

Version 01/15/08

Syllabus

AREC Winter Term Tutorial: Matlab for Econometrics

January 2 - 22, 2008

COURSE WEB SITE: <http://faculty.arec.umd.edu/mnerlove/Syllabus2008.pdf>

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Our motto:

Omnia disce, videbis postea nihil esse superfluum.

(Learn everything; afterwards, you will find that nothing is superfluous.)

Classes Begin 1/2/08 (Wednesday)

Martin Luther King Holiday 1/21/08 (Monday)

Classes End 1/22/08 (Tuesday)

Dates and Times: We start Wednesday, January 2, 2008, and finish Tuesday, January 22, 2008, with one day off, Monday, January 21 for Martin Luther King's Birthday, a University Holiday. We will run from 3:30-5:30 M-F in the computer teaching lab, Symons 0115. We have 14 two-hour sessions altogether. In order to master Matlab, however, to the extent necessary for doing econometric analysis, you will need to work additional time on your own. I will be available via e-mail to answer questions that can be answered that way.

How We Will Proceed:

"Why," said the Dodo, "the best way to explain it is to do it. (And, as you might like to try the thing yourself, some winter day, I will tell you how the Dodo managed it.)

Lewis Carroll, *Alice's Adventures in Wonderland*, 1865

When the blind lead the blind, they both fall in the ditch.

Matthew, Ch. 15, ver. 4

We will go as far with the program laid out here as time and your capacity permit, with plenty of hands-on application on your part.

Required Texts:

MATLAB Tutor CD: Learning MATLAB Superfast, by Brian L. F. Daku. Text and CD, ISBN 0-471-274698, Wiley, 2006. You MUST purchase this book and bring it to our first class session on Wednesday, January 2. It is available new from Barnes & Noble for \$22.75 and from Amazon for \$21.95. You can get it for less used, but I do not advise doing so because the CD, which is an integral part of the book, may be damaged. You will have to use the CD the very first day of class in class and you cannot use a copied version because the CD that comes with the book is copy-protected. **(Ref. M-Tutor)**

The book and the CD which accompanies it are self-contained, hands on, MATLAB tutorial. The CD contains a restricted version of MATLAB, which you access and use via the M-Tutor window which opens when you run M-Tutor. We will proceed extremely fast the first week. My plan is to finish this book by the end of the day on Monday, Jan. 7, so that you can open the regular version of MATLAB from our network and get started using it on Tuesday, Jan. 8. I strongly advise all of you, not only those who plan to miss all or part of the first week, to purchase this book and CD before you leave for Christmas break. Load it on your personal PC or lap top and get started working through the “quickstart” lessons in Chapter 2, pp. 7-35.

The Mathworks, Matlab Tutorial, 2007. This free MATLAB Tutorial will help you to start using MATLAB for your homework and academic classes. After registering, start with the “Introduction to MATLAB Tutorials,” which will help you navigate through the remaining MATLAB Tutorials more efficiently. After completing the tutorial overview, you can jump to other tutorial sections that suit you best – whether this is your first time using MATLAB, or if you’re familiar with the MATLAB environment but not the syntax, or if you are already familiar with the basic command syntax of MATLAB. Register at http://www.mathworks.com/academia/student_center/tutorials/launchpad.html You will need to have access to the Student version of Matlab or to the full professional version on our network. See below on purchase of the Student version.
(Ref. Mathworks)

Mastering MATLAB 7, by Duane Hanselman and Bruce Littlefield. ISBN 0-13-1430181, Prentice-Hall, 2005. We will be using this book extensively starting Monday, January 8. It is available from Barnes & Noble for \$70.80 and from Amazon for \$80.00. I’m sure you can get it for less used, but be sure it’s for MATLAB ver. 7 before you buy.
(Ref. MM7)

There is a Toolbox to accompany the book available free of charge from the Mastering MATLAB web site. <http://www.eece.maine.edu/mm/MM6/tbx.html> .This version of the Toolbox is distributed in P-code format, which is an encrypted binary format. As a result, no on-line help is available for the functions. That is, `>> help mmname` displays no help text for the function **mmname**. In addition, it is not possible to see the MATLAB code

that implements the functions. If you wish to have access to the Toolbox M-files and have on-line help, you must register the Toolbox

The Toolbox reference manual is a complete rewrite of the manual that accompanied the prior edition of the Toolbox. Jeff has down loaded the tool box and put in the MATLAB search path. I have put the manual on our S-drive as MMTtoolboxManual.

