Mathematics - Preparatory Course
A.Y. 2023-2024 (Fall 2023)
Ph.D. in Business Administration and Management and Economics and Finance, Bocconi University

Course Description:

- The course, as the title suggests, is a preparatory mathematics course for the incoming Ph.D. students in accounting-economics-finance and business-administration-and-management programs. This course (and also the successor course, Introduction to Mathematics) aim at covering the standard mathematical tools that are required for subsequent Ph.D. courses. This preparatory course has three modules. First, we start with studying basic probability theory. As an application, we also study Bayes theorem in detail. Second, we move on to studying basics of calculus (differentiation and integration). Third, we study (static) optimization. (The successor course will cover calculus and optimization in more detail).

- The course will cover both abstract mathematics and applications to economics and finance. For core mathematical concepts whose conceptual or logical understanding is essential, the course materials (lectures and problem sets) are largely proof-based. In contrast, for certain topics when the emphasis of the course is for you to be able to use certain mathematical results correctly in applied settings, the focus during the course is to enable you to understand and use the results correctly as a user.

- The detailed syllabus (for example, with information on office hours) will be distributed at the course website.

Prerequisites: Undergraduate-level Set Theory, Calculus, Matrix/Linear Algebra, and Probability required for the social sciences

Instructor:

- Satoshi Fukuda (Department of Decision Sciences)

- Lecture and Office Hours: TBA

Course Outline (Tentative):

1. Basic Probability Theory

    - Probability Spaces; Random Variables; Conditional Probability; Bayes Theorem; Conditional Expectations

2. Calculus

- Differentiation: Derivatives and Partial Derivatives; Standard Techniques (Chain Rule, Differentiation of an Inverse Function, etc)

- Integration: Indefinite and Definite Integrals; Basic Examples; Fundamental Theorem of Calculus; Standard Integration Techniques (Integration-by-Parts and Integration by Substitution)

3. Introduction to Optimization

- Unconstrained Optimization
- Constrained Optimization: Lagrangian

Course materials and textbooks: There are no required textbooks for the course. The course material will draw from the lecture notes to be available at the course website. For those who would like to consult textbooks in addition to the lecture materials, a list of textbooks will be indicated in the lecture notes.

Grading: A combination of problem sets and final exam. Precise information will be announced.