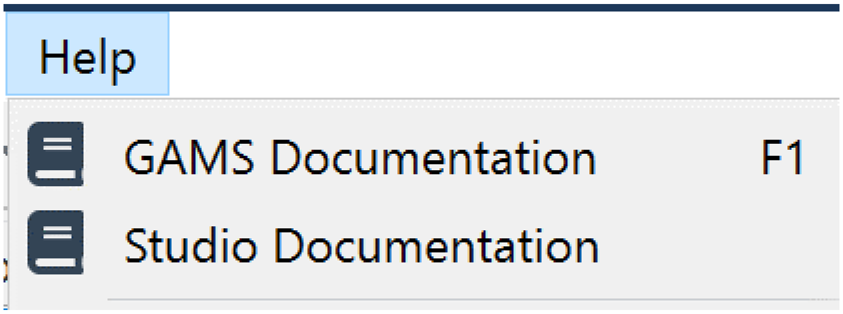
STUDIO has feature that identifies where a symbol is used. Taking the library file agreste.gms and positioning the cursor over a symbol like "crop" then double clicking places a gray highlight over all visible likely whole word instances of that symbol.



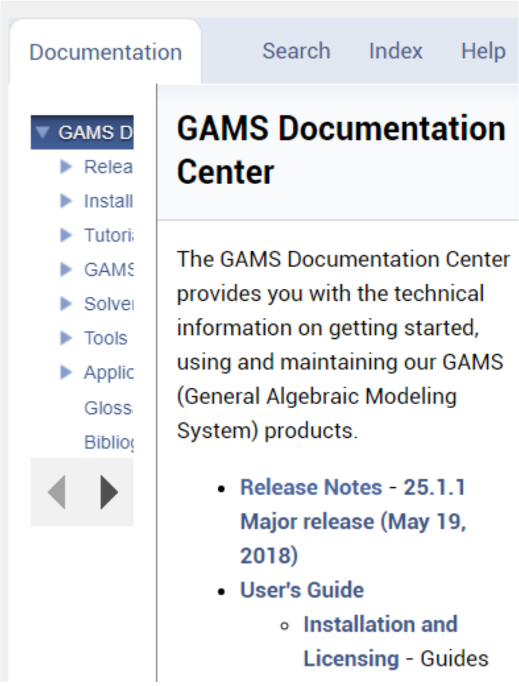
```

xcropl("crop-19","g
xcropl("crop-19","m

Table ldp(s,s) 'lan
                   goo
   good
   medium            -
   pasture

* land requirements
Table lio(s,r) 'lan
                   rec
   medium          1.4
   pasture          .2

Table labor(p,tm) '

   crop-02
   crop-05
   crop-10
```

Using GAMS STUDIO -- Finding out more
Accessing Documentation Via the Help

To access GAMS documentation choose help or F1 plus you can access documentation on STUDIO



And if you choose documentation you get access through a window in lower right corner as shown. Therein you can navigate, search, and look at the index. Also if you get on the documentation page and go to the bottom you find the McCarl guide.



GAMS Documentation Center

The GAMS Documentation Center provides you with the technical information on getting started, using and maintaining our GAMS (General Algebraic Modeling System) products.

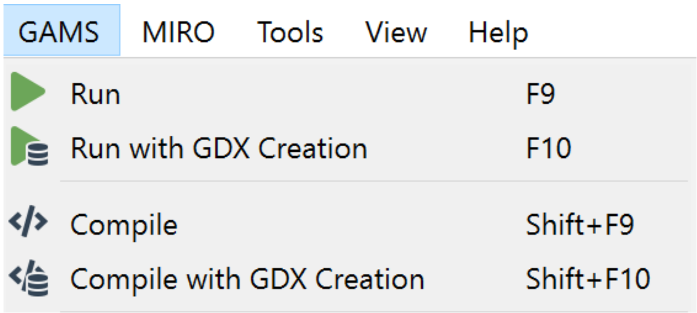
- Release Notes - 25.1.1 Major release (May 19, 2018)
- User's Guide
  - Installation and Licensing - Guides

If your cursor is on a reserved word in the source file and you press F1 an index opens to all treatments of that word although in some strange places.

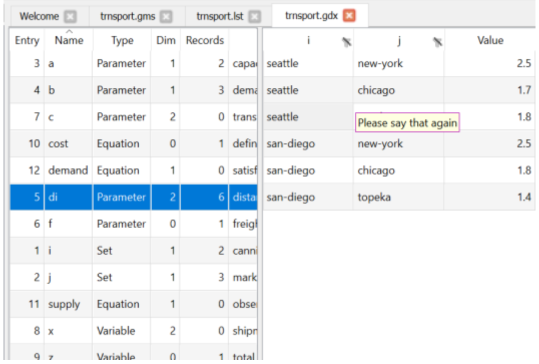
There is a STUDIO YouTube video that can be accessed through the Welcome page or in the general GAMS documentation under Tools.

Using GAMS STUDIO -- Finding out more
Making GDX files

STUDIO can create and view GDX files. To create in STUDIO use the GAMS tab and choose a GDX creating choice. Alternatively use one of the other ways in the language as we will discuss elsewhere.


GAMS
MIRO
Tools
View
Help
Run F9
Run with GDX Creation F10
Compile Shift+F9
Compile with GDX Creation Shift+F10

To browse a GDX file open it with the file open dialogue or click on green lines for ones created during a run in the process window and then for the transport example



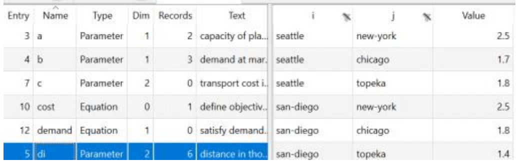
Entry	Name	Type	Dim	Records	
3	a	Parameter	1	2	capa
4	b	Parameter	1	3	dema
7	c	Parameter	2	0	trans
10	cost	Equation	0	1	defin
12	demand	Equation	1	0	satisf
5	di	Parameter	2	6	dista
6	f	Parameter	0	1	freig
1	i	Set	1	2	canni
2	j	Set	1	3	mark
11	supply	Equation	1	0	obse
8	x	Variable	2	0	shipr
9	z	Variable	0	1	total

i	j	Value
seattle	new-york	2.5
seattle	chicago	1.7
seattle	[illegible]	1.8
san-diego	new-york	2.5
san-diego	chicago	1.8
san-diego	topeka	1.4

Here in the left-hand panel one gets an alphabetical listing of the items in the GDX file and their characteristics. Then clicking on a left-hand panel item leads to the item contents being revealed in the right hand panel. As of now you can reorder columns and filter values in table mode. With 3 plus dimensional items in table mode you can move things in rows into columns and vice versa

Using GAMS STUDIO -- Finding out more
Examining GDX files

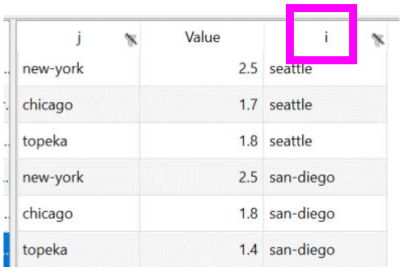
When you have opened a GDX file and selected an item then you get a window like that on the previous page



Entry	Name	Type	Dim	Records	Text
3	a	Parameter	1	2	capacity of pla...
4	b	Parameter	1	3	demand at mar...
7	c	Parameter	2	0	transport cost i...
10	cost	Equation	0	1	define objectiv...
12	demand	Equation	1	0	satisfy demand...
5	di	Parameter	2	6	distance in tho...

