Syllabus for Economics 671, PhD Econometrics I
Fall 2015, version 1.4
Gray Calhoun

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OH	Tu, Th 11–11:40	Tu 2–3, Th 1–2

Table 1: Instructor and TA contact information. You may also contact us to set up appointments outside scheduled office hours.

Welcome to Econ 671! This class has three goals. You are going to study and learn fundamental techniques in econometrics and statistics so that you can use them in your future research. You are also going to learn some of the basic theoretical concepts in econometrics so that you can understand new techniques when you encounter them in future classes and later in your career. And, finally, you are going to learn how to use a computer to do statistical and econometric analysis.

If you have questions about the course material, the best times to address them are in the scheduled class meetings or during office hours. We can probably resolve questions or concerns about the course administration over email but if you have urgent questions please call me or stop by my office.

1 Textbooks and software

The main (required) textbooks for this class are [Ram93] and [Hay00].[1] [Ram93] covers the first half of the course (basic probability and statistics) and [Hay00] covers the theoretical foundations for the second half of the course (linear regression). [Hay00] will also be the main textbook for Econ 672 in the spring. By the end of this semester, you are essentially responsible for the first nine chapters of [Ram93], the first two chapters of [Hay00], and much of [IW09].[2] I have also assigned some papers and notes that will help you understand empirical research strategies; they are available through the course webpage. The course *Reading Guide* has a short overview of the different readings.

[1] There is a bibliography with full citations at the end of the syllabus.

[2] [Ram93] covers linear regression as well but its treatment is pretty dated. There is some regression material that [Ram93] covers and [Hay00] does not but we will cover that additional material in class.

I strongly recommend that you buy and read this class's optional books. [Fre09] is a very critical overview of regression analysis in social science and reading it will probably help your research more than any other book. The other recommended book, [Tho11], will be useful in your coursework and research but is not directly tied to this class's material.

You are also going to start to learn computer programming in this class.[3] You are required to use R, a specialized language that's designed for statistical analysis, for class assignments and the TA will teach R in some of the Friday discussion sessions.[4] [Tee11] is a useful reference book for R and I've required it for this course. You are expected to bring it to class meetings as reference material. There are many other excellent introductions to R; one advantage of this one is that it is organized by task, so it is relatively easy to look up information as you need it.

[3] [Hea13] makes some general suggestions on setting up a computer for research that largely match my own advice.

[4] R can be downloaded for free from http://www.r-project.org.

1.1 Assumed background knowledge

This class assumes that you have taken an undergraduate statistics and econometrics sequence. If you haven't, please talk to me immediately so we can come up with a plan together. But you should at least read [FPP07] (very basic probability and statistics) and [Tuf74] (simple regression and empirical research) ASAP and you are *especially* encouraged to read [Fre09] early in the semester. You may also find [Woo12] to be a useful resource. Old editions of these books should be fine.

1.2 An aside about your professional development

You should already be thinking about completing your dissertation and finding a job but we will not have time to cover these topics in this class.[5] (We barely have enough time to cover econometrics.) I would *strongly* suggest that you buy and read [Tho11], [Caw14], and [Kel15] very soon and follow their advice. [Tho11] gives an overview of graduate school in economics and also discusses writing research papers, preparing presentations, and reviewing papers. [Caw14] presents a very detailed guide to the academic job market in economics. And [Kel15] gives advice for academic job searches in general.[6] You should also prepare a very basic professional webpage and a Curriculum Vitae.[7] Your CV is not expected to be very long at this stage of your career but writing it and continuing to add to it throughout grad school is a very good habit.[8] At the very least, develop the five year plan suggested by [Kel15].[9]

[5] I know that graduation is at least 5 years away. But academic jobs are tough to get and you are sacrificing 5 years of salary and work experience to get a Ph.D. Make sure that you do everything possible to make it worthwhile.

[6] You should also read Karen Kelsky's blog for more advice, http://theprofessorisin.com.

[7] A single webpage at http://www.econ.iastate.edu/~yourname/index.html with a link to a pdf of your CV is fine for now. And a *professional* website should be a *bland* website. Express your personality and creativity somewhere else. There is more advice at https://chroniclevitae.com/news/1027-how-to-tailor-your-online-image.

