5/06

MATHEMATICS 471/COMPUTER SCIENCE 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 CSCI 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 Modeling, 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 Modeling, Addison Wesley, 1989

Mesterton-Gibbons, M. An Introduction to Game-Theoretic Modeling, Addison Wesley, 1992

Roberts, F., Discrete Mathematical Models, Prentice-Hall, 1976

Ross, S. Introduction to Probability Models, Academic Press, 1985

Shier, D. R. & K. T. Wallenius, Applied Mathematical Modeling A Multidisciplinary Approach, Chapman & Hall/CRC, 2000

Wan, F. Y. M., Mathematical Models & Their Analysis, Harper & Row, 1989

IV. Requirements

Exams and homework exercises or written reports on model building (models built by others, or models built by the student) may be used to assess student learning.