Optional Texts and Downloads:

Free on-line: Numerical Computing with MATLAB by Cleve B. Moler.

<http://www.mathworks.com/moler/> Moler is the Chairman and Chief Scientist of the MathWorks, which produces Matlab. He is the original author of Matlab and knows what he is talking about. I would have liked to use this book as our main text except that is very difficult for someone just starting out. It comes with many excellent exercises. (Ref. Moler)

Free Download: *Applied Econometrics using MATLAB*, by James P. LeSage,

Department of Economics, University of Toledo, October, 1999. I will also post a copy of this book and associated examples (data and m-files) to our S-drive on the AREC server. This book is essentially a manual for LeSage's Econometrics Toolbox. You can obtain the book and the Toolbox free from

<http://www.spatial-econometrics.com/>

I have downloaded this Toolbox and asked Jeff to put it in the network's Matlab search path so that you can access it from all the AREC computers which run Matlab. Professor Just and several of our grad students have made corrections to various M-files in the version we have on our network. You will be able to use this Toolbox in AREC624. (Ref. Metrix)

Optional: *Computational Statistics Handbook with MATLAB*, by Wendy L. Martinez and Angel R. Martinez, Chapman & Hall/CRC, 2002, ISBN 1-58488-229-8.

Available from Barnes and Noble, (\$89.95) or Amazon (\$86.35) ships within 24 hours. A library of Matlab M-files, Computational Statistics Toolbox, to supplement Mathwork's own Statistics Toolbox, accompanies this book and is available for free download at

http://www.crcpress.com/e_products/downloads/download.asp?cat_no=C2298.

I have downloaded this Toolbox and asked Jeff to put it in the network's Matlab search path so that you can access it from all the AREC computers which run Matlab. We used this book as our main text, in 2004, AREC 699 Special Topics in Econometrics: Computational Statistics: Monte Carlo, Bootstrapping and Simulation. It has excellent exercises. This book is available in the AREC Library. (Ref. M&M)

Optional: *MATLAB Guide* by Desmond J. Higham and Nicholas J. Higham, 2nd ed., SIAM, 2005, ISBN 0-89871-578-4. It is one of the best guides to Matlab available but it lacks exercises. (Ref. H&H)

Additional Problem Sets: I will post problem sets and additional tutorial Matlab m- and script-files associated with each topic listed below to the course web site and to the S-drive on the AREC server.

Student Version of MATLAB: See

http://www.mathworks.com/academia/student_version/?BB=1

This contains R2007a versions of:

MATLAB	Statistics Toolbox
Simulink	Optimization Toolbox
Control System Toolbox	Image Processing Toolbox
Signal Processing Toolbox	Symbolic math functions
Signal Processing Blockset	

Student Version also comes with complete electronic documentation on the DVD, plus three printed manuals. You can purchase the student version at <http://www.academicsuperstore.com/market/marketdisp.html?PartNo=825811>, with free shipping. Or from <http://www.journeyed.com/itemDetail.asp?itmNo=42391696>, for \$99.98, but shipping is not included. The university bookstore also carries it for \$110.

It should be noted that there is a freeware clone of Matlab, **Scilab**, freely downloadable at <http://www.scilab.org/>

I have not investigated Scilab in any detail, but it appears to contain everything we will need. Some students in previous years who use it swear by it.