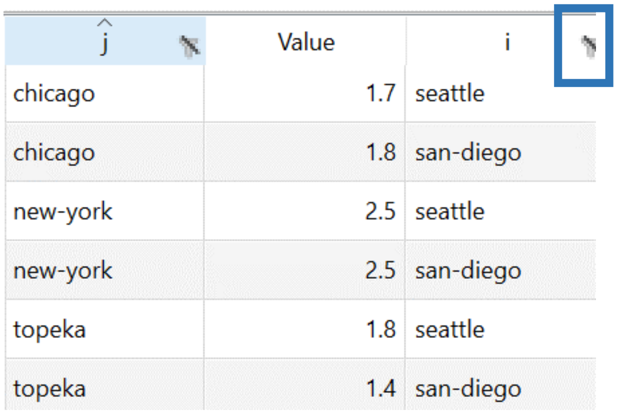
i	j	Value
seattle	new-york	2.5
seattle	chicago	1.7
seattle	topeka	1.8
san-diego	new-york	2.5
san-diego	chicago	1.8
san-diego	topeka	1.4

If in the right-hand panel I dragged the column labeled "i" to the right of value yielding.

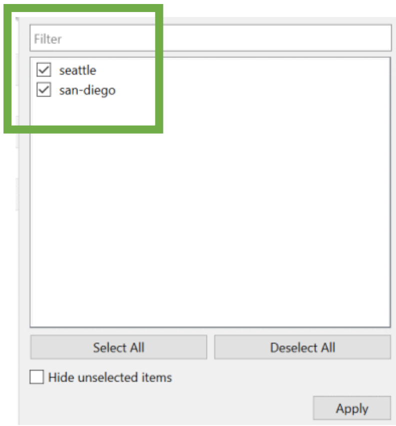


j	Value	i
new-york	2.5	seattle
chicago	1.7	seattle
topeka	1.8	seattle
new-york	2.5	san-diego
chicago	1.8	san-diego
topeka	1.4	san-diego

Also by clicking on the header you cause the array to be sorted with a ^ marking the sort order and by clicking on you can establish a filter that limits elements displayed



j	Value	i
chicago	1.7	seattle
chicago	1.8	san-diego
new-york	2.5	seattle
new-york	2.5	san-diego
topeka	1.8	seattle
topeka	1.4	san-diego



Filter

☑ seattle

☑ san-diego

☐ Hide unselected items

Using GAMS STUDIO
A difficulty you will have

When using and teaching both the IDE and STUDIO, I find that file locations sometimes gives me fits. I have a rule of thumb to avoid problems, but you will most likely inadvertently not follow it.

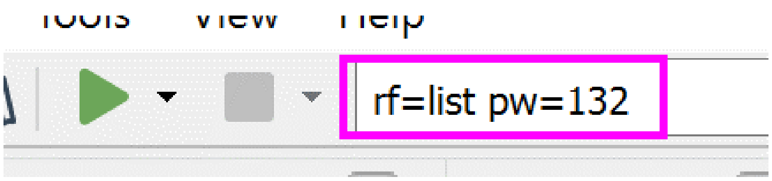
When working with a model with multiple files make sure they are located in the same directory location.

You do not have to follow this rule but deviations are the same as asking for trouble. When you are actively working on a file that you have opened from a directory then STUDIO will look for files in the directory where the active file and group is located. I would like STUDIO to open all in a single group if I specified that but the library manager fails to do that.

Also when you run a file which contains includes GAMS will look in the directory where the active file is located.

Using GAMS STUDIO
Command Line Parameters

Experienced DOS or UNIX based GAMS users are used to having command line parameters associated with their GAMS execution commands. In STUDIO a command line parameter entry box is available just to the right of the execute button the parameters are associated with a file and STUDIO will remember these whenever the file is opened.



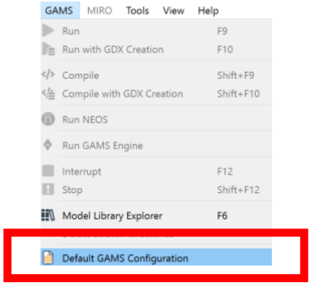
rf=list pw=132

This is particularly useful for save, restart, limrow, limcol, pw and rf parameters as once they are defined they are associated with every subsequent use of the file.

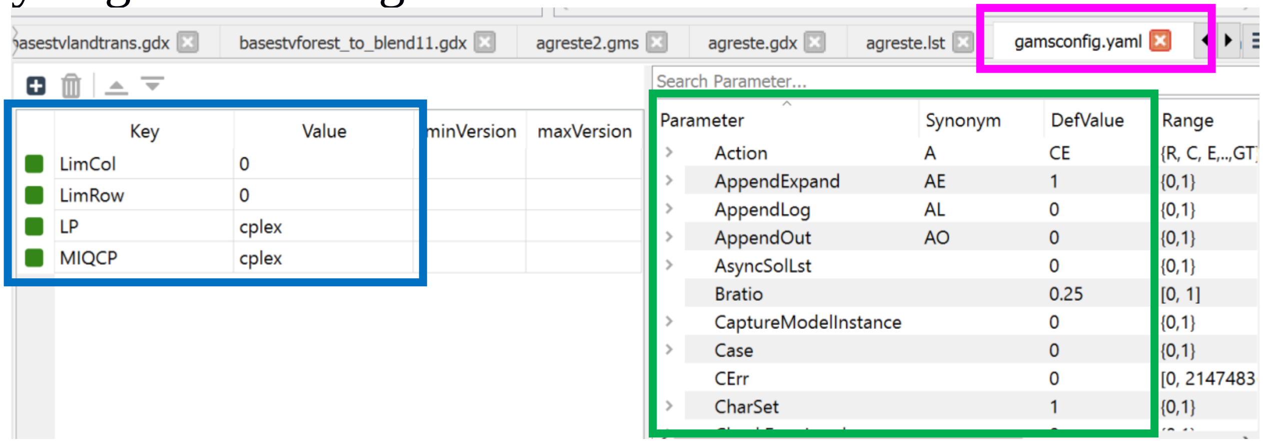
As of now you can also provide command line parameters for use in every run (like a wide page width) through the yaml file as discussed on the next page.

Using GAMS STUDIO
Default Command Line Parameters – yaml

There are cases when you would want to supply parameters to all jobs that you run. This can be done by manipulating the yaml file. In particular if you go into the GAMS menu choice under default configuration


GAMS
MIRO
Tools
View
Help
Run F9
Run with GDX Creation F10
Compile Shift+F9
Compile with GDX Creation Shift+F10
Run NEOS
Run GAMS Engine
Interrupt F12
Stop Shift+F12
Model Library Explorer F6
Default GAMS Configuration

you get something like



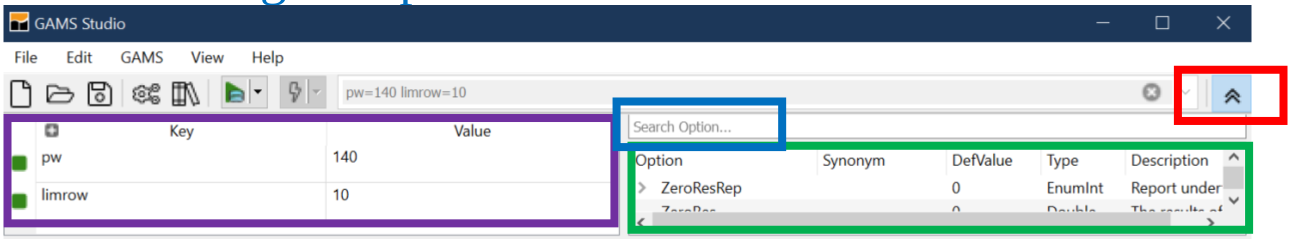
	Key	Value	minVersion	maxVersion
🟩	LimCol	0		
🟩	LimRow	0		
🟩	LP	cplex		
🟩	MIQCP	cplex		

Parameter	Synonym	DefValue	Range
Action	A	CE	{R, C, E,..,GT
AppendExpand	AE	1	{0,1}
AppendLog	AL	0	{0,1}
AppendOut	AO	0	{0,1}
AsyncSolLst		0	{0,1}
Bratio		0.25	[0, 1]
CaptureModelInstance		0	{0,1}
Case		0	{0,1}
CErr		0	[0, 2147483
CharSet		1	{0,1}

Where the default values appear on the left and you can select parameters to provide default values for in the right box. Note these choices are overridden if you enter things in the command line box as on the previous page.

