

## TENTATIVE COURSE SYLLABUS

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### 1. Resources

**Description from Course Catalog:** Regression and time series analysis. Specific topics include simple and multiple regression, multicollinearity; heteroscedasticity; diagnostics; forecasting with the regression model; binary and multiple-choice models; autocorrelation; random walks; ARIMA models; minimum mean-square-error forecasts and confidence intervals.

**Prerequisites:** STAT 040 and one of (STAT 072, STAT 130, or ACTS 135).

**Zimpleman Promises:** “Our graduates will be equipped with the technical skills, business acumen, empathy, and experience necessary to innovate and lead in a globally complex, diverse, and dynamic world. They will be (1) Proficient in their fields, (2) Data-driven, strategic, and innovative problem solvers, (3) Effective communicators, (4) Socially and ethically responsible leaders, and (5) Global and multicultural citizens.” This course addresses Promises (1) and (2).

**Lectures:** CRN 8904 meets Tuesday and Thursday 11:00-12:15 AM in Aliber 102.

#### How to contact instructor:

- Office: 319 Aliber Hall
- Telephone and voice mail: 271-3129
- Electronic mail: [william.boal@drake.edu](mailto:william.boal@drake.edu) (preferred)
- U.S. mail: Zimpleman College of Business, Drake University, 2507 University Avenue, Des Moines, Iowa 50311-4505

**Office hours:** Office hours are a time when you can get help with homework, ask questions about course material, and discuss your grade or anything related to this course or economics in general. Bring your slideshow handouts. My office hours this semester are **TBA**. If these hours are inconvenient due to schedule conflicts, please send email to schedule a special appointment and suggest some alternate times.

#### Resources to purchase:

- Required: Edward W. Frees, *Regression Modeling with Actuarial and Financial Applications*, Cambridge, Cambridge University Press, 2010, ISBN 978-0-521-13596-2 (paperback). Available for purchase at University Bookstore. (This course covers chapters 1-8.)
- Required: *Boal's STAT 170 Slideshow Handouts*, a course packet. Available for purchase at University Bookstore. Please bring it to class every day.
- Recommended: A three-ring binder and a highlighter for your course packet.

#### Online resources:

- Drake email. Course announcements will occasionally be sent to this account, so check it daily. Announcements often get diverted to “Junk” or “Clutter” folders, so check them as well as your inbox.
- Blackboard ([drake.blackboard.com](http://drake.blackboard.com)). Required online quizzes are posted here. If you have difficulty accessing Blackboard, please call the ITS HelpDesk at 271-3001.
- Course materials webpage ([wmboal.com/regress](http://wmboal.com/regress)). Instructor’s homework problems and old exams are posted here.

**Further reading:** There are many good textbooks on regression analysis. One of the best books at the undergraduate level is Jeffrey M. Wooldridge, *Introductory Econometrics: A Modern Approach*, 7<sup>th</sup> edition, Cengage, 2020, ISBN 9781337558860 (hardback). (Earlier editions are just as good, and often much cheaper.)

## 2. Requirements

**Course grade:** Each assignment is graded on a scale from zero to 100. Your overall course SCORE is calculated as a weighted average, using the following weights.

- 70% Exams.** There will be three in-class exams and a final examination. All exams are closed-book, closed-notes. Simple calculators are permitted, *but graphing calculators, calculators with alphabetical keyboards, wireless devices and mobile phones are not permitted.* The nature of the course material is cumulative, so exams may contain material from previous sections of the course. The final exam counts double and is required—students who do not take the final will not pass the course.
- 10% Project.** Each student will collect data and analyze it using regression. Report length should be about 3 pages, plus tables and graphs. See separate assignment sheet for details. A *required* template in Word format is posted on Blackboard.
- 10% Homework problems:** All problems are taken from the instructor's Problem Sets posted at [wmboal.com/regress](http://wmboal.com/regress). Three homework problems are due each time, but they are not to be turned in. Instead, one problem of the three will be given as a closed-book quiz at the beginning of class.
- 10% Slideshow quizzes.** After each topic is covered in class, a short quiz is due on Blackboard.
- 5% R labs.** A series of R labs will be done mostly in class but sometimes finished outside of class. Students must submit their R “sink” files on Blackboard for credit.

