AUTOMATA, COMPUTABILITY AND FORMAL LANGUAGES
MATH/CSCI 4660/8666

1.0 Course Description

1.1 Overview of Content and Purpose: (3 hours) This course presents a sampling of several important areas of theoretical computer science. Definitions of formal models of computation and properties of such models, including Finite Automata and Turing machines. Definition and important properties of formal grammars and their languages. Introduction to the formal theories of computability and complexity.

1.2 For whom Intended: Basic results and techniques relating to formal models of computation should be introduced. Stress should be given to developing student skills in understanding rigorous definitions in computing environments and in determining their logical consequences. Strong emphasis should be placed on problem assignments and their evaluations.

1.3 Prerequisite: CSCI 2610 and MATH/CSCI 2030

2.0 Content and Organization

2.1 Topics:

1. Definition and properties of various finite state automata.
2. Regular languages and their properties.
3. Context free grammars and related classes of automata.
4. Turing machines and their elementary properties.
5. Decidability and undecidability results.
6. Introduction to computational complexity.

Graduate Component:
A more detailed and in depth coverage of the topics above as well as certain graduate-only topics drawn from:

a) Various complexity classes and their relationships
b) Additional models of computation such as Post Systems, Oracles, Cellular Automata
c) Probalistic and Parallel Computation
d) Randomness and Kolmogorov complexity
e) Circuit complexity and lower bounds issue

3.0 Teaching Methodology

3.1 Methods to be Used: The class will be presented in a lecture-discussion format. Graded homework exercises will play an important role in the learning experience.

4.0 Evaluation

4.1 Basis for Evaluating Student Performance: Grades will be based on examinations and on graded homework exercises. The specific weighing of these components is left to the individual instructor. Graduate students will be expected to solve exercises which require substantially more rigor and depth of knowledge.