Using GAMS STUDIO
Command Line Parameters

GAMS provides assistance with command line parameters through the command line parameter editor. To activate it check the ⌄ symbol at the far right up top. Then part of the screen becomes as below. If the left hand part existing command line parameters in use are listed along with their values. On the right all possible command line parameters are listed with definitions and a search dialogue is provided.



pw=140 limrow=10

Key	Value
pw	140
limrow	10

Option	Synonym	DefValue	Type	Description
ZeroResRep		0	EnumInt	Report under

The search dialogue looks for text in any of the fields, thus typing in wid brings up page width as does pw and maxi brings up those with maximum in the description.

This is particularly useful for save and restart and a number of other parameters like limrow, limcol, and pw parameters as once they are defined they are associated with every subsequent use of the file.

Note pressing F1 while the cursor is on a command line entry opens help to a place with a detailed description of that parameter.

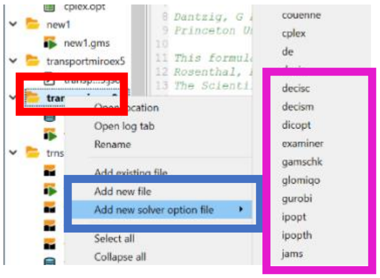
Using GAMS STUDIO
Solver option files

STUDIO contains allows you to edit or create a solver option file. When using the solver conopt you create conopt.opt or with cplex use cplex.opt (or .op1 or .o10 or .111) and more generally solvername.opt

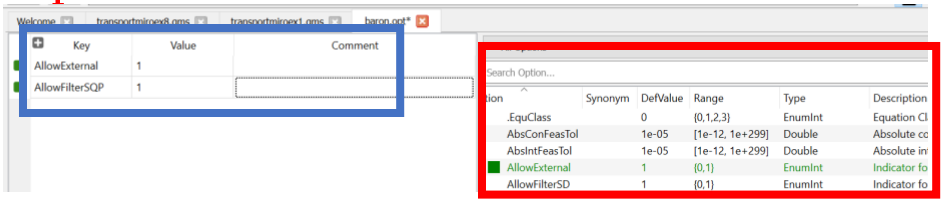
Specifying such a file allows you to manipulate the way the solver works on the model. For example, you can alter scaling, tolerances, iteration limits, solver algorithm, and branch and bound strategy along with many other things.

In STUDIO the option file editor is accessed by either

- Right clicking on the group name for a group where you want an option file then choosing add new solver option file and picking the appropriate solver name



- Creating a file with a name like conopt.opt then when you bring that up in the editor the option file editor appears. In the editor you see options in use, possibilities and definitions



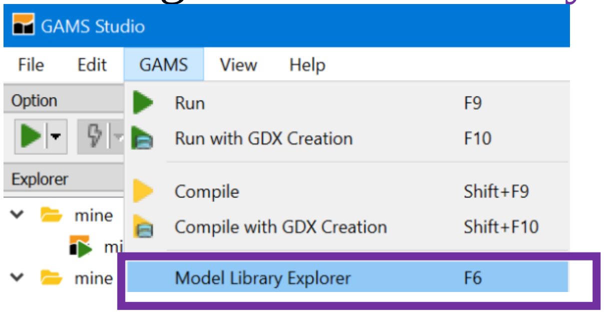
Key	Value	Comment
AllowExternal	1	
AllowFilterSQP	1	

ion	Synonym	DefValue	Range	Type	Description
.EquClass		0	{0,1,2,3}	EnumInt	Equation Cl
AbsConFeasTol		1e-05	[1e-12, 1e+299]	Double	Absolute co
AbsIntFeasTol		1e-05	[1e-12, 1e+299]	Double	Absolute in
AllowExternal		1	{0,1}	EnumInt	Indicator fo
AllowFilterSD		1	{0,1}	EnumInt	Indicator fo

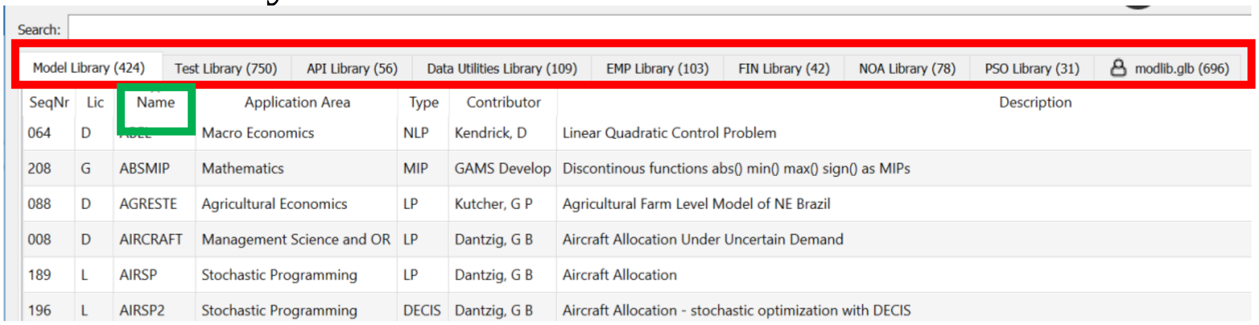
//

Using GAMS STUDIO
Using Libraries

STUDIO allows one to access libraries under the GAMS menu item and choosing the Model Library Explorer


GAMS Studio
File
Edit
GAMS
View
Help
Option
Explorer
mine
mi
mine
Run F9
Run with GDX Creation F10
Compile Shift+F9
Compile with GDX Creation Shift+F10
Model Library Explorer F6

in turn this opens a screen which identifies names of the libraries in tabs with a count of included files and, for the tab selected, the library contents. Furthermore across the top are tabs that when clicked on cause sorts. The picture below came after I clicked on the tab name with the model library active



SeqNr	Lic	Name	Application Area	Type	Contributor	Description
064	D	ABEL	Macro Economics	NLP	Kendrick, D	Linear Quadratic Control Problem
208	G	ABSMIP	Mathematics	MIP	GAMS Develop	Discontinous functions abs() min() max() sign() as MIPs
088	D	AGRESTE	Agricultural Economics	LP	Kutcher, G P	Agricultural Farm Level Model of NE Brazil
008	D	AIRCRAFT	Management Science and OR	LP	Dantzig, G B	Aircraft Allocation Under Uncertain Demand
189	L	AIRSP	Stochastic Programming	LP	Dantzig, G B	Aircraft Allocation
196	L	AIRSP2	Stochastic Programming	DECIS	Dantzig, G B	Aircraft Allocation - stochastic optimization with DECIS

Users can define their own libraries. They have to define what's called a GLB file and the formatting creation of this is discussed in my newsletter in the second issue. https://www.gams.com/mccarl/newsletter/news2.htm.

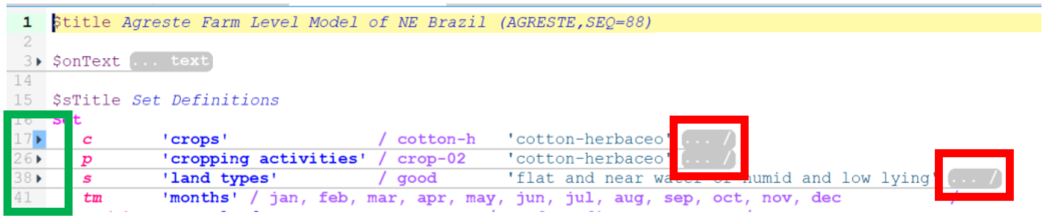
Using GAMS STUDIO
Folding Code

STUDIO allows one mark or otherwise select code to hide when in the editor in a procedure called folding. This does not remove that code from the GMS file but just hides it from view in the STUDIO editor.

