

COMPUTER SCIENCE 471/MATHEMATICS 471

MATHEMATICAL MODELING

I. Introduction

A. Catalog Description

A study of the process of mathematical modeling as well as specific deterministic (both discrete and continuous) and stochastic models. Certain mathematical topics such as graph theory are developed as needed. Crosslisted as MATH 471. *Prerequisite: MATH 375 or permission of the instructor.* Offered every other Spring term; offered Spring 2007.

B. Objectives

The purpose of this course is two-fold. First and foremost it should expose a student to the process of building a mathematical model. This is not a process that can be described by a set of equations or a cookbook procedure. Rather, the ability to formulate mathematical models is one that is gained with exposure to many different models, and much practice in the art of model building. Therefore students should be presented with a wide variety of models, and should be encouraged to construct many themselves.

Secondly, in the course of analyzing situations and determining appropriate models, there is an opportunity to introduce many mathematical topics that may not appear in other more standard courses. Thus, the course should contain exposure to topics that have applicability to the model building process, yet have not been included in the rest of the curriculum.

C. Prerequisites

Students should be of upper division standing, and have taken Math 280, Math 290, and Math 375.

II. Topics

Instead of listing required topics and additional topics, a course may consist of a selection of topics listed below. It is possible to present a course with a bias towards either discrete, continuous, or probabilistic models; however, an attempt should be made to at least make a student aware of the different types of models.

1. The model building process. The axiomatic approach to modeling. The cyclic nature of model design.
2. Markov chain models.
3. Linear programming models.
4. Game theoretic models.
5. Graph theoretic models.
6. Models for growth processes.
7. Queueing theory.

III. Bibliography

- Edwards, D. & M. Hamson, Guide to Mathematical Modelling, CRC Press, 1990
- Giordano, F. & M. Weir, A First Course in Mathematical Modeling, Brooks-Cole, 1985
- Maki, D. & M. Thompson, Mathematical Models & Applications, Prentice-Hall, 1973
- Mesterton-Gibbons, M., A Concrete Approach to Mathematical Modelling, Addison Wesley, 1989
- Mesterton-Gibbons, M., An Introduction to Game-Theoretic Modelling, Addison Wesley, 1992
- Roberts, F., Discrete Mathematical Models, Prentice-Hall, 1976
- Ross, S., Introduction to Probability Models, Academic Press, 1985
- Wan, F. Y. M., Mathematical Models & Their Analysis, Harper & Row, 1989

IV. Requirements

Exams and homework exercises should be required. Also, it is possible that written reports on model building (models built by others, or models built by the student) may be required.