There are other third-party freeware Toolboxes on-line which can save you from investing in the proprietary ones available from Matlab. See the links below especially to the econometrics and statistics third-party toolboxes below. There is no really good substitute for the Optimization Toolbox discussed below, although Chris Sims' collection, linked there, is not bad for those who know what they are doing. See

<http://www.mathtools.net/MATLAB/index.html>

<http://www.mathworks.com/matlabcentral/fileexchange/index.jsp>

If you mount any of these Toolboxes on your home pc, follow the instructions on where to place them in the Matlab search path. Otherwise copy them into whatever directory you habitually work from, e.g., your SaveFile, which you have established on your local drive.

PART ONE: BASIC MATLAB with M-Tutor

In this section of the course we will be using M-Tutor, which requires the CD which comes with the book to be loaded into the machine you are using. Click M-Tutor icon on your desktop. You will see the message: "This program cannot run with out the original CD in the drive." Insert your CD to continue. (Once you've used it, it appears that M-Tutor will run for awhile even if you now remove the CD.) M-Tutor has two rather unfortunate features for running on a Lab machine: (1) It has sound over. Please turn the

sound on your computer way down or off; it is unnecessary for following the tutorial. (2) You tell it who you are and it records your progress through the tutorial so you can always pick up where you left off last time. This means, if you want to use this feature that you must sit at the same computer every time. Please pick one and stick to it. The M-Tutor program also establishes a Workspace on your local computer, which is yours as long as you use the computer. Later you should establish a MatlabSave file on your H-drive which you can access permanently when you use the full version of Matlab.

The White Rabbit put on his spectacles. "Where shall I begin, please your Majesty?" he asked.
"Begin at the beginning," the King said gravely,
"and go on till you come to the end; then stop."
Lewis Carroll, *Alice's Adventures in Wonderland*, XII

DO the following now: Start with the "Quickstart Lessons," Chap. 2 pp. 7-35 in the book and pp 141 – 147 of M-Tutor. Go through all the lessons working the examples and exercises in your M-Tutor desktop and checking them in M-Tutor.

NEXT DO the following now: First, establish a Matlab save file on your h-drive so that you can save your work. Next, open up Matlab from the icon on your desk top. The first time MATLAB starts, the desktop will open with a three-panel display (Current Directory, Command History and Command Window), with toggles for two other panels (Workspace and Current Directory). You will also find a menu bar at the very top. The important button for first-timers is the white page furthest left; clicking on this will open an editor-debugger page which you can use to save your work. In the command Window it will say "To get started, select "MATLAB Help" from the Help menu." **Do it.** You can also access all of these from the **Start** menu obtained by double clicking on **Start** at the lower left-hand corner of the Matlab window. The Help window will open up. On the left side you will find a list of the help files for the different installations (mine are: MATLAB, Simulink, Excel Link, Optimization Toolbox, Statistics Toolbox and Symbolic Math Toolbox). The student version now bundles:

MATLAB	Statistics Toolbox
Simulink	Optimization Toolbox
Control System Toolbox	Image Processing Toolbox
Signal Processing Toolbox	Symbolic math functions
Signal Processing Blockset	

Double click on MATLAB; a contents tree will open up. Sub-branches 1-5 constitute an excellent Tutorial in basic Matlab. (The same is true of the other main branches for Simulink, the Optimization Toolbox, the Statistics Toolbox, and the Symbolic Math Toolbox. We will do some work with two of these toolboxes later in this course.) Now open up Getting Started and Using Matlab. We will refer to their sub-branches and sub-sub-branches as we proceed in the remainder of this course.

The next step is to open the network version of Matlab, which you should now be able to use.

NEXT: Go through **Mathworks**, Matlab On-Ramp Tutorial (30 minutes), Tutorials 1 and 2. Make sure the sound is off if you do this in class or in the lab upstairs.

NOW Work through pp. 36-153, Chapters 3-7 of the book which accompanies Matlab-Tutor working all of the problems using the main Matlab desk top and storing these results in your Matlab Save File. You will not be able to use the stripped-down Matlab which is part of M-Tutor. Coordinate your work with the corresponding chapters in **Mastering Matlab 7**. **MM7** contains no exercises as such, but you should treat the problems as if they were exercises.

