Advanced GAMS Modeling
On line, June 5 - June 7 and June 10, 2024

This is an offering of an Advanced GAMS class preceded immediately by a Basic class. This will be a four day Advanced GAMS class designed for users acquainted with GAMS who wish to improve their skills in terms of GAMS usage and in model debugging. It will cover many topics- see the outline for details.

Contents

Next course:

- Online – June 5 (8 am US Mountain time - Denver) – June 7 (1pm) Plus June 10, (4 days -- Wednesday – Friday and Monday)

For more information select any one of the following topics:

- Instructor
- What Will You Learn By Taking the Course?
- Brief Course Description
- Assumed Background and Motivation of Participants
- Class Objectives
- Basic Course Outline
- Course Presentation Method
- Materials and Experiences You Will Get by Attending the Workshop
- Things to Do Before the Class
- Course History and past Participants
- Course Site and Time Schedule
- Course Fees
- Need More Information?

Why on line

I am offering my GAMS classes as an online offering. This is due to three reasons. First, I gave this course via ZOOM the last two years and it opened it up the material to more students plus saved them travel money and time. Also the course feedback has indicated that it was effective in that format. Third, there are the ongoing COVID issues around the world and there is the likelihood that they will still be obstacles yet this year. I will be using ZOOM to deliver the class and distributing materials so that all overheads and class examples that are used in the zoom presentation are also available to each of the students in the form of a PDF or GMS files. I will also record the ZOOM sessions that I give and will make them available through the cloud for I believe as long as 30 days after the class is over.

Schedule

To accommodate the online presentation and people's varying time zones including a number in Europe I have shortened the class day and extended the number of days on which there will be classes by one day. In particular the

- Basic class will go June 3- 6 from 8 AM until about 1 PM US Mountain (Denver) time

- **Advanced class will go June 5-7 and June 10 again from 8 AM until about 1 PM US Mountain (Denver) time.**

- Combined class will go from June 3 - 7 and then on June 10.

I also will make available and optional discussion time both scheduled and negotiated before and after class to accommodate people in different time zones.

Introduction to the Instructor

Bruce A. McCarl is a University Distinguished Professor and a Regents Professor at Texas A&M University in College Station Texas specializing in Mathematical Programming applications in Agricultural Economics. He has wide teaching, research, consulting and applied analysis experience in the application of mathematical programming and GAMS to industry, and government. (Read about some projects he has done). He wrote the Expanded Users Guide that was distributed with GAMS for 20 years and provided the basis for the current GAMS user guide. It is still available at https://www.gams.com/mccarlGuide/gams_user_guide_2005.htm. It is also more oriented toward new users than is the current official GAMS User Guide.

He has been on the Texas A&M faculty since 1985 and previously taught at Oregon State University, Purdue University and Pennsylvania State University. Dr. McCarl is a winner of awards from USDA, and USEPA for his optimization applications. He was part of the IPCC group that was awarded the Nobel Peace Prize. He is Deputy Editor of Climatic Change. He was Editor of Choices and Associate Editor of Water Resources Research and the American Journal of Agricultural Economics. Dr. McCarl earned a B.A. in Business Statistics from the University of Colorado and a Ph.D. in Management Science from the Pennsylvania State University.

Dr. McCarl taught his first GAMS short course in 1986 and has been a GAMS user since 1985. He has written the GAMSCHK modeling assistance product and the Expanded User Guide plus a tutorial on STUDIO which is being freely distributed with releases of GAMS or through their webpage. He has consulted on optimization and GAMS use with employees of First National Bank of Maryland, Tasmanian Hydropower, Neodyme, USCOE, American Express, USAID, Government of Egypt, International Harvester, World Bank, Department of Energy, Bonneville Power, Electric Power Research Institute, USDA, and USEPA among others.

(Return to Top of document)

What will the course help you learn?

You will learn advanced techniques for better using the professional's choice in modeling software -- GAMS. The 3-day course will provide you with learning experiences regarding the following questions:

- When modeling does it take you a long time to construct, verify, use the model for comparative studies and convert output into meaningful reports? Learn techniques which increase the efficiency with which you use GAMS.
- Have you ever had a model which was infeasible, unbounded or worse yet optimal but nonsensical? Learn approaches that reveal where problems are in models so you can fix them.