An overall course SCORE of 97 or above is required for an A+, 93 for an A, 90 for an A-, 87 for a B+, 83 for a B, 80 for a B-, 77 for a C+, 73 for a C, 70 for a C-, 67 for a D+, 63 for a D, and 60 for a D-. SCORES will not be rounded before awarding letter grades. Extra credit work is not available.

**Policy on absences:** Attendance is taken at every class. Students may miss up to three classes for any reason without penalty (except when exams are given). Thereafter, one point will be deducted from the course SCORE for each absence. Athletic team trips, documented by an official schedule sheet, will not be counted as absences.

**Policy on rescheduling exams:** If your own medical emergency, or a serious illness or death in your family requires you to miss an exam, you may be given a makeup exam. However, you must inform me of the emergency before the exam (e.g., by phone or email) and soon afterward submit a written explanation (including date of absence and documentation).

Certain other circumstances are acceptable reasons for rescheduling an exam. These include religious observance, medical appointment, interview trip, and athletic team trip. Because these circumstances can be predicted, you must send me an email request to reschedule, with an explanation, at least one week before the date of the exam. *Unacceptable* reasons include family vacation, ride leaving early for break, early plane flight, overslept, etc.

**Policy on grade corrections:** Accurate grading is important. If you find an error, please let me know as soon as possible. The deadline for regrading homework, problem sets, or midterm exams is the day of the final exam.

**Policy on computers and phones in class:** Computers, tablets, and phones must be turned off during class unless I specifically announce otherwise.

**Disability accommodation:** Any student who has a disability that substantially limits his or her ability to perform in this course under normal circumstances should contact Student Disability Services, 271-1835, to request accommodation. Any request must be received and approved at least one week before the necessary accommodation. All relevant information will be kept strictly confidential.

### How to succeed in this course:

- Attend every class.

- Read the textbook and online lecture notes before class.
- Study with pencil and paper. Try to reproduce any numerical examples and mathematical derivations while covering the page. Everything will make more sense if you work it through yourself.
- Prepare for exams by working old exams, posted at [wmboal.com/regress](http://wmboal.com/regress). Don't look at the answer key until *after* you have worked each problem, or you will become overconfident.
- If you are doing all this but not doing as well as you would like, please ask for help. Talk to me after class, send email to [william.boal@drake.edu](mailto:william.boal@drake.edu), or visit my office hours. I am eager to help!

**Policy on academic integrity:** The Zimpleman Academic Integrity Policy (<https://www.drake.edu/zimpleman/about/policies/>) applies to this course. The consequences of violating this policy vary, depending on my evaluation of the severity of the dishonesty. A violation (such as cheating, plagiarism, or fabrication) can result in a grade of zero on the test or assignment, an F for the course grade, or even expulsion from the university. Please read the policy and ask for clarification if necessary.

### 3. Schedule

Textbook and lecture notes should be read before lecture. If bad weather or an epidemic closes campus, most likely we will have class online.

Tentative dates are in [brackets].

#### Part 1: Introduction and review

##### A. Introduction [Aug 27, Aug 29]

- Bring these slideshow handouts to class: *What is regression analysis? Economic data sets. The summation operator. Derivatives of sums. Averages and weights. Definition of least squares. Alternatives to least squares.*
- Read Frees textbook, sections 1.1, 1.5, and 1.6.
- Take slideshow quiz on Blackboard by Sept 2.
- Do homework problems (1.6), (2.3), and (2.8) posted at [wmboal.com/regress](http://wmboal.com/regress), due Sept 3.

##### B. Probability review [Sept 3, Sept 5]

- Bring these slideshow handouts to class: *Random variables. Joint distributions. Expected value or mean. Variance and standard deviation. Covariance, correlation, and conditional expectation. The Bernoulli distribution. The normal distribution. Distributions related to the normal distribution.*
- Take slideshow quiz on Blackboard by Sept 6.
- Do homework problems (3.6), (4.3), and (5.7) posted at [wmboal.com/regress](http://wmboal.com/regress), due Sept 10.