There is a nice summary of useful additional commands and functions, not all of which are operational in the restricted version of Matlab packaged with M-Tutor, which, however, are available in Appendix A of the book. They are contained as web Material, which you can download from <http://www.m-tutor.usask.ca/appendix.htm> . It's a good idea to do so.

M-Tutor (MT) and Mastering Matlab 7 (MM): Concordance

MT Chap.3	MM Chap.3
MT Chap. 3.3	MM Chaps. 26-27
MT Chap. 3.4	MM Chap 3.2
MT Chap 3.5	No correspondence
MT Chap. 4	MM 5-9
MT Chap. 4.5	MM 10
MT Chap. 5	MM Chap. 12
MT Chap. 6	MM Chap. Chaps. 26-27
MT Chap. 7	MM chap. 4, 10-11, 13

BEFORE YOU EVEN START, read Chap. 37, "Getting Help,"pp731-735, of MM7.

Review: MM7. Chaps. 1-4, pp.1-37. Work through all of the examples provided as if they were exercises. There are no exercises as such in **MM7**.

FINALLY: Go through **Mathworks**, Tutorials 3-9 (60 minutes).

PART TWO: INTERMEDIATE MATLAB with Mastering MATLAB 7.0

This Part of the course will be based on selected chapters of **MM7, Moler**, and exercises from **Moler**, and Problem Sets linked here. Note that there is a toolbox available for **MM7** which has been put on the network Matlab and a manual to accompany it on our S-drive. I have also posted the electronic text of NCM to our S-drive. The file is the folder NCMText. In that folder you will find pdf files of the individual chapters and another folder labeled Files. Please download the folder labeled Files to your h-drive and add it to your Matlab path at the end of the list.

Problem Set 1: Basic Syntax and Exercises in Writing Matlab Scripts and Functions

READ Moller, Chap. 1, pp. 1-55.

DO: Moler, Exercises, 1.3, 1.4, 1.19, 1.20, 1.25, 1.35, 1.38, and-1.45, pp. 41-51. My solutions to these exercises are posted to our S-drive in the folder shared\$\MathFiles\MatlabTutorial 2005\NCMExercises.

I have also posted the electronic text of NCM to our S-drive. The file is the folder NCMText. In that folder you will find pdf files of the individual chapters and another folder labeled Files. Please download the folder labeled Files to your h-drive and add it to your Matlab path at the end of the list.

1. File Management in Matlab

When you work with Matlab, you'll need to understand these important aspects of file management:

Workspace - The workspace is the set of variables maintained in memory during a Matlab session. Use the Workspace browser or equivalent functions to view the workspace.

Search path - Matlab uses a search path to find M-files and other MATLAB related files. Use the Set Path dialog box or equivalent functions to view and change the path. Type <path> in your command window to see what's on your current path.

File operations - To search for, view, open, and make changes to MATLAB related directories and files, use the Matlab Current Directory browser or equivalent functions. Go to Using Matlab->Development Environment->Workspace, Search Path and File Operations

Go through these topics. There are a couple of nice video demos accessible through **Desktop Tools and Development Environment->Work Space, Search Path and File Operations**.

READ: MM7, Chap. 14, pp. 249-260

2. Importing and Exporting Data

READ MT Chap. 5,3, matlab help-> Programming->Data Import and Export

Go to Using Matlab->Development Environment->Importing and Exporting Data->Importing Text Data->Using the Import Wizard with Text Data. It's **a long section; read it carefully**.

The easiest way to import text data into the workspace is to use the Matlab Import Wizard. You simply start the Import Wizard and specify the file that contains the data you want to import. The Import Wizard can process most numeric data files automatically, even if they contain text headers.

If you need to work from the Matlab command line or perform import operations as part of an M-file, you must use one of the Matlab import functions. Your choice of which function to use depends on the type of data in the file and how the data is formatted.. Matlab has functions that work with numeric data and other functions that can handle both alphabetic and numeric data.

