Wayne State University- Department of Economics
ECO 5100 Introductory Statistics and Econometrics (Winter 2018)

Instructor: Vitor Kamada
Class: MW, 8:30 - 10:10 am at 0116 MAIN
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Office hours: MW, 2:10 – 3:30 pm, after the lecture, and by appointment.

1) Course Description

This course introduces several statistical and econometric methods that are frequently used in economic consulting, big corporations, nonprofit organizations, academic research, etc. An important emphasis is put on practical application and on the use of statistical software (R) to analyze real-world datasets. The first part of this course covers the foundations of Probability and Statistics. This part was designed to maximize your learning of the second part of this course - Regression and Modern Statistical Methods. These tools/techniques are the minimum requirement to get a job as Econometrician or Data Scientist.

2) Learning Outcome

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 a professional statistical software (R) to perform a variety of statistical and econometric analysis, specially forecasting economic variables.

3) Textbooks

Colonescu, C. (2016). **Principles of Econometrics with R**. Available for free in the Author website: https://bookdown.org/ccolonescu/RPoE4/

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

James, G., Witten, D., Hastie, T., Tibshirani, R. (2017). **An Introduction to Statistical Learning with Applications in R.** Springer. Available for free in the Author website: http://www-bcf.usc.edu/~gareth/ISL/

4) Course Schedule

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

Date	Topics/Key Concepts	Chapters
Week 1 **Jan 8**	**1) Probability** Law of Large Numbers, Mutually Exclusive Outcomes, Probability Distributions, Independence, Conditional Probability, Marginal and Joint Probabilities.	A.1 A.2
Week 1 **Jan 10**	**2) Random Variables** Expectation, Variance, Standard Deviation, and Linear Combinations.	A.3
Week 2 **Jan 15**	**Holiday - University Closed**	
Week 2 **Jan 17**	**3) Experiment** Association vs Causation, Treatment and Control Group, Population and Sample, Random Sample, Bias, and Randomized Experiment.	1
Week 3 **Jan 22**	**4) Introduction to Data** Mean, Variance, Standard Deviation, Scatterplots, Histograms, Box Plots, Quartiles, Median, Outliers, Contingency Tables, Bar Plots and Pie Chart.	1
Week 3 **Jan 24**	**5) Statistical Test** Null Hypothesis, Alternative Hypothesis, p-value, Statistical Significance, Test Statistic, Type 1 Error, and Type 2 Error.	2 and 3.1
Week 4 **Jan 29**	**6) Normal Distribution** Central Limit Theorem, Z score, Normal Probability, Standard Error (SE), Confidence Interval, and Margin of Error.	2
Week 4 **Jan 31**	**7) t-distribution** t-confidence Interval for the Mean, One Sample t-test, Paired t-test, Difference of Two Means.	4
Week 5 **Feb 5**	**8) Analysis of Variance (ANOVA)** F-test, Mean Square Between Groups (MSG), Mean Square Error (MSE), and Bootstrapping.	4

Part 2 – Regression and Modern Statistical Methods, based on James et al. (2017)

Date	Topics	Chapters	
		Theory	**Lab**
Week 5 **Feb 7**	**9) Simple Linear Regression**	3.1	3.6.1, 3.6.2

Week 6 Feb 12	10) Multiple Linear Regression	3.2	3.6.3
Week 6 Feb 14	11) Other Considerations in the Regression Model	3.3	3.6.4, 3.6.5, 3.6.6
Week 7 Feb 19	12) Logistic Regression	4.3	4.6.1, 4.6.2
Week 7 Feb 21	13) Linear Discriminant Analysis	4.4	4.6.3, 4.6.4
Week 8 Feb 26	14) K-Nearest Neighbors	2.2.3, 3.5, 4.5	4.6.5, 4.6.6
Week 8 Feb 28	15) Cross-Validation	5.1	5.3.1, 5.3.2, 5.3.3
Week 9 Mar 5	16) Bootstrap	5.2	5.3.4
Week 9 Mar 7	17) Subset Selection	6.1	6.5
Week 10 Mar 12	**Holiday - No Classes**		
Week 10 Mar 14	**Holiday - No Classes**		
Week 11 Mar 19	18) Ridge Regression, and Least Absolute Shrinkage and Selection Operator (LASSO)	6.2	6.6
Week 11 Mar 21	19) Principal Components Regression, and Partial Least Squares	6.3	6.7
Week 12 Mar 26	20) Polynomial Regression, Step Functions, Basis Functions	7.1, 7.2, 7.3	7.8.1
Week 12 Mar 28	21) Regression Splines, Smoothing Splines, Local Regression	7.4, 7.5, 7.6	7.8.2
Week 13 Apr 2	22) Generalized Additive Models for Regression and Classification Problems	7.7	7.8.3
Week 13 Apr 4	23) The Basics of Decision Trees	8.1	8.3.1, 8.3.2
Week 14 Apr 9	24) Bagging, Random Forests, Boosting	8.2	8.3.3, 8.3.4
Week 14 Apr 11	25) Maximal Margin Classifier, and Support Vector Classifiers	9.1, 9.2	9.6.1
Week 15 Apr 16	26) Support Vector Machines (SVM)	9.3, 9.4	9.6.2, 9.6.3, 9.6.4
Week 15 Apr 18	27) Principal Components Analysis	10.2	10.4

Week 16 Apr 23	28) K-Means Clustering, and Hierarchical Clustering	10.3	10.5 10.6
Week 16 Apr 25	Final Deadline for Lab: 5:30 - 07:10 pm		

5) Grading

5.1) Your final grade will be assessed as follows:

Assignment	Weight	Date
Surveys*	1%	Monday, Feb 5 (at 4:00 pm)
Homework	25%	Check on Canvas
Lab	74%	Check on Canvas
Total	100%	

Grading Scale

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

5.2) Instructions for Surveys, Homework, Lab, and Final

Guidelines and detail instructions about Surveys, Homework, and Lab are available on Canvas.

5.3) 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.

6. Course Expectations

6.1) 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.

6.2) 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.

6.3) 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.

6.4) 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.