##### C. Statistics review [Sept 10, Sept 12]

- Read Frees textbook, Appendix 1, “Basic Statistical Inference.”
- Bring these slideshow handouts to class: *Random samples and estimators. Exact finite-sample properties of estimators. Asymptotic properties of estimators. Asymptotic normality. Reliable principles for finding good estimators. Standard errors. Confidence intervals. Basic concepts of hypothesis tests. Testing the mean of a distribution. P-values.*
- Take slideshow quiz on Blackboard by Sept 13.
- No problem set. Instead, study for exam.

##### First exam [Sept 17]

- Prepare by studying slideshow handouts, old exams posted at [wmboal.com/regress](http://wmboal.com/regress), and recent problem sets.
- Exam seating is assigned, so please check the projector screen before you sit down.

## Part 2: Two-variable regression

### A. Algebraic properties of least squares [Sept 19]

- Bring these slideshow handouts to class: *Algebraic properties of least squares*.
- Read Frees textbook, section 2.1.
- Take slideshow quiz on Blackboard by Sept 20.
- Do homework problems (8.3), (8.6), and (8.8) posted at [wmboal.com/regress](http://wmboal.com/regress), due Sept 24.

### B. Properties of least-squares under Gauss-Markov assumptions [Sept 24, Sept 26]

- Read Frees textbook, sections 2.2, 2.3, 2.4, and 2.5.
- Bring these slideshow handouts to class: *Fundamental assumptions. Properties under fundamental assumptions. Additional useful assumptions. Properties under additional assumptions. Asymptotic confidence intervals and tests. Prediction with two-variable regression*.
- Take slideshow quiz on Blackboard by Sept 27.
- Do homework problems (9.5), (9.8), and (9.9) posted at [wmboal.com/regress](http://wmboal.com/regress), due Oct 1.

### C. Properties under normally-distributed error terms [Oct 1, Oct 3]

- Bring these slideshow handouts to class: *The assumption that the error terms are normally-distributed. Properties with normally-distributed error terms. Exact confidence intervals and tests. Prediction intervals. Summary of properties*.
- Take slideshow quiz on Blackboard by Oct 4.
- Do homework problems (10.1), (10.2), and (10.5) posted at [wmboal.com/regress](http://wmboal.com/regress), due Oct 8.

### D. Practical issues [Oct 8]

- Read Frees textbook, section 2.6.
- Bring these slideshow handouts to class: *Alternative functional forms. Influential observations*.
- Take slideshow quiz on Blackboard by Oct 9.
- No problem set. Instead, study for exam.

### Second exam [Oct 10]

- Prepare by studying slideshow handouts, old exams posted at [wmboal.com/regress](http://wmboal.com/regress), and recent homeworks.
- Exam seating is assigned, so please check the projector screen before you sit down.

- Enjoy Fall Break! [Oct 14-15]

### Part 3: Multiple regression with cross-sectional data

#### A. Algebraic properties with multiple regressors [Oct 17, Oct 22]

- Read Frees textbook, section 3.1.
- Bring these slideshow handouts to class: *Why include more regressors? Definition of least-squares with two regressors. Algebraic properties of least-squares with multiple regressors.  $R^2$  and adjusted  $R^2$ .*
- Take slideshow quiz on Blackboard by Oct 23.
- Do homework problems (12.1), (12.3), and (12.8) posted at [wmboal.com/regress](http://wmboal.com/regress), due Oct 24.

#### B. Properties under Gauss-Markov assumptions and normal error terms [Oct 24, Oct 29]

- Read Frees textbook, sections 3.2, 3.3, 3.4, 4.2, and 5.5 (skip matrix algebra on pp. 75-76, 79-80, and 114-115).
- Bring these slideshow handouts to class: *Fundamental assumptions and resulting LS properties. Additional assumptions and resulting LS properties. The normality assumption and resulting LS properties. Prediction and prediction intervals with multiple regression. The analysis-of-variance (ANOVA) table. Multicollinearity. Testing hypotheses about coefficients.*
- Take slideshow quiz on Blackboard by Oct 30.
- Do homework problems (13.2), (13.4), and (13.5) posted at [wmboal.com/regress](http://wmboal.com/regress), due Oct 31.