Caution: When you import data into the MATLAB workspace, you overwrite any existing variable in the workspace with the same name.

To import text data using the Import Wizard, perform these steps:

1. Start the Import Wizard, by selecting the Import Data option on the Matlab File menu. Matlab displays a file selection dialog box. To use the Import Wizard to import data from the clipboard, select the Paste Special option on the Matlab Edit menu. You can also right-click in the Matlab command window and choose Paste Special from the context menu. Skip to step 3 to continue importing from the clipboard.
2. Specify the file you want to import in the file selection dialog box and click Open. The Import Wizard opens the file and attempts to process its contents.
3. Specify the character used to separate the individual data items. This character is called the delimiter or column-separator. The Import Wizard can determine the delimiter used in many cases. However, you may need to specify the character used in your text file. Once the Import Wizard has correctly processed the data, click Next.
4. Select the variables that you want to import. By default, the Import Wizard puts all the numeric data in one variable and all the text data in other variables but you can choose other options.
5. Click Finish to import the data into the workspace.

EXERCISE, Importing Data: Go to the National Institute of Standards and Technology website, Statistical Reference Datasets: Archives, <http://www.itl.nist.gov/div898/strd/general/dataarchive.html> . Under Linear Regression, find the benchmark results for Longley, <http://www.itl.nist.gov/div898/strd/lis/data/Longley.shtml>. Locate Data file (ASCII Format). This is a .txt file. At the very end you will find the Longley dataset. Copy just those data into a text file and import it into your Matlab workspace and/or your Matlab save file. We will use these data in subsequent exercises.

3. Data Types, Arrays and Matrices

READ: MT Chaps. 5-9, MM7 Chaps. 5-9 & 17, pp.38-187. Moler, Chap. 2, pp. 1-43. From the Matlab Help menu, select and read:

Getting Started->Manipulating matrices

Matlab->Mathematics->Matrices and Linear Algebra
Matlab->Mathematics->Data Analysis and Statistics
Matlab->Mathematics->Sparse matrices

Tutorial: There's a really good tutorial by Peter Acklam, "Matlab array manipulation tips and tricks," at <http://home.online.no/~pjacklam/matlab/doc/mtt/doc/mtt.pdf>

EXERCISE, Running an OLS Regression:

Load the Longley data you imported in the previous exercise on Importing Data. Set y = the dependent variable (col. 7); set X = a column of ones (to capture a nonzero intercept) concatenated with cols 2-6 of the data matrix you have imported.

- (a) Calculate the determinant of $X'X$ and its condition number.
- (b) Calculate the vector of regression coefficients and their standard errors using the inverse matrix $(X'X)^{-1}$ and the usual formulas.
- (c) Look up the Matlab function **regress** (it's in the Statistics Toolbox). Run the regression using regress.

Compare your results with those obtained by the National Institute of Standards and Technology <http://www.itl.nist.gov/div898/strd/lls/data/Longley.shtml>

DO: Problem Set 3: Exercises on Matrices, Vectors and Linear Algebra

Note exercises are out of order.

4. Programming in Matlab: Operators and Flow Control; M-Files, Scripts and Functions

READ: MT: Chaps 4, 5, 7, MM7: Chaps. 10-13, pp. 188-248. From the Matlab Help menu, select and read Getting Started->Programming with Matlab

Matlab->Programming; help->
Matlab->Mathematics->Function Functions

- DO:**
- Problem Set 2.1: Exercises on Relational and Logical Operations**
 - Problem Set 2.2: Exercises on Flow Control, if-blocks**
 - Problem Set 2.3: Exercises on Loop Constructs**
 - Problem Set 2.4: Exercises in Programming**
 - Problem Set 4: Exercises on Functions** (NOTE: numbering is out of sequence)

5. Graphics in MATLAB

READ: MT, Chap. 6, MM7 Chaps. 26-28 & 30-31, pp. 397-476 & 487-538.

