ECON 6561  Applied Time Series Econometrics and Forecasting  Spring, 2016

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OFFICE HOURS:  M  3:45 – 4:45  During the weeks of 2/9 – 3/1
               Tu  2:45 – 4:45  Tu 2:00 – 4:45
               F  12:30 – 1:30  and BY APPOINTMENT

Special Needs
Please inform me during the first week of class if you have any conditions that may limit or affect your ability to participate in this course so that we can make necessary arrangements. Please contact the Office of Disability Services (ODS), in the 707 Building (11th and Wisconsin), Room 503; phone (8-1645) for more information (see also: http://www.marquette.edu/disability-services/).

Emergency Plan
Every Marquette University campus building has emergency shelter and evacuation plans. Please familiarize yourself with the plans of each building in which you take classes or attend meetings. Make sure to note the routes to the lowest level of the buildings for shelter during inclement weather, as well as exits from the buildings in the event of fire or other emergency.

Attendance Statement
The Marquette University Graduate School of Management considers regular class attendance an important component of the learning process. Students are expected to attend scheduled class meetings; excessive absences may have adverse consequences, ranging from a lowered course grade to forced withdrawal from the course. Excessive absence is generally defined as missing more than 10-15 percent of the regularly scheduled class time. Please consult the instructor’s course syllabus for additional details regarding a particular course. For ECON 6561, anything more than 10 class periods is determined to be “excessive”. If expect to miss 3 or more class periods, please do not enroll for this course this semester. Finally, please contact me (or Dr. Nourzad if the session is during the weeks of Feb 9 – Feb 23) prior to the beginning of the class which you will be absent.

PLEASE REMEMBER - - CLASS TIME IS  5:30 – 8:10 (with a 10 minute break beginning about 6:50). There is one exception to that schedule for the meeting on March 8. That session is the night of the common break for all Graduate School of Management courses. We will meet from 5:30 – 8:30 with a 30 minute break approximately 7:00- 7:30.

REQUIRED TEXT:  NONE
OPTIONAL TEXTS:  Basic Econometrics, by D. Gujarati, 5TH Edition (ECON 6560 text)

Quite a few of the topics we will cover are described in some detail in the "HELP" module of E-Views, so that is another reference source.
Electronic Information: This course uses the D2L resource to disseminate information during the semester. Marquette’s D2L entry page is http://d2l.mu.edu. It is suggested that you save any files that are posted to a storage drive (flash drive, etc.) and then print. I will use Marquette EMarq accounts for email correspondence as part of this class; you can have mail forwarded to another if you would like.

Please remember that the computer lab in DS 116 has the most up-to-date version of E-VIEWS (version 9) and STATA (v. 14); E-VIEWS will be used for class demonstrations, STATA may be used. The student version of E-VIEWS may not be sufficient for some assignments as it may be the case that the number of data points (number of observations * number of variables) exceeds the limit that can be handled by the student version. Also, some of the operations we will do in this course are not available in the student version.

In the past, the SAS statistical package was introduced to students as part of this course. However, almost every spring semester, a one-credit skills course on the basics of SAS has been offered as part of the MBA curriculum (BUAD 6112). Given that course is offered again this semester, we will not discuss SAS as part of this course. If you are not already enrolled for the SAS skills course, it is strongly recommended that you register for that course, though none of the assignments will require you to do any of the work for this class using SAS. (HURRY – THE COURSE IS OFFERED AND CONCLUDES IN THE FIRST FEW WEEKS OF THE SEMESTER)

The reason that it is recommended that you learn the basics of that package are: (1) the logic of the SAS program, how it handles data and how it does specific statistical analysis is somewhat different than E-Views (and STATA), so it is not the easiest of software packages to learn without some fundamental instruction, (2) SAS is a package often used in the private sector, so acquiring some knowledge of it may prove to be quite valuable to you in the future. Surveys of our MSAE alums and anecdotal evidence suggest that if you can say you have some working knowledge of SAS, however small, your prospects of obtaining your first job when you are done with our program noticeably improve.

