

## **On line Basic to Advanced GAMS Modeling** **On line, June 5- June 9 and June 12, 2023**

This is an offering of a six day on line bridged Basic to Advanced GAMS class. This will be a GAMS class designed for users initially who know little about GAMS or in need of a refresher who wish to improve their skills in terms of GAMS model setup, usage and debugging. It will cover many topics- see the [outline](#) for details.

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### **Next course:**

- On line – June 5– June 9, and Monday June 12
- 8 am to 1 pm each day US Central time (Chicago)

For more information select any one of the following topics:

- [Instructor](#)
  - [What Will You Learn By Taking the Course?](#)
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## 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 possible participants from 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 5- 8 from 8 AM until about 1 PM US Central (Chicago) time.
- Advanced class will go June 7 - 9 and June 12 again from 8 AM until about 1 PM US Central (Chicago) time.
- **Combined class will go from June 5 - 9 and then on June 12.**

I also will make available an 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](#) distributed with GAMS as well as GAMSCHK which is listed as one of the GAMS solvers but helps diagnose problems in models.

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 Associate Editor of Climatic Change. He was Editor of Choices and Associate Editor of Water Resources Research and the American Journal of Agricultural Economics. He is a Deputy Editor of Climatic Change. 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](#) which is being freely distributed with releases of GAMS. 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.

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## What will the course help you learn?

You will learn both basic and advanced techniques for better using the professional's choice in modeling software -- GAMS. The 5-day course will provide you with learning experiences regarding the following questions:

- Do you find it desirable to do a model on how the firm might act given changes in prices, programs, policies, regulations or environmental forces? Learn how to model business and agricultural entities and reflect the influence of such forces on production processes and markets.
- Do you want to put a CGE model into MCP format but are unsure how to do it? Learn basic CGE modeling and MCP specification.
- 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

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## Brief Course Description

### Topics covered

- A Fundamental Introduction To GAMS
- Looking at a GAMS Generated Model to Make Sure it Appears Right
- Accessing GAMS Documentation
- Exploiting the Power of Integrated Algebraic Modeling
- Modeling a Firm's Decision Making Setting
- Basics of Using Conditionals and Post Solution Report Writing
- 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](#)

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## **Assumed Background and Motivation of Participants**

The course will be instructed assuming those present wish to do impact analyses using GAMS but initially are not very familiar with the GAMS language. It will then build to advanced topics. 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.

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## **Course Objectives**

- To teach on line participants techniques allowing them to
  - Learn to use GAMS
  - Conduct impact analyses
  - 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](#), GAMS-STUDIO and MIRO
- To carry out this instruction in a practical GAMS application setting exposing students to a variety of modeling issues and techniques

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## 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.

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## 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 but we moved last years to Google drive where they remain)
- 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 at <https://www.gams.com/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/optimization modeler
- Be trained in the use of software

<a href="#">GAMSCHK</a>	analyzes GAMS models and assists in their use
GAMS-STUDIO	PC, MAC and Linux editing, execution and debugging environment
Put_toHTML and Put_toEXCEL	Simplified Links to HTML and EXCEL
MIRO	A package for creating graphical and tabular output displays of solution results that can also be based on a server

- 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

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## 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 (using the Adobe pdf Reader)

the [GAMSCHK writeup](#)

- [Advanced GAMS usage tips](#)
- [A paper using GAMSCHK](#)
- [Notes on use of the STUDIO](#)
- [The course setup and schedule](#)
- The course notes when I send them out
- [A copy of McCarl and Spreen](#)

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## Course History and past Participants

This course has been taught since 1995 at least 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.

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## 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

- [the GAMS home page](#)
- [The GAMSWORLD Page under contributed documentation at the very end](#) or at <https://forum.gamsworld.org/>

Other questions may be addressed by email to

[brucemccarl@gmail.com](mailto:brucemccarl@gmail.com) or [courses@gams.com](mailto:courses@gams.com)

or to

Bruce McCarl  
2100 Fawn Court  
College Station, TX, 77845  
(979) 204-6023

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## Daily Schedule:

Check-in on the first day: 8:00 - 8:15 a.m. US Central

Daily classes: 8:00 a.m. - 1:00 pm

Here is the [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 still distributed with GAMS.
- He has also written a number of GAMS based utilities including
  - GAMSCHK which allows one to diagnose misbehaving models and
  - procedure to obtain advanced basis,
  - 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, and 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: \$2300

Fee – university student\*\*, if payment received 14 days prior to start of class: \$1400

Fee - if paid later than 14 days prior to start of class: \$2450

Fee - university student\*\*, if paid later than 14 days prior to start of class: \$1550

**\*\* 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](mailto: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