- Does it take you a long time to construct, verify, use for comparative studies and convert output into meaningful reports? Learn techniques which increase the efficiency with which you use GAMS.
- Do you have a GAMS implementation that takes a long time to compute, generate or solve? Learn ways to find out the cause of extensive solution time and ways that have, in cases, reduced execution times by an order of magnitude or more.
- Have you ever talked to an experienced modeler and found out there are powerful things GAMS can do that you don't know about because of hidden features or a lack of treatment in the documentation? Learn a number of such features.
- Have you heard about STUDIO, MIRO and GAMSCHK and wonder how they work? Learn about them from the developer of GAMSCHK who has used and taught GAMS since early 1998.
- Do you find yourself modeling large problems? Learn techniques to facilitate your and others understanding, documentation, ease of use and level of comfort with such models.
- Do you want to link GAMS to a spreadsheet either just using and returning data or doing a more interactive approach? Or do you even want to run GAMS in the background in a manner transparent to the user? Learn techniques to allow this.
- Might you want to deploy your model on the web? Learn about MIRO.

(Return to [Top of document](#))

Brief Course Description

Topics covered
- Good Modeling Practices
- Finding Out Why and Fixing Models That Do Not Work Right
- Incorporating Multiple Locations and Transportation
- Forming and Solving NLPs In GAMS
- Doing A Comparative Analysis
- Basic Introduction to CGE Modeling
- Intermixed treatment on GAMS usage including
- Using GAMS STUDIO
- Using GAMS Conditionals and Tuples to Control Algebra
- Doing A Comparative Analysis
- Output Improvement and Management
- Links to Spreadsheets for Obtaining Data and Reporting Results
- Using GAMS MIRO for Model Deployment
- Pre-Solution Checking of Models
- Small to Large Model Development
- Doing Calculations and Using Macros
- Conditional Compilation
- Post Solution Debugging of Models that Obtain Nonsensical Solutions
- Scaling Models Within GAMS

- Finding and Fixing Execution Errors
- Fixing Unbounded and Infeasible Models
- Finding and Fixing Causes of Slow Model Execution and/or Excessive Memory Use
- Improving Efficiency by Saving Model Status and Restarting from Saved Status
- Using Advanced Bases and Starting Points
- Using and Exploiting GAMS Solvers

See a more detailed outline

(Return to

Assumed Background and Motivation of Participants

The course will be instructed assuming those present wish to do impact analyses using GAMS and are not familiar with the basics of the GAMS language but not advanced material. Participants should wish to receive practical instruction on topics that will enable them to easily do impact analyses and increase the efficiency and accuracy with which they use GAMS in modeling settings.

(Return to

Course Objectives

- To teach on line participants techniques allowing them to
  - Use GAMS efficiently.
  - Better diagnose causes of improperly solving models
  - Enhance computer and human efficiency when using GAMS particularly when dealing with large models
  - Enhance the usefulness of GAMS output.
  - Use somewhat hidden and or new GAMS features.
  - Teach users how to use GAMSCHK, and STUDIO
- To carry out this instruction in a practical GAMS application setting exposing students to a variety of modeling issues and techniques

(Return to

What is the class focus

Unlike most of the other classes offered through the GAMS Webpage based list of courses, these classes do not focus on computable general equilibrium applications but rather on general GAMS applications with more of a focus in the optimization arena. Optimization examples will be the main ones used. Additionally there will be a short introduction to CGE. Furthermore a number of topics will be treated which are modeling method independent.

Course Presentation Method

The class will mix hands on computing sessions with on line computer based lectures. Participants will be provided with zip files with all class examples and back up documents. Participants will also receive a personalized PDF of all overheads. During the pre and post class optional discussion sessions and during hands on sessions the instructor will interact on demand regarding class topics, questions and general GAMS usage.

(Return to Top of document)

By taking this course you will

- Receive training on the topics above
- A Personalized pdf of all overheads that will be used in the class.
- A Zip file that contains all class examples, and reference documents
- At least 30 day access to ZOOM recordings (this is the duration for which ZOOM stores materials)
- ZOOM based discussions during class presentations and questions as they arise in the hands on exercises.
- Optional beginning and end of day question/discussion sessions
- Treatment of topics as listed in the schedule that is available on the GAMS web page under courses
- Ability to request as many as two personalized zoom sessions with the instructor of duration one half hour. These will be arranged at a mutually agreeable time during the time interval between June 10 and June 30.
- Be virtually exposed to others attending the class learning about their impact analysis usage
- Interact with the instructor who is a very experienced GAMS based impact analysis modeler
- Be trained in the use of software and receive copies for your use of

GAMSCHK	analyzes GAMS models and assists in their use
GAMS-STUDIO	PC and MAC editing, execution and debugging environment

- Receive manuals on GAMS usage, and class notes including

A Guide to Algebraic Modeling Using GAMS by McCarl and Spreen -- a book on agricultural modeling using GAMS

McCarl's GAMSCHK writeup

McCarl's Expanded GAMS User Guide

McCarls book on So your Model did not work right that covers procedures to fix malfunctioning models

(Return to

Things to Do Before the Class

The class will be conducted using PCs, Students will have available an Editor which resides in the GAMS-STUDIO integrated development environment. Students wishing to use other editors or their own laptops should feel free to bring such. Note course software will be distributed through the internet and a zipfile.