COURSE DESCRIPTION AND OBJECTIVE

This course is designed to further enhance the students' knowledge of statistical, econometric, data manipulation and forecasting techniques. In particular, the course has two main points of emphasis: the analysis and use of time-series data and models, and forecasting methods. Specific issues in the time series component of the course are univariate and multivariate time series models as well as topics from financial econometrics that deal with high-frequency time series data that tend not to satisfy some of the assumptions of the classical linear regression model. Elements of forecasting will be part of each of the time series issues. Prior to the introduction of those topics, other econometric issues (a review and extension of topics dealing with limited dependent variables and other “unfinished” business related to topics from ECON 6560) are examined. Finally, we spend one part of the course on specification error as it relates to endogenous explanatory variables and the methods used to account for and overcome that problem.
From the discussion of univariate time series data through the remainder of the semester, this course can be thought of as one that

- introduces the students to a variety of data manipulation, econometric and forecasting techniques,
- describes the reason to use these techniques (as opposed to OLS in some cases) and the circumstances where they are useful and/or critical, and
- provides practice in the use of the techniques with economic/business data

As a rule, this course is somewhat less concerned about econometric theory than ECON6560 (although there are topics where a brief discussion of the theory is a necessary foundation). Rather, it is more concerned about why and when someone would need to use the technique under study; why it is different than simple OLS; how to interpret and present the results; and, where pertinent, perform forecasts, data manipulations or simulations using the technique. Using the basic tools that you should have mastered in an introductory econometrics course (ECON 6560), the main objective of this course is to give you further practice in the effective use of statistical, econometric and data manipulation techniques used by applied economists to estimate and forecast business, economic and/or policy-oriented relations. The other objective of this course is to provide an opportunity to practice reporting and communicating the results of your econometric and empirical work in such a way as to be comprehensible to both those people skilled in econometrics and (especially) to those that are less versed in quantitative methods.

**College of Business Administration Assessment Statement**

The fundamental mission of the College of Business Administration is to provide a quality education grounded in Catholic, Jesuit intellectual values. Students are expected to learn how to function effectively in a diverse and global economy and develop into responsible members of the business community. As one of many methods of assuring that the goals of our educational mission are successfully met, the college regularly and systematically engages in the assessment of these competencies. Students in our other graduate programs (i.e., MSAE) are assessed on specific competencies related to their disciplines.

Assessment takes place each semester in all programs and settings using quantifiable measures to gather and analyze information to help continuously improve the educational process. The College of Business Administration is dedicated to successfully providing a quality education for all students. Assessment is the continuous improvement process of evaluating our success. More information on assessment can be found at (http://www.marquette.edu/assessment/) or in the assurance of learning tabs under http://business.marquette.edu/academics/assurance-of-learning-undergrad or http://business.marquette.edu/academics/assurance-of-learning-graduate

**Assessment statement and how it relates to this course**

The following four items are the current program goals for the MSAE program; students graduating from the program should be able to show that they can:

1. critically analyze global and domestic issues
   a. one learning outcome for this goal is to assess if students can effectively critique relevant research on economic and business issues
2. conduct an independent economic research project
   a. while we will not be doing an “independent project” we can still assess the following learning outcomes for this goal: assess if students can effectively use proper estimation and statistical techniques and then make accurate forecasts
3. verbally communicate the results of empirical research
4. communicate the results of empirical research in written format
   a. one learning outcome for this goal is to assess if students can prepare technical reports
   b. a second learning outcome for this goal is to assess if students can prepare non-technical reports

In order to allow faculty members of the Department of Economics to assess whether specific program learning goals were met, data will be collected from student assignments in this course. While there will be several different assignments used to determine your final grade, only specific assessment items will be used in association with the MSAE program goals. To assess some of the learning outcomes (as well as help determine your final grade), students will be asked to complete a semester-long analysis that is part of several homework assignments all related to a specific topic. While the individual assessment instruments related to this topic will be discussed in detail prior to each assignment, the following is a brief overview of the analysis:

a. The semester-long analysis is based on a relatively simple article from a recent publication from the National Association of Business Economists. One of your assignments will be to read the article and complete a written assignment where you review, evaluate and critique the work of the authors. This assignment can be used to assess the learning outcome as described in (1a).

b. Some of your other tasks will be various homework assignments tied to that article. You will be asked to complete the econometric/statistical manipulations and submit the results using the appropriate technical descriptions with the results of your manipulations. (Homework assignments that are not directly tied to the main project will be part of the course as well; those will be similar to the homework assignments in ECON 6560.) All of the homework assignments are eligible to help assess learning outcome (2a). The homework responses will be more or less technical analysis, though will not be in the form a “report”. However, one homework assignment is designated to be written as a short non-technical “report” which can help assess learning outcome (4b).