Several kinds of code are folded including

- code between matching parentheses across multiple lines
- code between $ontext and $offtext, $onfold and $offfold, $onput and $offput, $ifthen and $endif and others
- Code in multiple line definitions of sets, items surrounded by parentheses, things in multiple line loops, ifs and others.

Markers are inserted to indicate folded code. One to the right of the line numbers and another in the first line of the folded block.



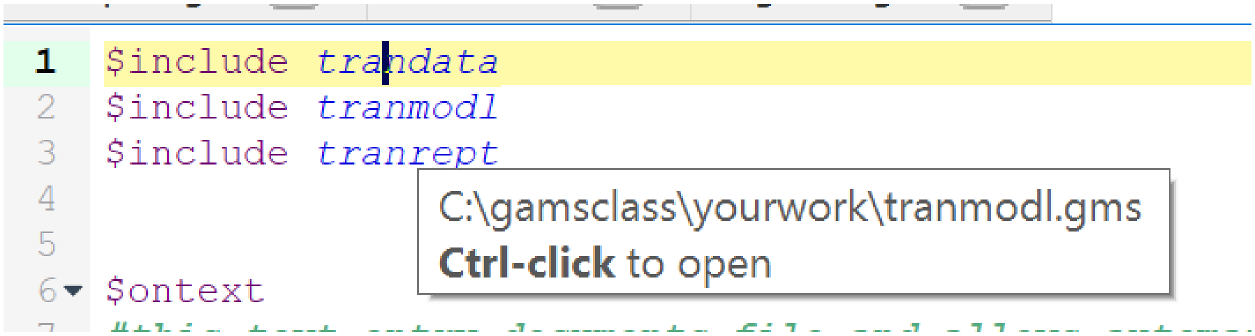
```
$title Agreste Farm Level Model of NE Brazil (AGRESTE,SEQ=88)

$onText ... text

$sTitle Set Definitions
set
   c         'crops'                 / cotton-h    'cotton-herbaceo' ... /
   p         'cropping activities'  / crop-02     'cotton-herbaceo' ... /
   s         'land types'            / good        'flat and near water or humid and low lying' ... /
   tm        'months' / jan, feb, mar, apr, may, jun, jul, aug, sep, oct, nov, dec
```

To toggle folding state of a section either the fold-marker by the line numbers can be clicked or the shortcut key Alt - L when cursor is on a foldable line. All folds are activated or deactivated using View menu or Alt - O and Alt - Shift - O.

Using GAMS STUDIO
Bookmarks and accessing include files

STUDIO allows you to add bookmarks in the code then access them under view and bookmarks. Unfortunately they are not saved from one use of STUDIO to another and thus disappear when STUDIO is closed. Hopefully GAMS will create a way to store them like it does command line parameters.

Studio also allows you to automatically open files referenced by include statements as long as they are located in you STUDIO working directory. To do this you hover over a file name in an include statement and then type control click as prompted



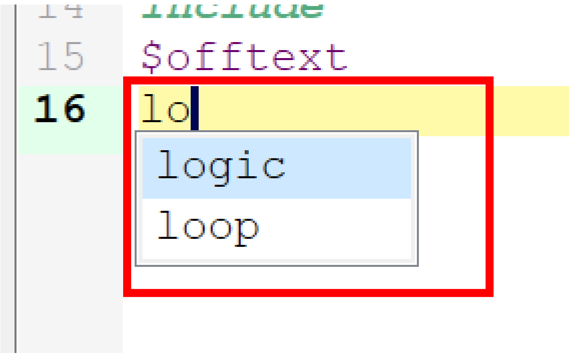
```
$include trandata
$include tranmodl
$include tranrept


$ontext
```

C:\gamsclass\yourwork\tranmodl.gms
Ctrl-click to open

Using GAMS STUDIO
Code completion

STUDIO offers completion for keywords known by the compiler.

The code completer is active by default and shows keywords that matches the current syntax and starts with the already typed characters of the word to the left of the cursor. Below I started typing lo and the completer showed up with choices



```
include
$offtext
lo
```

The selected word can be inserted with the keys tab or enter/return or by double clicking a word in the list.

Using GAMS STUDIO
Using REF files Listing and Unraveling Data items

There is a procedure in STUDIO called to display GAMS reference files that gives information on where things are defined and used.

Why? GAMS Modelers sometimes have to deal with complex implementations that

- Use include statements to incorporate numerous files.
- Have been developed by others
- Have a complex structure with definitions and uses of items widely spread in a file or files.
- Contain items that are defined but never used.
- Were developed some time ago but are not extensively documented.

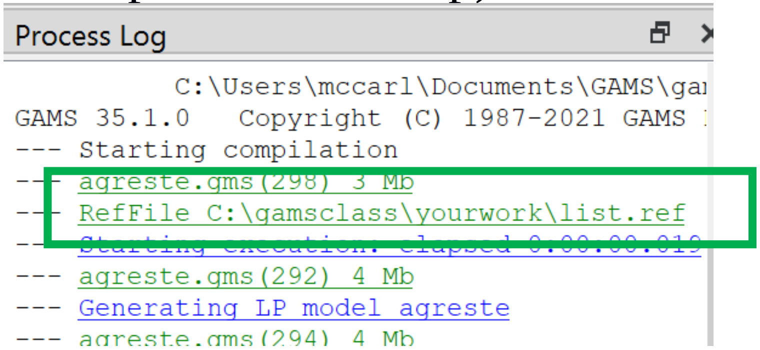
When faced with such cases one often asks

- Are there items defined in the program that are not used and if so what are they and where are they.
- In what files is an item defined, declared and used.

To resolve these questions some years ago I wrote a Fortran program called GAMSMAP but never made it widely available. Subsequently its function was included into the GAMSIDE and now in STUDIO.

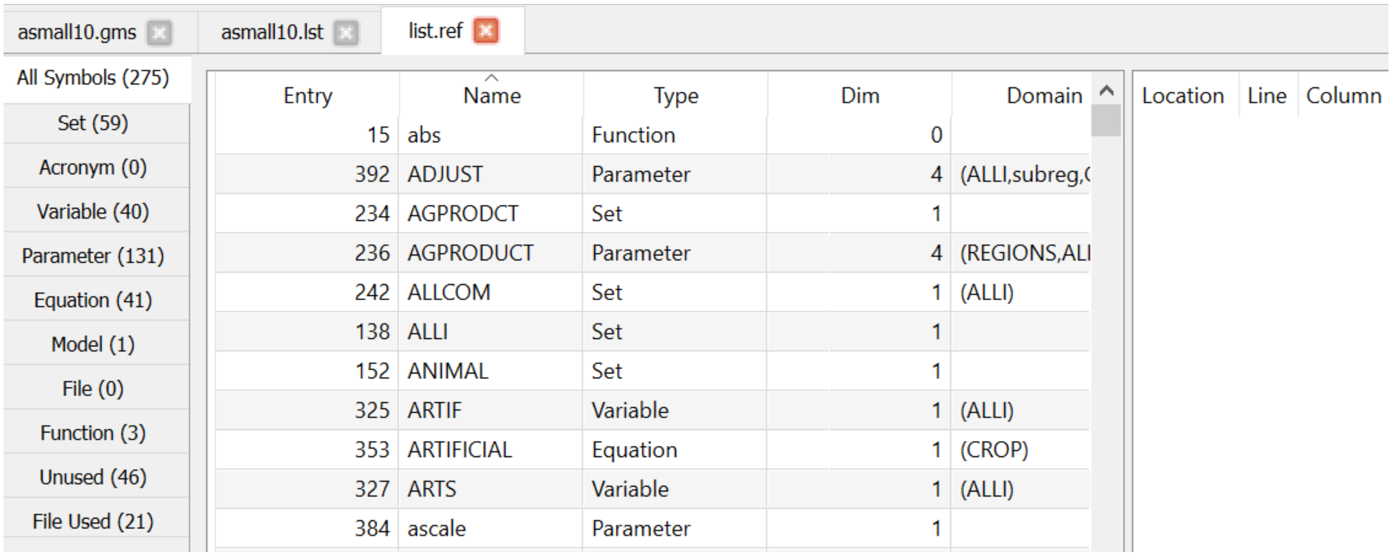
Using GAMS STUDIO
Using REF files - Listing and Unraveling Data items