[8] Karen Kelsky has written an excellent guide for writing a CV, which is included in [Kel15] but is also available on her blog at http://theprofessorisin.com/2012/01/12/dr-karens-rules-of-the-academic-cv. I've written a LaTeX template that tries to follow her advice and you are welcome to use it: https://github.com/grayclhn/safecv.

[9] The five year plan is also described at http://theprofessorisin.com/2014/05/02/why-you-need-a-5-year-plan.

2 Grading[10]

This course uses the *Team-Based Learning* (TBL) instructional strategy, which is probably different from instruction styles you've had before. Most of the content is covered individually with read-

[10] This section borrows heavily from [Mic01].

Topic	RAT	Reading
Probability theory (weeks 1–3)	9/01	[Ram93] 2–3
Sampling and asymptotics (4, 5)	9/15	[Ram93] 5–7
Estimation and inference (6–8)	9/29	[Ram93] 8, 9
Finite sample OLS (9, 10)	10/20	[Hay00] 1
Regression asymptotics (11, 12)	11/03	[Hay00] 2
Causal inference (14–15)	12/03	[IW09], [Rub08]
Other events	Dates	
Practice peer evaluation	10/20	
Extended regression application	11/17–11/20	
Thanksgiving break	11/23–11/27	
Final exam	Fri. 12/18	7:30a–9:30

Table 2: List of major units and required reading for the class. There is a bibliography with full citations at the end of the syllabus. The individual chapters and articles are available on on the course homepage (or on Google). Notice that the schedule changes quite a bit in weeks 13–15.

ings and short problems completed outside of class. Most of the activities and projects, which would conventionally be done as out-of-class homework and group projects, are done in teams during class.

The course is split into six units of material, which are listed in Table 2. There will be six short multiple-choice *Readiness-Assurance Tests* (RATs) at the **beginning** of each unit of material; these will be taken as individuals first, then as a team. The lowest individual score will be dropped (to accommodate emergencies or illness) but all of the team scores are counted. The RATs will test you on the reading assignments but are designed to establish a baseline level of understanding so that the team activities will be productive. You will not be expected to master the material until we have finished the unit. The course *Reading Guide* spells out in detail my expectations for what you will learn from the reading.

There will also be several graded team activities during each unit, as well as an individual final exam. For team tests and projects, all members of the team will receive the same score. The "extended regression application" is an in-class team activity as well.

Scores in three areas will determine the grades: *Individual Performance*, *Team Performance* and constructive behavior as determined by *Peer Evaluations*.

2.1 Setting grade weights

Representatives from each team will set the percentage of the course grade that will be determined by scores in each of the major

Component	Weight	Min. (%)	Max. (%)
INDIVIDUAL PERFORMANCE	____	20	60
Individual RATs	____	20	80
Final exam	____	20	80
TEAM PERFORMANCE	____	20	60
Team RATs	30%		
Team projects	70%		
PEER EVALUATIONS	____	20	60

Table 3: Possible weights for each component of the course grades — the specific weights will be determined by the class as described in the syllabus. The three components of "individual performance" must add up to 100%, with a minimum weight of 20% on each exam and on the overall individual RAT scores. The weights of the three main performance areas (in bold) must also add up to 100% and must each be at least 20%.

performance areas during the first class period. Team representatives will also decide on the relative weight of the Readiness Assurance Tests and the exams within the Individual Performance area.

Grade weights will be set for the class using the following procedures:

1. Each team will set preliminary weights and select a member to meet with other teams' representatives.
2. Team representatives will meet in the center of the room and develop a consensus (i.e., every representative has to be in agreement) about the grade weights for the class as a whole.
3. The only limitations on your grade weight decisions are listed in the table:
   (a) A minimum of 20% of the total grade must be assigned to each major performance area.
   (b) Within the individual performance area, at least 20% of the grade must be based on the final exam and at least 20% must be based on the total of the individual RATs.

Table 3 summarizes these rules and provides space to enter the weights after you negotiate.