One issue that I will likely ask you to do in some of the homework assignments is to graphically and numerically analyze and describe the raw data. The motivation for this additional requirement, in part, comes not only from the learning outcomes for the program but also from discussions with business “friends” associated with the College of Business Administration. A basic requirement of any business or economics graduate is to be able to manipulate data, create graphs, and so on, in EXCEL. At times, in our desire to learn more advanced econometric techniques we forget that discussing and showing data allows people to see quite a bit even before we obtain regression results. Further, a good way to understand if the estimated coefficients of a regression are not only statistically but also economically or practically significant is to more fully understand the magnitudes of the variables in the analysis. For example, a coefficient estimate for some independent variable may be huge relative to all others - - does that mean it is that most important impact on the dependent variable? Not necessarily, as perhaps that variable typically only changes by 0.15 units, so interpreting the coefficient, where we assume the estimate shows how the
dependent variable changes for a one-unit change in the independent variable, can mislead us to overstate the practical or economic magnitude of the impact in this sample period (a good example of this will be found in your first assignment). It is for these reasons that you will be asked to analyze, describe and graph the data in the context of EXCEL for some of your assignments.

ASSIGNMENTS AND GRADING

Quizzes

There are no tests (open-book, take-home or otherwise) in this course. However, to insure that you are keeping up with and comprehending the material, there will be quizzes on the material covered from previous class meetings. There will be five (5) quizzes throughout the course. The first quiz is worth 4.5 points, quizzes 2 - 4 are worth 7 points each, and the final quiz (number 5) is worth 9.5 points each; the total sums to 43.75% of the course grade. In many cases, questions on the quizzes will be examples of or related to the statistical and econometric applications that students are performing as part of the homework corresponding to the material. Quiz 5 during finals week will have approximately 50% of its points based on issues from the final topic / final homework assignment and the remainder of the points will be based on key issues from ECON 6560 or ECON 6561 (translation; part of the last quiz is cumulative).

Homework

43.75% of the course grade is based on eight (8) homework problems. Since this course is basically a techniques course, in most cases, the data necessary to build and estimate a suitable empirical model will be provided for each assignment. In addition, when necessary, a brief explanation of a theoretical model that could be the basis for estimation will be given and reviewed. Some of the homework assignments and necessary data are directly out of a text (Gujarati or some other text), others are related to the analysis of the issue that is brought up in the review article (see below). Given the data and a brief description of the model, it will be up to you to use that background, the techniques that you have acquired, and any other insights that you might provide to complete the assignments.

Most of the homework assignments (7 of the 8) will be more or less similar to the homework exercises you did in ECON 6560. I will require you to print out the results, any data table/graphs and your discussion of data and results. As was the case for ECON 6560, the questions that you are to answer/discuss will be given to you as part of the assignment. A difference with these assignments compared to ECON 6561 is that I want you to treat them as if you are an assistant in a research department of some organization, and your “assignment” is part of your research responsibility to your supervisor.

While a more detailed explanation of what constitutes a technical description that will be requested as part of most homework assignments will be provided as part of those assignments, several sentences on these terms are given here. In the technical descriptions, you may be asked to be asked to: (1) discuss/describe the data used and show some “data analysis” (in an attempt to reveal in a graphical, statistical and/or numerical sense how variables are related), (2) discuss the “regression” results in a general manner – with emphasis on the numerical interpretation of estimated coefficients, and (3) if relevant, discuss the accuracy of any forecasting/simulation
generated from the empirical model. You should assume that when your draft the technical
descriptions for the homework, the person reading your “report” is skilled in econometrics (you can
think of it as one of the other people in the course or some of the Economics Department faculty or
the committee members of the oral component of your MSAE professional project). This means
that you should use technical terminology to describe the issue, methods, and results; in fact, it is
expected that you will use the correct technical terminology in the homework descriptions.