From the Matlab Help menu, select and read:

Getting Started->Graphics
Entire section on Graphics; read the demos on 2-D graphics, line plotting, axes properties, and axes aspect ratio.
3-D Visualization: Creating 3-D Graphs, Defining a View, Lighting, Transparency

[Problems in Graphics](#)

6. Supplementary Exercises

DO: The examples in MM7 Chapter 38, "Examples, Examples, Examples," pp.735-804, as if they were exercises.

PART THREE: Root Finding, Optimization and Computational Statistics

1. Optimization and Root Finding

READ: MM7: Chaps. 20 &23, pp. 326-335 & 359-369. Moler: Chap. 4, pp.1-25.

From the Matlab Help menu, select and read:

Matlab->Mathematics->Function Functions->Minimizing Functions
and ->Finding Roots

Using Matlab->Mathematics->Functions->Minimizing Functions and Finding
Roots

Find the help menu for the Optimization Toolbox

The Optimization Toolbox is a collection of functions that extend the capability of the MATLAB numeric computing environment. The toolbox includes routines for many types of optimization including:

Unconstrained nonlinear minimization

Constrained nonlinear minimization, including goal attainment problems, minimax problems, and semi- infinite minimization problems

Quadratic and linear programming

Nonlinear least squares and curve-fitting

Nonlinear system of equation solving

Constrained linear least squares

Sparse and structured large-scale problems

All of the toolbox functions are MATLAB M-files, made up of MATLAB statements that implement specialized optimization algorithms.

Go through the Tutorial for the Optimization Toolbox and the following demos:

Large-scale unconstrained nonlinear optimization

Large-scale constrained linear least-squares

Minimization of the "banana function"

From the help menu:Optimization Toolbox->

Using the Optimization Toolbox>Tutorial

Exercises to be supplied.

OPTIONAL: Press, et al., *Numerical Recipes*, obsolete 2nd ed. Chapters 9 – 10, available on line at

<http://www.nrbook.com/a/bookcpdf.php>

OPTIONAL: P. Venkataraman, *Applied Optimization with Matlab Programming*, Wiley, 2002, Chapter 5, "Numerical Techniques -- The One-Dimensional Problem," pp. 203-226; Chapter 6, "Numerical Techniques for Unconstrained Optimization," pp. 227-264; Chapter 7, "Numerical Techniques for Constrained Optimization," pp. 265-317; Chapter 9, "Global Optimization," pp. 350-378. There is a copy of this book in the AREC Library. I will ask Katherine to put it on reserve. There is a website which gives a link to all the Matlab code for this book:
<http://www.wiley.com/legacy/products/subject/engineering/venkat/> .

OPTIONAL: Eric W. Weisstein et al. "Global Optimization." From MathWorld--A Wolfram Web Resource. <http://mathworld.wolfram.com/GlobalOptimization.html>

OPTIONAL: Genetic Algorithm and Direct Search Toolbox

This Toolbox supplements the Optimization Toolbox by introducing two techniques for global maximization: The genetic algorithm, which operates like Darwinian natural selection, and direct or patterned search, which is a sophisticated form of grid search. **Genetic Algorithm and Direct Search Toolbox- >Getting Started** will give you a good introduction to the kind of problems you can solve with these global maximization techniques

2. Computational Statistics: Monte Carlo and Bootstrapping

Reference for this section of the tutorial is

Computational Statistics Handbook with MATLAB, by Wendy L. Martinez and Angel R. Martinez, Chapman & Hall/CRC, 2002, ISBN 1-58488-229-8, \$89.95. Available from Barnes and Noble or Amazon, ships within 24 hours. Free shipping. A library of Matlab M-files, Computational Statistics Toolbox, to supplement Mathwork's own Statistics Toolbox, accompanies this book and is available for free download
http://www.crcpress.com/e_products/downloads/download.asp?cat_no=C2298 .

