**Wayne State University - Department of Economics**
**ECO 5100 (001) 14233 - Introductory Statistics and Econometrics (Fall 2018)**

**Instructor:** Vitor Kamada
**Class**: MW, 2:30 - 04:10 pm in 201 STAT
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**Office hours:** MW, 4:10 – 5:40 pm, or by appointment.

## 1) Course Description

This course introduces several statistical and econometric methods that are frequently used in economic consulting and big corporations. An important emphasis is put on practical application and on the use of Python Computer Language to analyze real-world datasets. The first part of this course covers Probability and Statistics, the foundations for the second part of this course: Regression Analysis.

## 2) Learning Outcomes

The main goal of this course is to develop statistical and econometric reasoning. Econometric reasoning involves understanding the logic behind the econometric procedures and being able to fully interpret the results. Furthermore, after this course students will become proficient in using Python to perform a variety of statistical and econometric analysis, specially forecasting economic variables.

## 3) Required Textbook

Diez, D. M., Barr, C. D., Çetinkaya-Rundel, M. (2014). Introductory Statistics with Randomization and Simulation. Available for free at: https://www.openintro.org/stat/textbook.php?stat_book=isrs

Lifelines (2018). Survival Analysis Documentation available for free at: https://lifelines.readthedocs.io/

Quantopian (2018). Lectures available for free at: https://www.quantopian.com

Rey,S. J. and Arribas-Bel, D. (2018). Geographic Data Science with PySAL. Available for free at: http://darribas.org/gds_scipy16/

Sargent, T. J. and Stachurski, J. (2018). Lectures in Quantitative Economic. Available for free at: https://lectures.quantecon.org/py/

Sheppard, K. (2018). Introduction to Python for Econometrics, Statistics and Data Analysis. Available for free at: https://www.kevinsheppard.com/Python_for_Econometrics

## 4) Required Software

### 4.1) Anaconda Distribution

It is a free Python distribution that includes 1,000+ data science packages. Installing Anaconda is straightforward, download it at: https://www.anaconda.com/download/ . Inside Anaconda, we are going to use the Spyder, an integrated development environment (IDE) for scientific programming.

### 4.2) Quantopian

We can run Python code online at Quantopian website (https://www.quantopian.com). However, we cannot load external data or packages, that's why you must install Anaconda in your Laptop. The advantage of Quantopian is that we can perform econometric analysis in expensive proprietary data for free, but we cannot download the data. In Quantopian, for example, we can access Corporate Fundamental Data from Morningstar, and clean Twitter Trader Mood data from PsychSignal. Just few years ago, PhD students and business analysts used to dream with the possibility to access this type of data for free. Please, create a personal account at Quantopian, it is free.

## 5) Course Schedule

**Part I –Probability and Statistics, based on Diez et al. (2014)**

| Date | Topics/Key Concepts | Chapters |
|---|---|---|
| **Week 1**<br>**Aug 29** | **1) Probability**<br>Law of Large Numbers, Mutually Exclusive Outcomes, Probability Distributions, Independence, Conditional Probability, Marginal and Joint Probabilities. | A.1<br>A.2 |
| **Week 2**<br>**Sep 3** | **Labor Day** | |
| **Week 2**<br>**Sep 5** | **2) Random Variables**<br>Expectation, Variance, Standard Deviation, and Linear Combinations. | A.3 |
| **Week 3**<br>**Sep 10** | **3) Experiment**<br>Association vs Causation, Treatment and Control Group, Population and Sample, Random Sample, Bias, and Randomized Experiment. | 1 |
| **Week 3**<br>**Sep 12** | **4) Introduction to Data**<br>Mean, Variance, Standard Deviation, Scatterplots, Histograms, Box Plots, Quartiles, Median, Outliers, Contingency Tables, Bar Plots and Pie Chart. | 1 |
| **Week 4**<br>**Sep 17** | **5) Statistical Test**<br>Null Hypothesis, Alternative Hypothesis, p-value, Statistical Significance, Test Statistic, Type 1 Error, and Type 2 Error. | 2 and 3.1 |
| **Week 4**<br>**Sep 19** | **6) Normal Distribution**<br>Central Limit Theorem, Z score, Normal Probability, Standard Error (SE), Confidence Interval, and Margin of Error. | 2 |

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|---|---|---|
| **Week 5**<br>**Sep 24** | **7) t-distribution**<br>t-confidence Interval for the Mean, One Sample t-test, Paired t-test, Difference of Two Means. | 4 |
| **Week 5**<br>**Sep 26** | **8) Analysis of Variance (ANOVA)**<br>F-test, Mean Square Between Groups (MSG), and Mean Square Error (MSE). | 4 |