When a Ref file is created for a run (using a command line entry like rf=list) and then opened by clicking on its line in the LOG file (this is located in the LOG just at the end of compile step toward the top)



```
          C:\Users\mccarl\Documents\GAMS\ga
GAMS 35.1.0   Copyright (C) 1987-2021 GAMS
--- Starting compilation
--- agreste.gms(298) 3 Mb
--- RefFile C:\gamsclass\yourwork\list.ref
--- Starting execution: elapsed 0:00:00.019
--- agreste.gms(292) 4 Mb
--- Generating LP model agreste
--- agreste.gms(294) 4 Mb
```

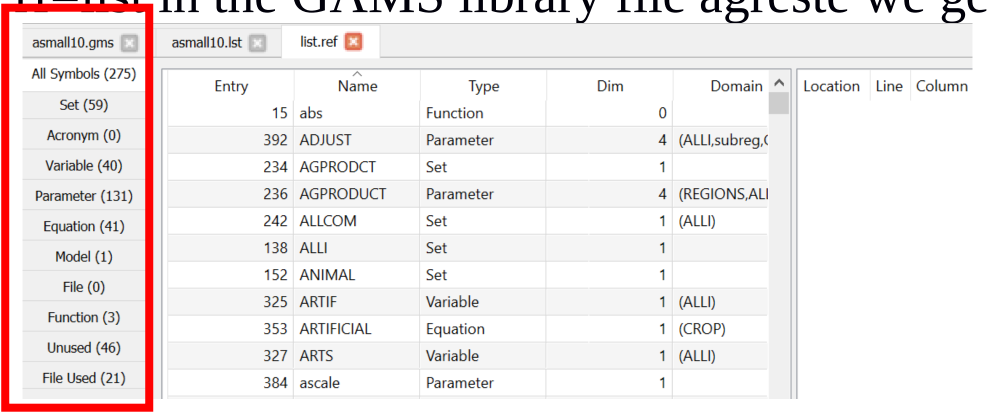
or simply opening it STUDIO creates a window as follows



Entry	Name	Type	Dim	Domain
15	abs	Function	0	
392	ADJUST	Parameter	4	(ALLI,subreg,(
234	AGPRODCT	Set	1	
236	AGPRODUCT	Parameter	4	(REGIONS,ALI
242	ALLCOM	Set	1	(ALLI)
138	ALLI	Set	1	
152	ANIMAL	Set	1	
325	ARTIF	Variable	1	(ALLI)
353	ARTIFICIAL	Equation	1	(CROP)
327	ARTS	Variable	1	(ALLI)
384	ascale	Parameter	1	

Using GAMS STUDIO
Using REF files - Listing and Unraveling Data items

Using rf=list in the GAMS library file agreste we get



Entry	Name	Type	Dim	Domain
15	abs	Function	0	
392	ADJUST	Parameter	4	(ALLI,subreg,(
234	AGPRODCT	Set	1	
236	AGPRODUCT	Parameter	4	(REGIONS,ALI
242	ALLCOM	Set	1	(ALLI)
138	ALLI	Set	1	
152	ANIMAL	Set	1	
325	ARTIF	Variable	1	(ALLI)
353	ARTIFICIAL	Equation	1	(CROP)
327	ARTS	Variable	1	(ALLI)
384	ascale	Parameter	1	

The column on the left gives tags that can be clicked on and the key ones are

All Symbols lists all items declared and a count of them

Set lists all sets in the program and a count

Variable Lists all variables and a count

Parameter Lists all parameters (items defined in scalar, parameter or table statements) and a count.

Equation Lists all equations in the program and the names of files in which they appear

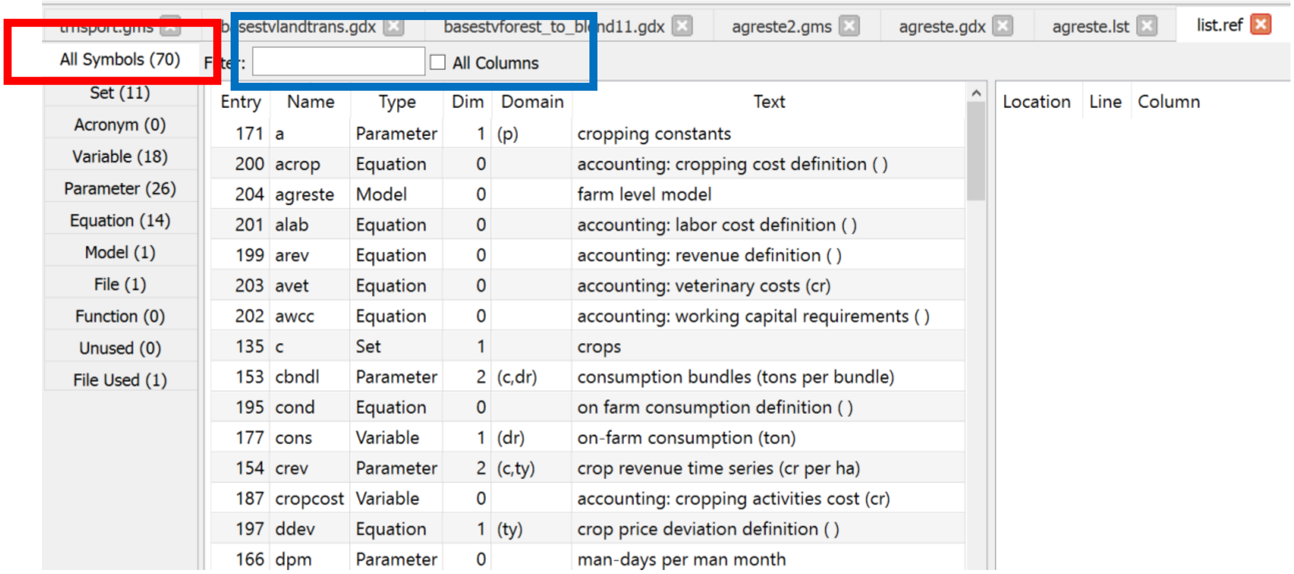
Model Lists all models that exist in the program and the names of files in which they appear

Unused Lists all items that are declared or that are not used anywhere in the model

File used Lists almost all files included into the model (note ones without GAMS keywords like included data files are not listed)

Using STUDIO
Listing and Unraveling Data items
All Symbols Tab

Choosing all symbols row causes the output to appear as follows (for the model library agreste.gms example)



Entry	Name	Type	Dim	Domain	Text
171	a	Parameter	1	(p)	cropping constants
200	acrop	Equation	0		accounting: cropping cost definition ( )
204	agreste	Model	0		farm level model
201	alab	Equation	0		accounting: labor cost definition ( )
199	arev	Equation	0		accounting: revenue definition ( )
203	avet	Equation	0		accounting: veterinary costs (cr)
202	awcc	Equation	0		accounting: working capital requirements ( )
135	c	Set	1		crops
153	cbndl	Parameter	2	(c,dr)	consumption bundles (tons per bundle)
195	cond	Equation	0		on farm consumption definition ( )
177	cons	Variable	1	(dr)	on-farm consumption (ton)
154	crev	Parameter	2	(c,ty)	crop revenue time series (cr per ha)
187	cropcost	Variable	0		accounting: cropping activities cost (cr)
197	ddev	Equation	1	(ty)	crop price deviation definition ( )
166	dpm	Parameter	0		man-days per man month

This shows all symbols used. The columns give

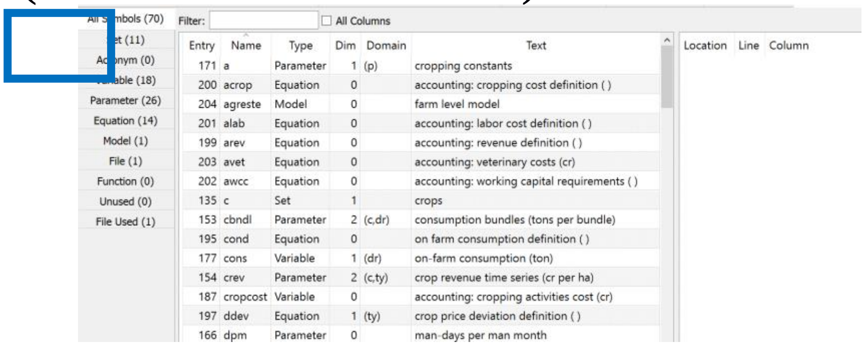
the symbol name (Name),
it’s type(Type) – set parameter etc,
its dimension (Dim) – # of sets it is defined over,
names of sets that dimension it (DOMAIN)
the explanatory text used in it’s declaration (TEXT).