The idea for this somewhat formal approach is that your supervisor probably is analyzing
many issues at once. The first two items are a way to provide some context for (and to help her/him
remember) the “assignment”. Finally, for help in showing items (2) and (3) above, either in the
assignment proper or separately in an appendix (that you refer to from the assignment), please
provide your output! That is, print out the ULTIMATE version of the regressions that you run -
in most cases E-VIEWS tables are acceptable for homework! However, DO NOT provide all
the “preliminary” regressions that you estimated in the course of completing the homework.

The first homework assignment is one where you are not asked to generate results (except for
some graphical evidence related to the data analysis point (1) mentioned above). The emphasis on
this assignment (which I will call assignment A) is on non-technical writing. For assignment A, I
will provide you with the data and results for a relatively simple model using time series variables. I
will also provide you with a very brief discussion of the theory or economic reasoning on why we
think the variables are related. With the information that I provide, I will ask you to write a short
non-technical report about the issue, the data and results and which also provides a hypothetical
analysis of how the results might impact your “organization” or might be useful to how your
organization conducts business.

“Review Article”

The remainder of the course grade (12.5%) is a short review and critique of an article from a
recent issue of Business Economics, a publication from the National Association of Business
Economists (NABE). Specifically, the citation for this article is (though you will not need to include
the citation in the assignment):

Dye, Robert A. and Sutherland, Chad. “A New Metric to Gauge Household Economic

The article has been copied to a PDF file and placed on D2L for you to access. The article
expands on the notion of the so-called “Misery Index” which is a constructed value equal to the sum of
the unemployment rate (in %) and the annual percentage rate of change of the Consumer Price Index
(CPI); this component is also measured in %. The idea behind the Misery Index is that as both
unemployment and inflation are high, such as the case in the “stagflation” era of the 1970s, consumers
are detrimentally affected by a poor job market that depresses overall income and high inflation that
erodes the spending power of their already depressed income.

The main addition the authors provide to this concept is that another important indicator of the
well-being of households is missing from the simple Misery Index, the value of wealth felt by households
in the form of the housing stock. That is, as house prices rises, household wealth tends to rise, which can
lead to higher consumer sentiment and other factors that can have positive impacts on the economy. On the other hand if house prices fall, that might have the same impact as higher unemployment and/or higher inflation. Therefore, the authors re-define the Misery Index to be the sum of the unemployment rate and the rate of inflation minus the annual percentage rate of change of the home prices. Using this new Misery Index, the authors go on to show how it compares to the original index, and how it relates to some negative consequences to the economy.

A separate document will spell out this “critical review” assignment; you are asked to read the article, then evaluate and critique it with respect to several issues. Given that you have completed at least one course in econometrics (and part of this one by the time the assignment is due), you should be able critically read an article in such a publication and discuss its content and merits, at least in terms of the economics, the statistical and econometric concepts used and the overall message. You will also get practice at writing an executive summary for this article. This assignment comprises 12.5% of the course grade.

Some of the homework will incorporate the idea and related data from the article. For example, one of the homework assignments is based on a simple linear model for forecasting purposes; two more deal with basic univariate time series issues; another uses univariate time series methods for forecasting; and finally, another homework assignment examines the main issue using a multi-variable vector autoregressive and/or error correction approach. I am likely to break the members of the class up so I can have you look at this issue using data defined for different “targets” so that while the homework is based on the same general topic, the results may be different based on the target variable of interest assigned to different students.

For the article critical review, I will provide a “Grading Sheet” that will be used to assess your submission. The Grading Sheet for the “critical review” of the article assignment has been posted to D2L prior to the semester.

The weighting scheme for grades will be as follows:

Quizzes: 1 @ 4.5 points, 3 @ 7 points each and 1 @ 9.5 points . .................. 35
Homework: 2 @ 2.5 points each, 5 @ 5 points each . .................. 30
Homework Special Writing Assignment: 1 @ 5 points . .................. 5
Critique/Review of Fed Funds Rate article. .................. 10

The number of points sum to 80. The grading scale that will be used in this course is a bit different than that in ECON 6560. The grade "cut-off" in terms of PERCENTAGE of points earned (i.e., the lowest weighted-average score to get the corresponding grade) for this course are A: 92.5, AB: 87, B: 81, BC: 75.5, C: 70 - - anything below 70 is an F.