I have downloaded this Toolbox and asked Jeff to put it in the network's Matlab search path so that you can access it from all the AREC computers which run Matlab. We used this book as our main text this Fall in Special Topics in Econometrics: Computational Statistics: Monte Carlo, Bootstrapping and Simulation. It has excellent exercises. This book is available in the AREC Library. (Ref. M&M)

REVIEW: Hogg, McKean, and Craig, *Introduction to Mathematical Statistics, 6th ed.* Sections 5.8-5.9, pp. 286-309. (ref. HMC). Some computer exercises from these two sections are assigned below.

a. MATLAB's Statistical Toolbox.

The Statistics Toolbox->Getting Started provides a good introduction. In addition, there are a large number of statistics demos accessible through the help pull-down menu -

Distribution Functions

Random Number Generation

Simulation Dependent Random Variables Using Copulas

See: Eric W. Weisstein. "Copula."

From **MathWorld**--<http://mathworld.wolfram.com/Copula.html>

Fitting Univariate Distributions

Robust Regression

The Statistics Toolbox is a collection of tools built on the MATLAB numeric computing environment. The toolbox supports a wide range of common statistical tasks, from random number generation, to curve fitting, to design of experiments and statistical process control. The toolbox provides two categories of tools:

Building-block probability and statistics functions

Graphical, interactive tools

The first category of tools is made up of functions that you can call from the command line or from your own applications. Many of these functions are MATLAB M-files, series of MATLAB statements that implement specialized statistics algorithms. Secondly, the toolbox provides a number of interactive tools that let you access many of the functions through a graphical user interface (GUI). Together, the GUI-based tools provide an environment for polynomial fitting and prediction, as well as probability function exploration.

There's a good tutorial for the Statistics Toolbox at:

http://www.mathworks.com/products/demos/statistics/stats_intro_fin/Viewlet/stats_intro_fin_viewlet.html

Also check out the following statistics Toolbox available free on the web:

<http://www.statsci.org/matlab/statbox.html>

b. Computer Generation of Random Numbers

READ:

M. Nerlove, "Notes on Random Number Generation," unpublished (1997, revised 2007).

DO: Exercises 1-7.

READ:

Cleve Moler, Fall 1995, "Random Thoughts," at

http://www.mathworks.com/company/newsletters/news_notes/pdf/Cleve.pdf

Cleve Moler, Spring 2001, "Normal Behavior," at

http://www.mathworks.com/company/newsletters/news_notes/clevescorner/spring01_cleve.html

M&M, Chapter 4, "Generating Random Variables," pp. 79-110.

DO: M&M Ex. 4.1-4.2, 4.4-4.9, 4.11-412, 4.14..

You must learn how to construct three different types of Histograms and to construct Quantile plots:

The *frequency histogram*. **hist** and **histc** in MATLAB for counts.

Relative frequency histograms. See **M&M**, pp.113-116.

Density histograms. See **M&M**, pp.113-116.

Quantile plots. See **M&M**, pp.119-126.

DO: M&M, Ex. 5.1-5.2, p. 187.

DO: Replace R by MATLAB in the following exercises and do them: **HMC**, Exercises 5.8.1-2, 5.8.4-12, 5.8.17-20, pp. 294-296.

c. Monte Carlo Methods for Statistical Inference

READ: M. Nerlove, "Notes on Monte Carlo Methods," unpublished (1997, revised 2007).

READ: **M&M**, Chapter 6, Sections 6.1 - 6.3, pp. 191-214.

DO: Exercises 6.2, 6.4, 6.8-6.9, 6.12, pp. 228-229.

d. Bootstrapping, Jackknifing, and Data Partitioning

READ: M. Nerlove, "Notes on Bootstrapping," unpublished, (1998, revised, 2007).

READ: **M&M**, Chapter 6.4, pp. 214-226. Chapter 7, pp. 231-258.

DO: **M&M**, Exs. 6.13, p. 229, 7.4-7.7, 7.9, p. 256.

DO: Replace R by MATLAB in the following exercises and do them: **HMC**, Exercises 5.9.2, 5.9.3, 5.9.5, 5.9.6, 5.9.7, 5.9.8, 5.9.9, 5.9.12, 5.9.13, pp. 306-309.