**Part 2 – Regression Analysis**

| Date | Topics/Reference |
|---|---|
| **Week 6**<br>**Oct 1** | **9) Linear Regression**<br>Quantopian (2018): Lecture 12 |
| **Week 6**<br>**Oct 3** | **10) Multiple Linear Regression**<br>Quantopian (2018): Lecture 15 |
| **Week 7**<br>**Oct 8** | **11) Violations of Regression Models**<br>Quantopian (2018): Lecture 16 |
| **Week 7**<br>**Oct 10** | **12) Model Misspecification**<br>Quantopian (2018): Lecture 17 |
| **Week 8**<br>**Oct 15** | **13) Residual Analysis -Heteroscedastic**<br>Quantopian (2018): Lecture 18 |
| **Week 8**<br>**Oct 17** | **14) Residual Analysis – Autocorrelation**<br>Quantopian (2018): Lecture 18 |
| **Week 9**<br>**Oct 22** | **15) Poisson Regression**<br>Sargent and Stachurski (2018): Ch 4.4 |
| **Week 9**<br>**Oct 24** | **16) Beta Hedging**<br>Quantopian (2018): Lecture 31 |
| **Week 10**<br>**Oct 29** | **17) Sentiment Analysis**<br>Quantopian (2018): Tutorial 1, 2, 3, and 4 |
| **Week 10**<br>**Oct 31** | **18) Estimation of Capital Asset Pricing Model**<br>Quantopian (2018): Lecture 30 |
| **Week 11**<br>**Nov 5** | **19) Integration, Cointegration, and Stationarity**<br>Quantopian (2018): Lecture 43 |
| **Week 11**<br>**Nov 7** | **20) Cointegrated Pairs Trading**<br>Quantopian (2018): Lecture 44 |
| **Week 12**<br>**Nov 12** | **21) Futures Contracts**<br>Quantopian (2018): Lecture 51 |
| **Week 12**<br>**Nov 14** | **22) Mean Reversion on Futures**<br>Quantopian (2018): Lecture 53 |
| **Week 13**<br>**Nov 19** | **23) Draft Empirical Report** |
| **Week 13**<br>**Nov 21** | **Holiday - No Classes** |

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| **Week 14**<br>**Nov 26** | **24) Introduction to Survival Analysis**<br>Lifelines (2018): Kaplan-Meier Survival Function and Hazard Rates |
| **Week 14**<br>**Nov 28** | **25) Survival Regression**<br>Lifelines (2018): Cox Proportional Hazard Model |
| **Week 15**<br>**Dec 3** | **26) Introduction to Spatial Econometrics**<br>LeSage (2008). Revue d'économie industrielle |
| **Week 15**<br>**Dec 5** | **27) Spatial Econometrics with PySAL**<br>Rey and Arribas-Bel (2018): Part I and II |
| **Week 16**<br>**Dec 10** | **Study Day** |
| **Week 16**<br>**Dec 12** | **Final Exam**<br>**Empirical Report** |

## 6) Grading

### 6.1) Your final grade will be assessed as follows:

| Assignment | Weight | Date |
|---|---|---|
| Surveys* | 1% | Wednesday, Sep 26 (at 4:00 pm) |
| Homework | 30% | Check on Canvas |
| Quizzes | 10% | Check on Canvas |
| Lab | 40% | Check on Canvas |
| Empirical Report | 19% | Wednesday, Dec 12 (at 4:00 pm) |
| Total | 100% | |

* You can answer the surveys "Demographics and Study Methodology" and "Early Course Evaluation" on Canvas.

**Grading Scale**

94+ = A
90+ = A-
87+ = B+
84+ = B
80+ = B-
77+ = C+
74+ = C
70+ = C-
67+ = D+
64+ = D
61+ = D-
Below 61 = F

### 6.2) Instructions for Surveys, Homework, Lab, and Empirical Report

Guidelines and detailed instructions about Surveys, Homework, Lab, Empirical Report are available on Canvas.

### 6.3) Makeup Policy for any Assignment

If you miss any Assignment, I will provide a makeup activity in the case of an excused and unavoidable absence. Then it is YOUR RESPONSIBILITY to provide satisfactory written documentation of an excused and unavoidable absence as soon as possible. For example, if you are ill – the accompanying doctor's note must say that you cannot (or could not) do the Homework or Lab. If the doctor's note does not state this clearly, your score will be zero.

## 7. Course Expectations

### 7.1) Clarifying Expectations

To succeed in this course, you'll need to invest a good amount of time and energy doing exercises outside the class time. If at any time you feel you're investing the required time and energy but aren't learning the material or improving your skills, contact me and I'll do my best to help you and to suggest additional resources and options. If you have questions or concerns that you believe can be handled via e-mail, feel free to contact me that way. If I cannot adequately respond to your question via e-mail, I'll ask you to come to my regular office hours or make an appointment.

### 7.2) Extra Credit

If you have more than 80% attendance, I will add 1 extra point (1%) to your final grade. If you have more than 90% attendance, I will add 2 extra points (2%) to your final grade.

### 7.3) Academic Integrity

Wayne State University aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Student Code of Conduct, please see https://doso.wayne.edu/conduct/codeofconduct.pdf. Students who commit or assist in committing dishonest acts are subject to sanctions described in the Student Code of Conduct.

### 7.4) Special Accommodations

If you have a documented disability that requires accommodations, you will need to register with Student Disability Services (SDS) for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TDD only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.