In part to comply with the Federal Educational Rights and Privacy Act (FERPA), Marquette University requires faculty members to submit final grades via CheckMarq by midday the Tuesday after finals week. Students are able to view their final grades in CheckMarq at the end of the business day on the Tuesday after finals week.
CLASS NOTES

Each week, by no later than 2:30 p.m. on the day of class, the PowerPoint file that will be used in class that evening will be available on the D2L “course” site in an effort to give you an outline of the topics discussed in class that night. For most weeks, soon after class, you may also get access to more extensive notes in D2L. These will have detailed notes and some other issues that may not be explicitly brought out in class. The PowerPoint files will be called WEEKx.PPT and the more extensive notes will be called WEEKx.DOC, where “x” stands for the semester week of the class.

TENTATIVE COURSE OUTLINE

For brevity, Gujarati is (GUJ) and page numbers for the specific topics are provided. Other readings may be announced in class or on the D2L site for the course.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Readings</th>
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<tbody>
<tr>
<td>1) INTRODUCTION (JM)</td>
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There will be a special writing example homework assignment (A): DUE DATE January 26

2) SOME UNFINISHED BUSINESS: Extensions of topics from ECON 6560 (JM)
   a) “Prediction” when the dependent variable is natural log NOTES
   b) Qualitative/Limited Dependent Variable models NOTES; GUJ 541-79
      i) Review – why not OLS?
      ii) Brief discussion of Count models
      iii) Tobit models
      iv) Sample Selection issues

There will be homework assigned for topic (2) - DUE DATE February 2

3) Part 1 UNIVARIATE TIME SERIES, the basics (JM)
   a) Trend NOTES
      i) Classifying trends
      ii) Trend forecasts
         (1) Linear vs. Log (see topic 2a)
         (2) Pattern change, etc.
   b) Seasonality
   c) Persistent Data and Stationarity GUJ 737-47
   d) Spurious Regression (briefly) NOTES
   e) Simple Unit root testing GUJ 748-60
   f) Forecasting Issues with Non-Stationary data (briefly) NOTES

There will be homework assigned for topic (3): DUE DATE February 8

A quiz for topics 2) and 3) will take place at the beginning of class on February 9.
4) FORECASTING WITH THE LINEAR REGRESSION MODEL (FN)
   a) Introduction
   b) Types of Forecasts
   c) Using the LRM for Forecasting
      i) Mean Forecasts
      ii) Individual Forecasts
      iii) Forecasting with Autocorrelated Errors
      iv) Forecasting with Multicollinear Regressors
   d) Forecast Tests of Model Stability
      i) Chow Forecast Test
      ii) N-Step Ahead Forecast Test
      iii) One-Step Ahead Forecast Test

5) EVALUATION OF FORECASTS, part 1 (FN)

   There will be homework assigned for topics 4) and 5): DUE DATE February 16

6) MODELS OF VOLATILITY (2 weeks)
   a) Autoregressive conditionally heteroscedastic (ARCH) models
   b) Generalized autoregressive conditionally heteroscedastic (GARCH) models
   c) Asymmetric GARCH models
      i) Exponential GARCH (EGARCH) model
      ii) GJR model
   d) Engle-Ng tests of asymmetry
   e) ARCH-in mean
   f) EGARCH in mean (EGARCH-M)
   g) Multivariate GARCH (MGARCH) models
      i) Vech
      ii) Diagonal Vech
      iii) BEKK
   h) Forecasting variances using GARCH models

   There will be homework assigned for topic (6): DUE DATE February 28

A quiz for topics 4) through 6) will take place at the beginning of class on March 1.

Critical review article assignment due by Tuesday, March 15 @ 4:00 pm (in drop box) or hard copy at the beginning of class

7) UNIVARIATE TIME SERIES, modeling, estimation and forecasting (JM)
   a) Review and extension of Unit Root tests

   GUJ 775-84
b) The cycle part - - ARIMA techniques

c) The identification of the cycle pattern in the data

d) The estimation of the cycle pattern in the data

e) Diagnostic Checking of the results - - correct pattern?

f) Including seasonality to the cycle

g) Forecasting
   i) Review of forecasting with non-stationary data
   ii) Forecasting issues with ARMA models

There will be homework assigned for topic 7: DUE DATE April 3

A quiz for topic 7) will take place at the beginning of class on April 5.

