E4113: Introduction to Mathematical Economics

Logistical Information

Classes: Tuesday and Thursday, 2:30 – 3:45 pm., Spring 2010, 255 Blegen Hall.
Instructor: David Rahman (dmr@umn.edu, econ.umn.edu/~dmr).
Office hours: Wednesday, 10:30 – 12:00 or by appointment, 4-147 Hanson Hall.
Prerequisites: Economics 3101, 3102, Mathematics 1271, 1272, 2243 or equivalent.
Students should know basic linear algebra, calculus, and reading/writing proofs.

Course Description

The purpose of this course is to introduce students to the mathematical language of
economics. Intuitively, economics is the study of how society organizes itself: why
people do what they do, why they give what they give, why they get what they get.
Formally, economists model behavior as the result of an optimization problem—be
it the behavior of an individual, an institution, or a society. Optimization is the key
idea that will be formalized in this course to build a framework for rigorous economic
reasoning. The course is divided into three parts: (i) linear programming, (ii) concave
programming, and (iii) economic applications.

Assessment

Two Midterms (in class): Thursday, Weeks 5 and 10.
Final exam: Saturday, May 15, 2010, 1:30 – 3:30 pm., 255 Blegen Hall.
Homework: Six problem sets distributed in class every two weeks, starting week 2.
Grading: A student's overall grade will be calculated according to the formula below.

$$\text{overall} \;=\; \tfrac{1}{2}\max\{\text{final}, \tfrac{1}{2}\,\text{final} + \tfrac{1}{2}\,\text{midterm average}\} + \tfrac{1}{2}\text{homework average}$$

Reading

Dixit, A. K., *Optimization in Economic Theory*, Oxford University Press.
Gale, D., *The Theory of Linear Economic Models*, University of Chicago Press.
Schrijver, A., *Theory of Linear and Integer Programming*, John Wiley and Sons.
Simon, C. P., and L. Blume, *Mathematics for Economists*, W. W. Norton & Co.
Vohra, R. V., *Advanced Mathematical Economics*, Routledge.

Tentative Outline

8. **Quasiconcave Programming**

   – Quasiconcave functions, necessary conditions for a maximum.

   – Sufficient conditions for a maximum.

   SPRING BREAK

9. **Kuhn-Tucker Theorem**

   – Corner solutions, equality vs. inequality constraints.

   – Constraint qualification, statement and proof of the theorem.

10. **Envelope Theorem**

    – Unconstrained and constrained, indirect utility, Slutsky equation.

    – *Second Midterm*, in class.

    Part III: Economic Applications

11. **Welfare Economics**

    – First welfare theorem with quasi-linear utility, core convergence.

    – Public goods and Lindahl pricing.

12. **Choice under Uncertainty**

    – Risk and risk aversion.

    – Portfolio choice, asset pricing.

13. **Optimization over Time**

    – From finite to infinite time horizon, discounting, present value.

    – Maximum principle.

14. **Dynamic Programming**

    – Bellman's equation.

    – Transversality, steady states.

15. **Information and Uncertainty**

    – Moral hazard in insurance markets.

    – Adverse selection.

Grading Standards and Academic Dishonesty

The Faculty Senate recommends that the following (or an equivalent) statement of grading standards be incorporated into every syllabus:

University Grading Standards

A: Achievement that is outstanding relative to the level necessary to meet course requirements.

B: Achievement that is significantly above the level necessary to meet course requirements.

C: Achievement that meets the course requirements in every respect.

D: Achievement that is worthy of credit even though it fails to meet fully the course requirements.

S: Achievement that is satisfactory, which is equivalent to a $C-$ or better (achievement required for an S is at the discretion of the instructor but may be no lower than a $C-$).

F (or N): Represents failure (or no credit) and signifies that the work was either (1) completed but at a level of achievement that is not worthy of credit or (2) was not completed and there was no agreement between the instructor and the student that the student would be awarded an I.

I (Incomplete): Assigned at the discretion of the instructor when, due to extraordinary circumstances, e.g., hospitalization, a student is prevented from completing the work of the course on time. Requires a written agreement between instructor and student.

Academic Dishonesty

Academic dishonesty in any portion of the academic work for a course shall be grounds for awarding a grade of F or N for the entire course.

Credits and Workload Expectations

For undergraduate courses, one credit is defined as equivalent to an average of three hours of learning effort per week (over a full semester) necessary for an average student to achieve an average grade in the course. For example, a student taking a three credit course that meets for three hours a week should expect to spend an additional six hours a week on coursework outside the classroom.