Things can be sorted by clicking on the column headings.

One can search for symbols using the **filter box**

Using STUDIO
Listing and Unraveling Data items
Sets, Parameters etc. Tabs

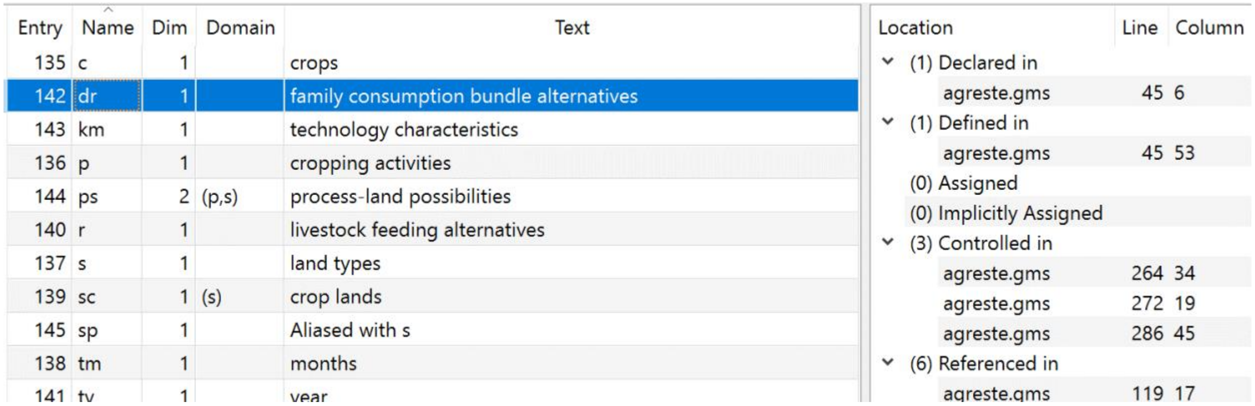
The display contains 5 lines that when activated give information for sets, parameters etc. The resultant display lists all items falling in a class (for all things that are sets or parameters etc.) and information on their characteristics and use. Specifically one gets output as follows (for the sets in this case)



Entry	Name	Type	Dim	Domain	Text
171	a	Parameter	1	(p)	cropping constants
200	acrop	Equation	0		accounting: cropping cost definition ( )
204	agreste	Model	0		farm level model
201	alab	Equation	0		accounting: labor cost definition ( )
199	arev	Equation	0		accounting: revenue definition ( )
203	avet	Equation	0		accounting: veterinary costs (cr)
202	awcc	Equation	0		accounting: working capital requirements ( )
135	c	Set	1		crops
153	cbndl	Parameter	2	(c,dr)	consumption bundles (tons per bundle)
195	cond	Equation	0		on farm consumption definition ( )
177	cons	Variable	1	(dr)	on-farm consumption (ton)
154	crev	Parameter	2	(c,ty)	crop revenue time series (cr per ha)
187	cropcost	Variable	0		accounting: cropping activities cost (cr)
197	ddev	Equation	1	(ty)	crop price deviation definition ( )
166	dpm	Parameter	0		man-days per man month

Location	Line	Column

Once set is clicked on the entries tell the names of the files in which certain things happen relative to the identified items.

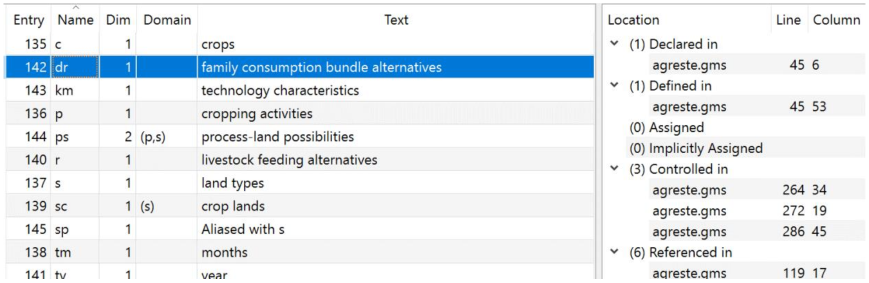


Entry	Name	Dim	Domain	Text
135	c	1		crops
142	dr	1		family consumption bundle alternatives
143	km	1		technology characteristics
136	p	1		cropping activities
144	ps	2	(p,s)	process-land possibilities
140	r	1		livestock feeding alternatives
137	s	1		land types
139	sc	1	(s)	crop lands
145	sp	1		Aliased with s
138	tm	1		months
141	ty	1		year

Location	Line	Column
(1) Declared in		
agreste.gms	45	6
(1) Defined in		
agreste.gms	45	53
(0) Assigned		
(0) Implicitly Assigned		
(3) Controlled in		
agreste.gms	264	34
agreste.gms	272	19
agreste.gms	286	45
(6) Referenced in		
agreste.gms	119	17

Clicking on a column name causes it to be sorted.

Using STUDIO
Listing and Unraveling Data items
Sets, Parameters etc. Tabs



Entry	Name	Dim	Domain	Text
135	c	1		crops
142	dr	1		family consumption bundle alternatives
143	km	1		technology characteristics
136	p	1		cropping activities
144	ps	2	(p,s)	process-land possibilities
140	r	1		livestock feeding alternatives
137	s	1		land types
139	sc	1	(s)	crop lands
145	sp	1		Aliased with s
138	tm	1		months
141	ty	1		year

Location	Line	Column
(1) Declared in		
agreste.gms	45	6
(1) Defined in		
agreste.gms	45	53
(0) Assigned		
(0) Implicitly Assigned		
(3) Controlled in		
agreste.gms	264	34
agreste.gms	272	19
agreste.gms	286	45
(6) Referenced in		
agreste.gms	119	17

The categories include the file name, line and column where items are declared, defined and used.

Declared places where the named item is declared in a Set, Parameter, Table, Scalar, Variable, Equation, Acronym, File or Model command. This will be the first appearance.

Defined places set elements or data are explicitly entered. For equations this tells where the .. specification begins.

Assigned places where items appear on left hand side of an assignment statement

Implicitly-Assignedplaces where an equation or variable has data put into it by the results of a solve statement.