2.2 Team activities and homework

Every member of a team will get the same score for in-class team activities. I will also typically assign homework that prepares you for the activity or builds on a concept introduced in class. These homework assignments will not be graded but are required;

and your teammates are strongly encouraged to use "homework preparation" as a factor in assigning peer evaluation grades. Some of this material has been used in past years but you will learn the most in this class if you do the work yourselves. *You are not allowed to use material from previous years for team activities, homework, or any other component of this course, unless I provide it to you. Using this material will be considered cheating.* If you are not sure whether or not you are allowed to use a particular external reference, you must ask me before you use it.

2.3 Final exam

The final exam will have a mixture of questions taken from the textbooks and that build on the in-class activities. This is a substantially different approach to the final exam than I've used in the past, so please do not use previous exams as a study guide for this year's test.

2.4 Peer evaluations

Each individual will rate the contributions all of the other members of their teams during the final exam. Individual Peer Evaluation scores will be the average of the points they receive from the members of their team. Assuming arbitrarily that: (1) constructive behavior is worth 10 points, and (2) that there six members in a team, an example of this procedure would be as follows:

Each individual must assign a total of 50 points to the other five members in their team. Raters must differentiate some scores in their ratings (This means that each rater would have to give at least one score of 11 or higher, with a maximum of 15, and at least one score of 9 or lower, with a minimum of 5). The Team Maintenance scores will produce differences in grades only within teams. As a result, team-members can't help everyone in their team get an A by giving them a high peer evaluation scores. The only way for everyone in a team to earn an A is by doing an outstanding job on the individual exams and team exams and projects.

2.5 Determination of final grades

The final grades will be determined as follows:

1. A raw total score will be computed for each student in each major performance area. (In the Individual Performance area, this will be a weighted combination of the sum of the five highest individual Readiness Assurance Test scores and the final exam

Topic	Date	Topic	Date
Probability review session	8/28	Regression in R	10/23
Introduction to R	9/04	*Asymptotics for regression review*	10/30
Sampling and asymptotics review	9/11	More R programming	11/06
Git and GitLab	9/18	TBD	11/13
Estimation and inference review	9/25	*Regular class meeting*	11/20
Graphics and reports in R	10/02	*Review of causal inference and modeling*	12/01
Data management	10/09	*Regular class meeting*	12/04
Finite-sample regression review	10/16	*Final exam review*	12/11

Table 4: Tentative list of topics covered during Friday review session. Classes that are *emphasized* will be held in the regular classroom; the rest will be held in the computer lab.

score; in the Team Performance area, this will be the sum of the scores on each of the graded team assignments; and the Team Maintenance score will be the average of the peer evaluations received from the other members of his or her team.)

2. Students' total scores will be computed by multiplying the raw scores in each area by the grade "weight" set by the class (see above).

3. Course grades will be based on each student's standing in the overall distribution of total individual scores within the class. The actual impact of any score on an individual student's final grade depends on both his or her actual score and also how high or low he or she scores relative to other members of the class. The conventional practice of 90% is an A, 80% is a B, etc. simply does not apply.

3 Friday lab sessions

We'll do two things with the Friday review sessions. Students in the past have asked for an opportunity to review the assigned reading before taking the RATs, so the TA will lead a reading-review session before each unit. Those sessions are meant primarily to answer your questions about the material, so please prepare questions in advance. We will use the remaining meetings to learn programming and some aspects of software development.[11]

The schedule will change in weeks 13–15 to accommodate two extended regression application exercises. (This is the week before Thanksgiving break through the rest of the semester.) We will have the review session for the Causal inference section on the Tuesday after Thanksgiving Break and will use the Friday session for regular class meetings.

A tentative plan for all of these sessions is listed in Table 4.

[11] These meetings are loosely based on the curriculum described by [Wil06] and available at at http://wwww.softwarecarpentry.org. Also see [WAB+14] for a summary of their advice.

4 License and copyright

5 University policies

The following policies apply to *every* course at Iowa State University. They are listed here for your convenience and reference.