Students wishing to do reading before the class can download some materials and study them (using the Adobe pdf Reader). Note IT has been moving my materials and they may not be available as specified below. If those do not work see the files here

- the GAMSCHK writeup
- A paper using GAMSCHK
- Notes on use of STUDIO
- The course setup and schedule
- The course notes when I send them out
- A copy of McCarl and Spreen

Related material is on

- McCarl's home page
- the GAMS home page

Course History and past Participants

This course has been taught since 1995 once or twice a year. In addition courses with much of the material herein has been taught by Dr. McCarl at Texas A&M, Oregon State and Purdue for over 25 years.
Prior participants in this training who have used concepts in their jobs include individuals employed in the insurance, banking, agricultural, telecommunications, military, petroleum, chemical engineering, government and energy arenas.

(Return to

Need More Information?

Additional course and related material is available in the web pages linked to this one giving the

- Detailed Course Outline
- List of instructor projects

- GAMSCHK description
- The course setup and schedule
- See a sample of basic course notes
- See a sample of more advanced course notes

Related material is on

- McCarl's home page
- the GAMS home page

Other questions may be addressed by email to
brucemccarl@gmail.com or courses@gams.com
or to
Bruce McCarl
2100 Fawn Court
College Station, TX, 77845
979-204-6023

(Return to Top of document)

Daily Schedule:

Check-in on the first day: 8:00 - 8:15 a.m. US Mountain (Denver) time
Morning classes: 8:00 a.m. - 1:00 pm

See schedule

Who Is the Instructor

The course will be taught by Bruce McCarl.
- He is a very experienced GAMS user and instructor having taught
  - His first GAMS course at the World Bank in 1982
  - Commercial courses before diverse audiences since 1985,
  - An optimization course with associated GAMS lab since 1987
- He has been a GAMS user since 1982 and continues today developing several new models within the last year.
- He wrote the so-called McCarl guide which served as the official GAMS documentation from the year 2000 until about 2018 and then much of the content of that guide was migrated into the most recent GAMS documentation. Furthermore the McCarl guide is distributed under contributed documentation by GAMS.
- He has also written a number of GAMS based utilities including
  - GAMSCHK which allows one to diagnose misbehaving models and

- procedures to graph solution output and
- procedures to move solution information to HTML and spreadsheets.
- His main application areas include agricultural, environmental, water and energy modeling although he is also done work in finance, chemical engineering, forestry and greenhouse gas control.
- He has taught commercial classes since 1985 most of which have been general across a number of different application areas but with specialized courses directed toward agricultural applications, electricity sector applications, petroleum refining, military applications.

Course introduction and detailed schedule

Fee, Payment, and Registration

The course fee depends on payment date and computer requirement. The following fee schedule applies:
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> Fee normal participant - if payment received 14 or more days prior to start of class: $1800
> Fee – university student**, if payment received 14 days prior to start of class: $1000
> Fee - if paid later than 14 days prior to start of class: $1950
> Fee - university student**, if paid later than 14 days prior to start of class: $1150

One may take this class jointly with the Basic Class for an additional $800 for non students and $400 for students.**

** Generally a student is one who is full time at the university being paid at a student rate or being unfunded. It is not someone finishing up a degree while working at a company or university earning non student wages.

An **eligible lap top** must
o   run the systems required by the latest GAMS which is now Windows 10 or better or MAC High Sierra or better,
o   be able to read a memory stick or download a zip file and
o   have more than 30 megabytes of available disk space

The fee includes an evaluation version of GAMS, a complete set of course notes (see sample course notes), and a zip file containing all class examples, programs and backup documents. Checks, Visa, MasterCard, American Express, and purchase orders are accepted.

How to Register for Course

To register by phone, fax, or e-mail, contact:

    Course Coordinator
    GAMS Development Corp
    tel: 202-342-0180
    fax: 202-342-0181
    email: courses@gams.com

To register by mail, send name, address, phone, fax, and email address (with payment or purchase order) to:

    Course Coordinator
    GAMS Development Corp.
    2751 Prosperity Avenue
    Suite 210
    Fairfax, VA 22031