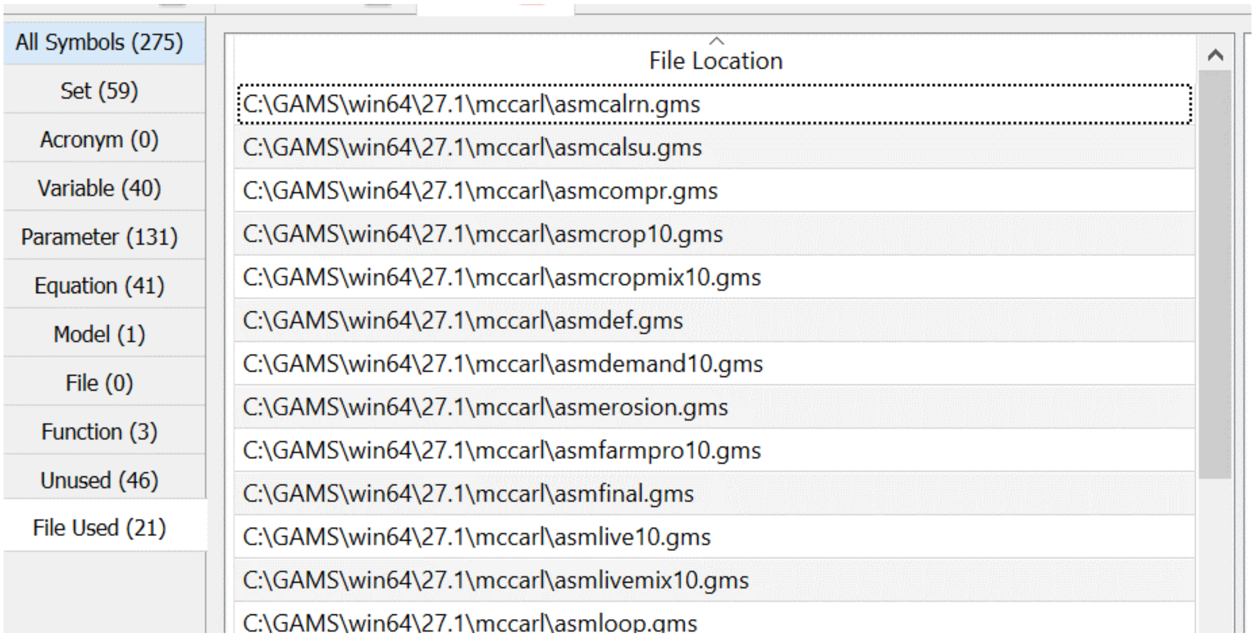
Controlled places where set is used in controlling a sum or defining an equation

Ref places where item is on left hand side of assignment statement or in a model equation

Clicking on lines here opens the subject file in the specific place

Using STUDIO
Listing and Unraveling Data items
File used Tab

The file used tab causes the output to appear as follows (for the asmsmall10.gms example)



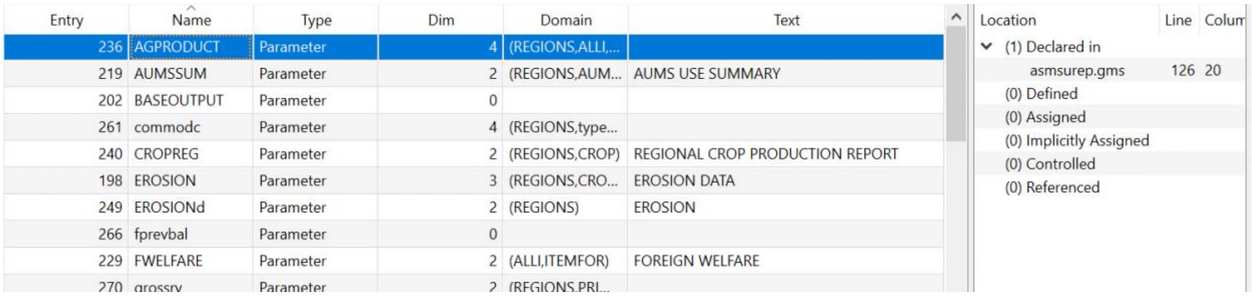
File Location
C:\GAMS\win64\27.1\mccarl\asmcalrn.gms
C:\GAMS\win64\27.1\mccarl\asmcalsu.gms
C:\GAMS\win64\27.1\mccarl\asmcompr.gms
C:\GAMS\win64\27.1\mccarl\asmcrop10.gms
C:\GAMS\win64\27.1\mccarl\asmcropmix10.gms
C:\GAMS\win64\27.1\mccarl\asmdef.gms
C:\GAMS\win64\27.1\mccarl\asmdemand10.gms
C:\GAMS\win64\27.1\mccarl\asmerosion.gms
C:\GAMS\win64\27.1\mccarl\asmfarmpro10.gms
C:\GAMS\win64\27.1\mccarl\asmfinal.gms
C:\GAMS\win64\27.1\mccarl\asmlive10.gms
C:\GAMS\win64\27.1\mccarl\asmlivemix10.gms
C:\GAMS\win64\27.1\mccarl\asmloop.gms

This gives the names of the files included in the program with their full path references.

Using STUDIO
Listing and Unraveling Data items
Unused Tab

The unused tab identifies items that are declared (in set parameter etc statements) but are never used on the right hand side of an assignment (=) statement or in a model equation.

The output for the model asmall10.gms (which is distributed with the McCarl user guide) is as follows



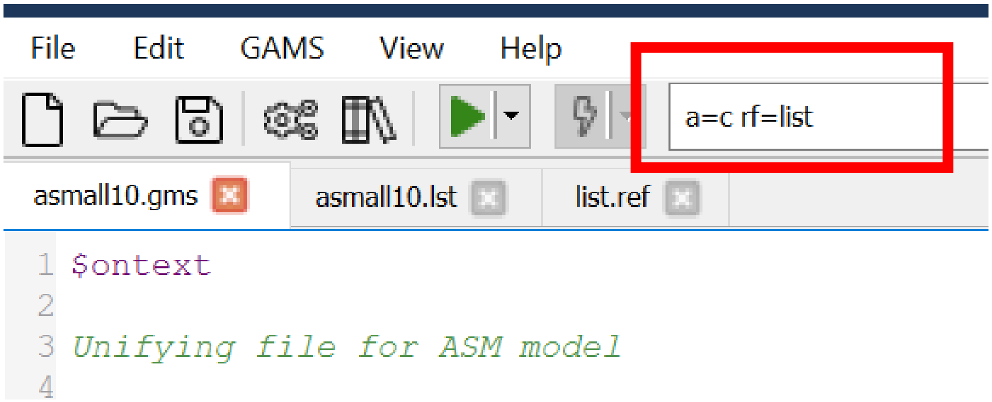
Entry	Name	Type	Dim	Domain	Text
236	AGPRODUCT	Parameter	4	(REGIONS,ALLI,...	
219	AUMSSUM	Parameter	2	(REGIONS,AUM...	AUMS USE SUMMARY
202	BASEOUTPUT	Parameter	0		
261	commodc	Parameter	4	(REGIONS,type...	
240	CROPREG	Parameter	2	(REGIONS,CROP)	REGIONAL CROP PRODUCTION REPORT
198	EROSION	Parameter	3	(REGIONS,CRO...	EROSION DATA
249	EROSIONd	Parameter	2	(REGIONS)	EROSION
266	fprevbal	Parameter	0		
229	FWELFARE	Parameter	2	(ALLI,ITEMFOR)	FOREIGN WELFARE
270	grossrv	Parameter	2	(REGIONS,PRI...	