8) MULTIVARIATE TIME SERIES, simple models (JM)
   a) Intervention Analysis and Transfer Functions
   b) Distributed lags
      i) Model Selection Criteria: The case of Lag Length
      ii) Geometric and Rational Distributed Lags
   c) VAR Models
   d) Estimating and interpreting VAR models
      i) (Non) Causality Tests
   e) Forecasting with VAR models

   There will be homework assigned for topic 7: DUE DATE April 3

A quiz for topic 7) will take place at the beginning of class on April 5.

9) MULTIVARIATE TIME SERIES, more complicated models (JM)

   There will be homework assigned for topics 8) and 9): DUE DATE April 17

10) FORECASTS AND EVALUATION OF FORECASTS, part 2 (JM)
    a) Review of Statistical evaluation methods
    b) Other evaluation methods
    c) Forecasting when a cycle change occurs
    d) The issue of combining forecasts
11) SPECIFICATION ERROR AND RELATED ISSUES, part 2 (JM)

   a) Endogenous Explanatory Variables
   b) Single-equation models
   c) Multiple-equation models (simultaneous regression techniques)
      i) Why is OLS inconsistent?
      ii) What is an alternative to OLS?
      iii) Test of Model Specification, Endogeneity Tests
      iv) Model Identification
   v) Estimation of multiple-equation models with endogenous explanatory variables
      (1) Simple techniques
      (2) Two-Stage Least Squares
      (3) System-Wide Estimation

There will be homework assigned for topic 11): DUE DATE May 8

A quiz for topic 11) will take place on May 10; part of the quiz will come from key topics covered in ECON 6560 and ECON 6561.

Homework due dates: Feb 2, Feb 8, Feb 16, Feb 28, April 3, April 17 and May 8

Quiz dates: Feb 9, March 1, April 5, April 19 and May 10

Special Writing Assignment A: Jan 26
Critical Review of Article: March 15

These may be subject to change (especially the quiz dates) in case of bad weather or more time spent than anticipated on certain topics. Some of the homework is due on Tuesdays (Jan 26, Feb 2 and Feb 16). That homework should be printed, brought to class and turned in at the beginning of the session it is due (it can also be posted to a drop box with deadline prior to the beginning of class). The remainder of the homework assignments are due on SUNDAY (one is on MONDAY, Feb 8 to avoid the Super Bowl game); for these, on the following Tuesday, you will have a quiz corresponding to some of the topics covered in the homework assignment. For the assignments due on Sundays (or Monday), to help you prepare for the subsequent quiz, an answer key will be posted to D2L by 7:00 pm on the day the homework is due. There will be no assignments accepted once the answer key has been posted. For the assignments due on Sundays (or Monday), please use the appropriate D2L dropbox to submit your assignments prior to the deadline for submission.

The rules for using the dropbox to submit assignments: (1) you must correctly submit the file prior to the time the assignment is due (or late penalty rules, defined below, kick in); (2) you must submit the assignment using Microsoft Word format (.doc or .docx) or Adobe format (.pdf); (3) it is YOUR responsibility to make sure that when the file is printed, the assignment comes out looking acceptable (double-spaced, tables all on one page, etc.); (4) if the files are not readable or printable, you will be asked to re-send them, if that is after the time when the assignment is due, the late penalty rules kick in (translation of points (3) and (4) - - you better be 100% sure or as close to it as possible that what you originally submit is correct!)
Finally, protect your work! I mean this in two ways. First, make backup copies of your files in case something happens that destroys one of the files on which you are working. *The excuse of something is wrong with some hardware is not considered valid.* The other meaning has to do with plagiarizing work. Please do not make it easy to have someone copy your work. I will follow the new Marquette University Academic Honesty policy in the event of a possible case of academic dishonesty. Finally, after this warning about working together, please do not completely stop doing the estimations in small groups. I have no problem if some of you get together to work on the statistical or econometric aspects of the assignments. There may be short cuts that someone will find that can benefit everyone and it is not the wish to prevent that from happening. However, the expectation is that everyone do the econometrics, it is not meant to have one person estimate all of the regressions, then everyone else copy from that person. In addition, there should be **absolutely no working together** in the generation of the written documents, graphs, etc., that you will hand in for grades. The expectation is that each student separately interpret the results and write their own homework assignments and reports.