

Course Outline for MATH 3681, Mathematical Programming

MATH 3681 Mathematical Programming (3 units)

Prerequisite: One of the following: MATH 206, MATH 244, [MATH 1151](#), or [MATH 2341](#); and one of the following: MATH 241, DATA/[MATH 1265](#) or [MATH 2263](#); and CSC 101 or [CSC 1001](#).

Symbolic and numerical mathematical algorithms. Recursive problem solving. Formulation of mathematical conjectures from data. Assessment of conjectures using generated data. 3 lectures. Formerly MATH 350.

Course Learning Objectives	
1	Perform standard computations and apply classical mathematical algorithms to problem solving.
2	Implement computations and algorithms in novel settings, including new mathematical concepts that arise.
3	Write iterative and recursive functions in a high-level programming language suitable for mathematics.
4	Produce static, dynamic and interactive visualizations to demonstrate mathematical ideas.
5	Design and implement experiments to form conjectures in a variety of mathematical areas.
6	Generate data to assess the validity of a mathematical conjecture.

Expanded Course Content

Textbooks, materials, and/or other resources
“Mathematica®: A Problem-Centered Approach”, by Roozbeh Hazrat.

Week	Readings	Topics of Discussion
1	Chapter 1	Basic functions. Mathematica as a calculator. Lists and Select.
2	Chapters 2 - 4	Structure of lists. Changing heads and list manipulation. Pure functions.
3	Chapters 5 - 6	Logic and sets. Sums and products.
4	Chapter 13	Graphics generation and manipulation.
5	Chapter 7	Loops. Looping commands. Fold, FoldList. Inner and Outer.

Week	Readings	Topics of Discussion
6	Chapter 8	Substitution and rules.
7	Chapter 9	Pattern matching.
8	None	Exam preparation. Written and code components.
9	Chapter 10	Functions with multiple definitions.
10	Chapter 11	Recursive functions. Memoization and optimization of runtime.
11	Chapter 12	Linear algebra. Vectors and matrices.
12	Chapter 14	Calculus. Differential equations. Symbolic manipulation and derivatives.
13	Instructor Notes	Complex analysis and visualization. Julia and Fatou sets.
14	Instructor Notes	Modern algebra. Structure and visualization of the symmetric group. Symbolic algebra.
15	None	Capstone project. Exploration of advanced topic by computer investigation. Formulation of conjectures.

Method of Assessment

The possible methods of assessment are written individual examinations, quizzes, in-class worksheets or presentations, projects, and homework. One or more midterms and a cumulative final exam are required.

Instructional Mode

The instructional mode for this class is face-to-face. This designation means that the essential academic standards of the course require in-class student engagement, and thus remote instruction is not appropriate.