Location	Line	Colum
(1) Declared in		
asmsurep.gms	126	20
(0) Defined		
(0) Assigned		
(0) Implicitly Assigned		
(0) Controlled		
(0) Referenced		

which shows the same information as in the All Symbols tab except when an item is clicked on one gets information on the files where it is declared

Using STUDIO
Listing and Unraveling Data items
Steps to Using Refreader

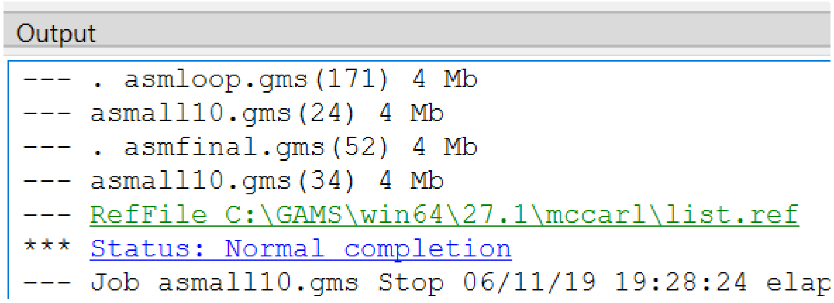
This will only work after a particular “reference file” has been created by a GAMS run. The file is generated by adding the rf option to the command line call entering a command in the command line box of STUDIO as follows
(a=c causes compilation only)



```
a=c rf=list
```

```
$ontext

Unifying file for ASM model

```

Once the file has been run with the rf option the logfile is augmented with the green line identifying the ref file name as below



```
--- . asmloop.gms(171) 4 Mb
--- asmall10.gms(24) 4 Mb
--- . asmfinal.gms(52) 4 Mb
--- asmall10.gms(34) 4 Mb
--- RefFile C:\GAMS\win64\27.1\mccarl\list.ref
*** Status: Normal completion
--- Job asmall10.gms Stop 06/11/19 19:28:24 elap
```

Double clicking on this opens the reference file window.

Using STUDIO
Listing and Unraveling Data items

The run of GAMS with the rf option places the name of the ref file in green in the GAMS log file and double clicking on that line causes the refreader program to run and create its output.

Several notes about the run

- The rf= command specifies the name of the file that STUDIO needs to open. STUDIO expects it to have the extension .ref. Typically I use rf=list that creates the file list.ref.
- The rf file only covers the program components in a run and does not include any information from restart files. In general to get the mose complete report it is best to explicitly use all the files in one program without use of save and restart
- It is often useful to just generate the reference file without any execution on behalf of the GAMS program. This is done by including the a=c option on the command line or in the command parameter box.

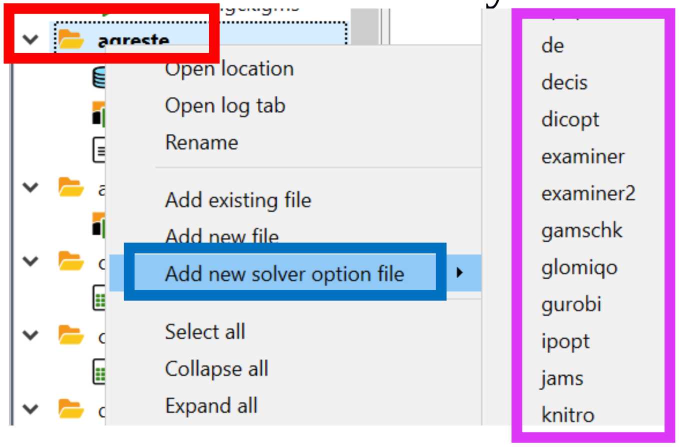
Using GAMS STUDIO
Editing Solver Option Files

Sometimes it is desirable to change solver specific options. This includes modifying things like branch and bound strategy, degree of scaling, barrier versus simplex solution approach, solution tolerances etc. The specific options allowed are described in the solver manuals.

STUDIO contains a solver option file editor that presents a solver specific menu of all possible options, default values and ones that have been altered. This is activated by either

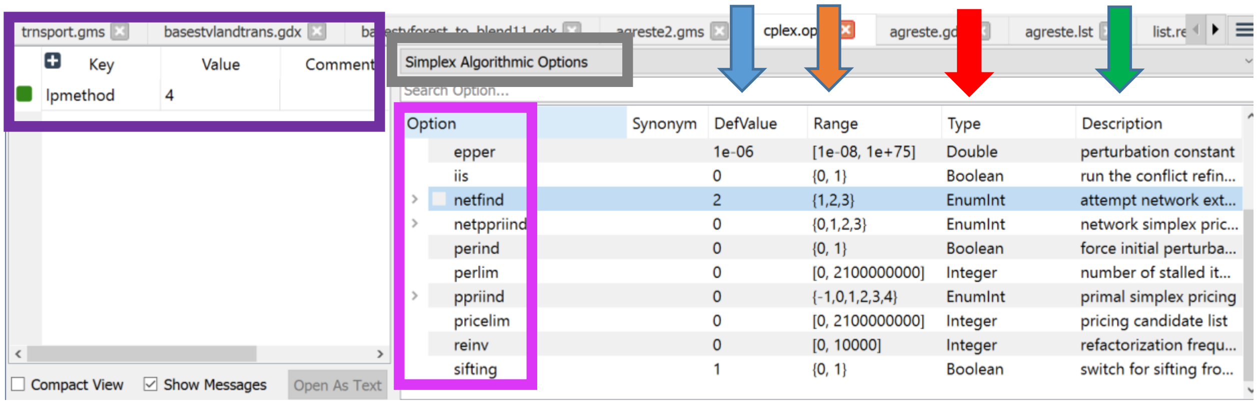
Opening or saving a file with solvername.opt (Like MINOS.opt)

Right clicking on a group file name in the STUDIO Explorer then selecting add new solver option file and subsequently selecting one of the many available solver names (only a few shown). This will creates a file you then need to save.



Using GAMS STUDIO
Editing Solver Option Files

Once it opens the general format of the solve option editor is as follows. Note the specific content depends on the solver chosen and in this case I use GAMSCHK.



Key	Value	Comment
lpmethod	4	

Option	Synonym	DefValue	Range	Type	Description
epper		1e-06	[1e-08, 1e+75]	Double	perturbation constant
iis		0	{0, 1}	Boolean	run the conflict refin...
netfind		2	{1,2,3}	EnumInt	attempt network ext...
netppriind		0	{0,1,2,3}	EnumInt	network simplex pric...
perind		0	{0, 1}	Boolean	force initial perturba...
perlim		0	[0, 2100000000]	Integer	number of stalled it...
ppriind		0	{-1,0,1,2,3,4}	EnumInt	primal simplex pricing
pricelim		0	[0, 2100000000]	Integer	pricing candidate list
reinv		0	[0, 10000]	Integer	refactorization frequ...
sifting		1	{0, 1}	Boolean	switch for sifting fro...

Here in the right part we see a list of all possible options for a **selected class of options for this solver**. A brief description of default values, entry type, if relevant allowable settings and a one sentence description of the option. In the left part we see the current entries in the option file and their settings.

Subsequently when this file is opened or its tab activated then this solver option editor appears.
Note pressing F1 while on an option opens help to a place with a detailed description of that option

Using GAMS STUDIO
When is it Not Worth Using?

There are costs and benefits of these approaches.

The STUDIO is much easier for simple models and can run across platforms.

The DOS/command line approach is generally better for models in customized environments

A development strategy for more complex implementations

A. Use the STUDIO to get it right

B. Debug components of large models using save and restart

C. Then use script files or DOS/UNIX with batch files such as

```
GAMS mymodel  -lo 0 -s ./t/save1
call myprogram.exe
GAMS moremod  -lo 0 -r ./t/save1
```

Using GAMS STUDIO
What does it not do?

A number of IDE features are currently missing. Just to inventory (note the last couple are pretty unimportant to me.)

- Find in files with directory to look specified
- The ability to do tiled windows and look at multiple cases of a file
- Ability to save output from the reference file viewer
- Ability to change license file
- Ability to change the file associations when clicking on them in Windows Explorer (you get more than I like at the moment and sometimes I want more)
- Project files (mixed blessing)
- Text file differencing (can use other programs)
- Spell checking

Using GAMS STUDIO
What does it not do so well?

Here are also some difficulties with it as of today

- Washed out colors – on my machine the syntax and error coloring is not very prominent.
- Unusual bolding and choice of items to color in the syntax coloring with for example the column names in the table bolded but not the row names.
- Confusing wording of just what is there for user defined library choice under settings and miscellaneous. Right now it simply tells you the name of the directory where library files are kept but when I first used it I thought it was where you would tell STUDIO about a new library and where it is located.
- Excessive library choices and no way to put the ones you have no interest in somewhere out of the way. Plus any user defined libraries are at the defined and there is no way to reorder.