#### C. Practical issues with multiple regressors [Oct 31, Nov 5]

- Read Frees textbook, sections 3.5, 4.1, 4.4, 5.1, 5.2, 5.4, 5.6, and 6.1.
- Bring these slideshow handouts to class: *Alternative functional forms. Dummy variables. Structural change. Influential observations. Selection of regressors for prediction. Selection of regressors for causal inference.*
- Take slideshow quiz on Blackboard by Nov 6.
- Do homework problems (14.1), (14.6 parts a & b only), and (14.9 part a only) posted at [wmboal.com/regress](http://wmboal.com/regress), due Nov 7.

#### D. Heteroskedasticity [Nov 7]

- Read Frees textbook, section 5.7.
- Bring these slideshow handouts to class: *Heteroskedasticity: definition and consequences. Testing for heteroskedasticity. Correcting for heteroskedasticity.*
- Take slideshow quiz on Blackboard by Nov 8.
- No problem set. Instead, study for exam.

#### Third exam [Nov 12]

- Prepare by studying slideshow handouts, old exams posted at [wmboal.com/regress](http://wmboal.com/regress), and recent homeworks.
- Exam seating is assigned, so please check the projector screen before you sit down.

#### Preliminary project presentations [Nov 14]

- Each student gets five minutes to present (clean) data and methodology for their project.
- Data: Bring a table of data definitions, a table of descriptive statistics
- Methodology: Show your proposed regression equation and state whether your goal is prediction or causal inference.
- Can be either hard copy (for document camera) or electronic (e.g., PowerPoint).

## Part 4: Univariate time series models

### A. Simple models of time series [Nov 19]

- Read Fries textbook, sections 7.1 and 7.2
- Bring these slideshow handouts to class: *Time series data and models. Time trends. Seasonality.*
- Take slideshow quiz on Blackboard by Nov 20.
- Do homework problems (17.3), (17.5), and (17.7) posted at [wmboal.com/regress](http://wmboal.com/regress), due Nov 21.

### B. Models allowing for serial correlation [Nov 21, Nov 26]

- Read Fries textbook, sections 8.1, 8.2, 8.3, and 8.4.
- Bring these slideshow handouts to class: *Stationary and weakly dependent processes. First-order moving average process. First-order autoregressive process. ARMA(p,q) process.*
- Take slideshow quiz on Blackboard by Dec 2.
- Do homework problems (18.1), (18.5), and (18.8) posted at [wmboal.com/regress](http://wmboal.com/regress), due Dec 3.
- Enjoy Thanksgiving Break! [Nov 27-29]

### C. Models allowing for nonstationarity [Dec 3]

- Read Fries textbook, sections 7.3, 7.4, 7.5, and 8.5.
- Bring these slideshow handouts to class: *Highly persistent time series. Random walks. ARIMA(p,d,q) process. Spurious regression.*
- Take slideshow quiz on Blackboard by Dec 4.
- No problem set. Instead, prepare for project presentations.

## Final project presentations [Dec 5]

- Each student gets five minutes to present data, methodology, and results.
- Bring a PowerPoint presentation, with one slide for each part of your project report and one slide for each table.

## Project report due [11:59 PM, Dec 6]

- Submit your report on Blackboard along with your R “sink” file. Make sure your report uses the template posted on Blackboard.

## Final Exam

The [Office of the Registrar](#) has scheduled the final exam for this course on **Tuesday, December 10 at 7:30 AM** in the regular classroom. The content of the final exam is comprehensive and includes questions from all parts of the course.

- Prepare by reviewing the exams you have already taken this semester, old final exams posted at [wmboal.com/regress](http://wmboal.com/regress), and recent homework problems.
- Exam seating is assigned, so please check the projector screen before you sit down.

[end of syllabus]