MATH 437 Game Theory

1. Catalog Description

MATH 437 Game Theory **4 units**

Prerequisite: MATH 206 or MATH 244, and MATH 248 with a grade of C- or better, or consent of instructor.

Development of the mathematical concepts, techniques, and models used to investigate optimal strategies in competitive situations; games in extensive, normal, and characteristic form, Nash equilibrium points and Nash Bargaining Model. 4 lectures.

2. Required Background or Experience

Math 206 or Math 244, and Math 248 with a grade of C- or better.

3. Learning Objectives

The student should:

a. Obtain an understanding of the types of mathematical models used to describe and study situations involving conflict and cooperation.
b. Know the connection that two-person zero-sum game theory has with duality in linear programming.
c. Be introduced to *n*-person games and utility theory.
d. Obtain an appreciation of the variety of techniques that one uses in studying these models, e.g. separation theorem, Brouwer fixed point theorem, graph theory, complementary pivot algorithms.

4. Texts and References

To be chosen by instructor. Suggested texts include:

- Ferbuson, T., Game Theory
- Binmore, K., Playing for Real
- Guillermo, Owen, Game Theory
- Jones, A.J., Game Theory: Mathematical Models of Conflict
- Straffin, Phillip D., Game Theory and Strategy

5. Minimum Student Materials

Paper, pencils and notebook.

6. Minimum University Facilities

Classroom with ample chalkboard space for class use.

7. Content and Method

a. Finite two-person zero sum games (matrix games)
   1. Introduction, examples, and the solution concept
   2. The equilibrium theorem and solving non-singular matrix games
   3. The Shapley Snow procedure (optional)
   4. Linear programming and the simplex algorithm specialized to matrix games
   5. Fictitious play

b. Other two-person zero sum games
   1. Games on the square
   2. Multistage and recursive games

c. Nonzero sum two-person games
   1. Nash equilibria and Pareto optimality
   2. The prisoners dilemma
   3. Evolutionarily stable strategies
   4. Cooperative games and the Nash bargaining scheme

d. N-person games
   1. Games in characteristic function form
   2. Solution concepts including the core, Shapley Value and Banzaf-Colman index
   3. Fair division

8. Methods of Assessment

Comprehensive final exam, mid-term exams or quizzes, homework.