5.1 Academic dishonesty

The class will follow Iowa State University's policy on academic dishonesty. Anyone suspected of academic dishonesty will be reported to the Dean of Students Office, http://www.dso.iastate.edu/ja/academic/misconduct.html.

5.2 Disability accommodation

This material can be provided to you in alternative format. Anyone who anticipates difficulties with the content or format of the course due to a physical or learning disability should see me immediately in order to work out a plan. You may also want to contact the Disability Resources (DR) office, located on the main floor of the Student Services Building, Room 1076 or call them at 515-294-7220.

5.3 Dead week

For academic programs, the last week of classes is considered to be a normal week in the semester except that in developing their syllabi faculty shall consider the following guidelines:

- Mandatory final examinations in any course may not be given during Dead Week except for laboratory courses and for those classes meeting once a week only and for which there is no contact during the normal final exam week. Take home final exams and small quizzes are generally acceptable. (For example, quizzes worth no more than 10 percent of the final grade and/or that cover no more than one-fourth of assigned reading material in the course could be given.)
- Major course assignments should be assigned prior to Dead Week (major assignments include major research papers,

projects, etc.). Any modifications to assignments should be made in a timely fashion to give students adequate time to complete the assignments.

- Major course assignments should be due no later than the Friday prior to Dead Week. Exceptions include class presentations by students, semester-long projects such as a design project in lieu of a final, and extensions of the deadline requested by students.

5.4 Harassment and discrimination

Iowa State University strives to maintain our campus as a place of work and study for faculty, staff, and students that is free of all forms of prohibited discrimination and harassment based upon race, ethnicity, sex (including sexual assault), pregnancy, color, religion, national origin, physical or mental disability, age, marital status, sexual orientation, gender identity, genetic information, or status as a U.S. veteran. Any student who has concerns about such behavior should contact his/her instructor, Student Assistance at 515-294-1020, or the Office of Equal Opportunity and Compliance at 515-294-7612.

5.5 Religious accommodation

If an academic or work requirement conflicts with your religious practices and/or observances, you may request reasonable accommodations. Your request must be in writing, and your instructor or supervisor will review the request. You or your instructor may also seek assistance from the Dean of Students Office or the Office of Equal Opportunity and Compliance.

5.6 Contact information

If you feel that any of your rights as a student have been violated, please email academicissues@iastate.edu.

References

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[Fre09] David A. Freedman. *Statistical Models: Theory and Practice*. Cambridge University Press, revised edition, 2009. Recommended textbook.

[Hay00] Fumio Hayashi. *Econometrics*. Princeton University Press, 2000. Required textbook.

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[Kel15] Karen Kelsky. *The Professor is In. The Essential Guide to Turning Your Ph.D. into a Job*. Three Rivers Press, 2015.

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[Ram93] Ramu Ramanathan. *Statistical Methods in Econometrics*. Academic Press, 1993. Required textbook.

[Rub08] Donald B. Rubin. For objective causal inference, design trumps analysis. *Annals of Applied Statistics*, 2(3):808–840, 2008.

[Tee11] Paul Teetor. *R Cookbook*. O'Reilly, 2011. Required textbook.

[Tho11] William Thomson. *A Guide for the Young Economist*. MIT Press, 2nd edition, 2011. Recommended textbook.

[Tuf74] Edward R. Tufte. *Data Analysis for Politics and Policy*. Prentice-Hall, 1974. Available as an ebook from http://www.edwardtufte.com/tufte/ebooks for $2.

[WAB+14] Greg Wilson, D.A. Aruliah, C. Titus Brown, Neil P. Chue Hong, Matt Davis, Richard T. Guy, Steven H.D. Haddock, Katy Huff, Ian M. Mitchell, Mark D. Plumbley, Ben Waugh, Ethan P. White, and Paul Wilson. Best practices for scientific computing. *PLoS Biology*, 12(1):e1001745, 2014.

[Wil06] Greg Wilson. Software carpentry: Getting scientists to write better code by making them more productive. *Computing in Science & Engineering*, November–December 2006.

[Woo12] Jeffrey M. Wooldridge. *Introductory Econometrics: A Modern Approach*. Cengage Learning, 5th edition, 2012.