1 Contact information

My contact information is as follows:

- **E-mail**: federico.bugni@duke.edu
- **Homepage**: https://sites.duke.edu/federicobugni/
- **Office hours**: Fri 1 PM - 3 PM in Zoom: 994-9412-3527 (or, for students in a different time zone, by appointment).

The TAs of the course are:

- Usaid Awan, **E-mail**: muhammad.awan@duke.edu, **Office hours**: Mon 4 PM - 5 PM in Zoom: 926-4827-8041.
- Eric Little, **E-mail**: eric.j.little@duke.edu, **Office hours**: Wed 12:30 PM - 1:30 PM in Zoom: 524-964-2536.
- Neha Karna, **E-mail**: neha.karna@duke.edu, **Office hours**: Mon 9 AM - 10 AM in Zoom: 979-8026-2479.
- Carrie Wang, **E-mail**: cgw19@duke.edu, **Office hours**: Wed 5 PM - 6 PM in Zoom: 707-326-3547.
- Anna Ziff, **E-mail**: anna.ziff@duke.edu, **Office hours**: Tue 6 PM - 7 PM in Zoom: 965-9908-0574.

2 Class time and place

- **Lectures**: Mon, Wed 1:45 PM – 3 PM in Zoom: 956-6408-5205,
- **TA session #1 by Anna**: Thu 12 PM – 12:50 PM in Zoom: 950-1864-9712 (starts the week of August 20),
- **TA session #2 by Usaid**: Fri 10:15 AM – 11:05 AM in Zoom: 947-3261-5159 (starts the week of August 20),
3 Course Description

This course provides an introduction to probability and statistics for undergraduate students in economics, which is a necessary requirement for the undergraduate econometrics sequence. The course requires a basic knowledge of simple calculus. The course covers topics such as probability, random variables, distributions, expected values, estimation, hypothesis testing, small and large sample properties, and simple least squares regression.

4 Lectures

- If this is possible, I strongly recommend you to attend the lectures live. This will give you opportunity to ask questions and make comments. I will often turn to students in the audience with questions.
- All lectures will be recorded and later posted in Sakai.

5 References

- DeGroot and Schervish (2019), referred to as “DGS”.
- Rice (2007), referred to as “R”.
- Some parts of the references are a bit more advanced that necessary. The right level of the course is determined by the lectures and the problem sets.

6 Course grade

- The course grade is graded S/U, determined according to problem sets (30%), midterm exam (30%), and final exam (40%).
- Midterm exam: Wed September 30, 1:45 PM – 3 PM. Take home.
- Final exam: Fri November 20, 9 AM - 12 PM. Take home. Comprehensive, but with a natural bias towards the material covered after the midterm exam.
6.1 Important information about S/U graded courses during this fall

- The change for these courses is to a mandatory S/U grading basis, so no student in these S/U courses will be able to opt into receiving a letter grade.

- As a special provision of this decision, courses converted to S/U under this policy will satisfy the requirements of any major, minor or certificate program as well as T-Reqs and other requirements for graduation.

- Any S/U courses you take this fall will not count toward the number of S/Us allowable per year or upon graduation.

- S/U grades are not factored into your GPA, and will not count toward Latin Honors.

- No decision has been made in regards to S/U grading for Spring 2021, and any extension of this policy would follow further review by the Trinity Arts & Sciences Council this fall.

- Please note that this decision applies only to courses that originate in Trinity. It does not apply, for instance, to courses that originate in Pratt or Nicholas or Sanford. However, as noted above, the S/U grading basis will apply to courses that originate in Trinity and are cross-listed in other departments or schools.

6.2 Problems sets

- There will be a problem set (approximately) every week.

- The problem sets will be posted in Sakai.

- The problems sets will be discussed in TA sections. Solutions to the problems sets will be posted in Sakai after the TA sections are complete.

- You are encouraged to work on the problems sets in groups of at most 4 people. Please turn in one problem set per group, with all the group members clearly listed.

- There will be $N$ problem sets. The problem set grade is the average of your $N - 2$ best problems sets.

7 Overview of the course

1. Probability: definitions.

   - Topics: experiment, Sample space, event, review of set theory, probability: definition and axioms, properties of probability.

   - Readings: DGS 1.1-1.5, R 1.1-1.3.

2. Probability: computation in simple experiments.
• Topics: simple experiments, counting strategies, multiplication principle, permutations, and combinations.

• Readings: DGS 1.6-1.11, R 1.4.


• Topics: Conditional probability, multiplication rule, law of total probability, Bayes’ Rule, and independence.

• Readings: DGS 2, R 1.5-1.6

4. Random variables and their distribution.

• Topics: definition of random variable (RV), classification: discrete and continuous, support, probability mass function (PMF), probability distribution function (PDF), and cumulative distribution function (CDF).

• Readings: DGS 3.1-3.3, R 2.1-2.2. Also, Stock and Watson (2011, Chapter 2).

5. Multivariate random variables and their distributions.

• Topics: definition of Multivariate RV, joint distribution: joint PMF/PDF and joint CDF, marginal distribution, conditional distribution, independence.

• Readings: DGS 3.4-3.9, R 3.1-3.5. Also, Stock and Watson (2011, Chapter 2).

6. Moments of a random variable.

• Topics: expectation/expected value, expectation of a function of RVs, properties of expectations, variance, covariance, correlation. Also, Stock and Watson (2011, Chapter 2).

• Readings: DGS 4, R 4.

7. Selected probability distributions.

• Topics: Bernoulli: definition and properties, binomial: definition and properties, normal: definition, properties, calculating the CDF.

• Readings: DGS 5, R 6. Also, Stock and Watson (2011, Chapter 2).

8. Introduction to statistical inference.

• Topics: Statistical inference: definition, population distribution, sample, sample statistic, large sample inference and finite sample inference: advantages and limitations.

• Readings: DGS 7.1, 8.14, and R 7.

9. Main asymptotic results.

• Topics: Law of large numbers (LLN) and central limit theorem (CLT)
10. Estimators and their properties.
   - Topics: method of moments (MOM) and maximum likelihood estimator (MLE).
   - Readings: DGS 7.5-7.6, 8.1, and R 8.3-8.5. Also, Stock and Watson (2011, Chapter 3).

11. Hypothesis testing.
   - Topics: introduction, hypotheses, critical region, test statistics, power, types of error, p-value, confidence intervals.
   - Readings: DGS 8.5, 9, R 9.1-9.3. Also, Stock and Watson (2011, Chapter 3).

12. Simple linear regression.
   - Topics: introduction, derivation, properties.

References

