

MSPE Statistics Camp

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Office Hours: T and Th, 10:00-11:00 AM CDT (pending), and by appointment (e-mail).

Textbooks: I will base the lectures in the following three books:

1. Probability and Statistical Inference (9th edition), by Hogg, Tanis and Zimmerman (**HTZ**) (available online)
2. Essentials of Probability and Statistics for Engineers and Scientists, by Walpole, Myers, Myers, and Ye (**WMMY**) (available online)
3. Introductory Econometrics: A Modern Approach (any edition), by Wooldridge (**W**)

For the probability and statistics sections, I will use a mix of both **HTZ** and **WMMY**. They are both available online if you search on Google. If you wish to buy the books, I recommend choosing one of them only. **HTZ** tends to be a bit more formal in its definitions and requires a bit more mathematical comfort than **WMMY**. On the other hand **WMMY** provides more examples and gives more intuitive explanations to some concepts. I will try to use the formality of **HTZ** with the more intuitive examples and explanations of **WMMY**.

Helpful links: If you are experiencing difficulties in following the course, these additional resources may be of help to you.

1. Introduction to Statistics in Coursera (<https://www.coursera.org/learn/stanford-statistics>)
2. Introduction to Statistics (Stanford) <https://www.classcentral.com/course/udacity-intro-to-statistics-361>
3. Introduction to probability (Saylor) <https://www.mooc-list.com/course/introduction-probability-theory-saylororg>
4. Lecture Notes from MIT: (<https://ocw.mit.edu/courses/economics/14-30-introduction-to-statistical-methods-in-economics-spring-2009/lecture-notes/>)

Course overview: This course will recap concepts in probability, statistics, and econometrics. The contents of this course are a prerequisite for MSPE 503 - Quantitative Methods for Program Evaluation.

Course Structure: The course will not be graded— which is a great opportunity to work in groups, and get to know one another. You will be given an initial and a final test. The initial test will help me customize the course to the needs of the class (for example, we can skip some topics and cover others in more detail). I will also post suggested problem sets. These will not be graded but I will

be available to discuss them in office hours as needed. It is very important for you to solve these problems, by yourself or in groups.

The course will be entirely online and self-paced through the Canvas system. There are 5 weeks of planned content. Each week I will release a new set of materials and video lectures. You are expected to complete each week before advancing to the next one.

At the beginning of the course I will assign everyone into groups of 2-3 students. The purpose of these groups is to discuss course topics on Canvas and work on the problem sets together.

Course Outline:

Section 1: Probability

- 1 Basic probability theory
 - 1.1 Definition of probability and its properties (**HTZ** 1.1)
 - 1.2 Conditional probability, Bayes Rule (**HTZ** 1.3, 1.5)
 - 1.3 Independent events (**HTZ** 1.4)
- 2 Random variables and distributions of random variables (Expectations and Variance included)
 - 2.1 Discrete random variables
 - 2.1.1 Examples and definition of Probability Mass Function (**HTZ** 2.1)
 - 2.1.2 Expectation and Variance for discrete variables (**HTZ** 2.2, 2.3)
 - 2.1.3 Bernoulli and Binomial (**HTZ** 2.4)
 - 2.2 Continuous random variables
 - 2.2.1 Probability density functions and cumulative distribution functions (**HTZ** 3.1)
 - 2.2.2 Expectation and Variance for continuous variables (**HTZ** 3.1)
 - 2.2.3 Normal Distribution (**HTZ** 3.3)

Section 2: Inference

- 3 Random samples and Central Limit Theorem
 - 3.1 Independent samples (**HTZ** 5.3)
 - 3.1.1 Properties of expectations and variances for a random sample (**HTZ** 5.3)
 - 3.1.2 Properties when random variable follows Normal distribution (**HTZ** 5.5)
 - 3.2 Central Limit Theorem (no proof) (**HTZ** 5.6, 5.7)
- 4 Estimation/estimators and their distributions (standard errors, confidence intervals, etc.)
 - 4.1 Estimator properties: Unbiasedness, consistency, efficiency (**WMMY** 5.1, 5.2, 5.3, 5.4)
 - 4.2 Confidence Intervals (**WMMY** 5.1, 5.2, 5.3, 5.4)
- 5 Hypothesis testing (**WMMY** 6.1, 6.2, 6.3, 6.4)
 - 5.1 Null hypothesis, test statistics, Type 1 and 2 errors, significance level
 - 5.2 Tests about one mean: examples

Section 3: Econometrics

6 Linear regression/OLS

- 6.1 Population Model (**W** 2.1, 3.1)
- 6.2 Mean independence (**W** 2.1, 3.1)
- 6.3 OLS (**W** Chap 2.2, 2.3, 3.2)
- 6.4 Distribution of OLS estimator; Gauss-Markov (**W** 3.3, 3.4, 3.5, 5.1, 5.2, 5.3)
- 6.5 Inference in OLS (**W** 4.1, 4.2, 4.3, 4.4, 4.5)

7 Violations of the OLS assumptions

- 7.1 Omitted variable (**W** 3.3)
- 7.2 Heteroskedasticity and Robust Standard Errors (**W** 8.1, 8.2)
- 7.3 Measurement error and selection (**W** 9.4)
- 7.3 Examples of OLS failures

Course schedule:

Week	Section	Topic
1	1	Probability theory and discrete random variables
2	1; 2	Continuous random variables, random samples, Normal distribution and Central Limit Theorem
3	2	Estimation and estimators, maximum likelihood, confidence intervals, and hypothesis testing
4	3	Intro to econometrics: Assumptions, OLS, inference
5	3	Econometrics: Violations of assumptions and examples

Title IX:

Please access this website: <https://safe.rice.edu/contact-title-ix-coordinator>.

Accessibility and Accommodations

Your experience in this course is important to us! We strive to provide content that is accessible to all students. If you need course accommodations because of a documented disability that may affect academic performance, please communicate your approved accommodations to the course team at your earliest convenience so we can discuss your needs in this course. All discussions

will remain as confidential as possible. You may also contact us at riceonline@rice.edu for more information.

Any student with a disability requiring accommodations in this course is encouraged to contact me via email or in Zoom office hours. Additionally, students will need to contact Disability Support Service (Allen Center, Room 111 / adarice@rice.edu / x5841

Supporting Students During an Online Course If you are facing challenges during this online course that can impact learning and performance, then please let me know via email. An additional resource for support is The Rice Wellness and Counseling Center [Links to an external site.](#) available 24/7 at (713) 348-3311.