MATH299M/CMSC389W Visualization through Mathematica

Spring 2020
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Time:	F 1:00 – 1:50 PM	**Place:**	EGR 3106

Course Page: See ELMS. ELMS will contain information on all assignments and projects, announcements, and the course discussion forum for any questions that may arise during the course.

Contacting Us: This STICs course has three instructors. The best way to contact us is through an ELMS message to all instructors so messages are available to all instructional staff. **Please avoid emailing us, except in a dire emergency.**

Furthermore, please reserve emailing Jason, the course advisor, for emergencies that we cannot solve. As we handle all lesson planning, lecturing, and grading, there's very little he can help you with; however, his email is provided anyway. We would like to thank him for his continuing support in dealing with the bureaucracy related running a STICs course.

Office Hours: Fixed and regular office hours are TBA. Questions can be directed towards the ELMS discussion page.

Prerequisites: MATH 141 – Calculus II, or equivalent.

Students who wish for this class to contribute towards his/her upper level CMSC elective requirements should register through CMSC389W; however, departmental permission is required.

Objectives: This course is designed to teach how to use the most common and useful features of Wolfram Mathematica; an extremely powerful technical computing system that can be used to model a wide range of problems. Students will also learn important techniques and styles that will equip them with a profound mastery of Mathematica. Plotting functions in several ways, making models that can be manipulated in real time by the user, and efficiently computing solutions to complicated equations are among the things we will cover. We will use these skills to model various structures in math, computer science and physics, and for the final project every student will pick something relative to their designated major (or interest otherwise) to model, whether that be in physics, math, engineering, economics, or anything else mathematical in nature. Over the course of learning these tools students will encounter mind-blowing examples of what Mathematica can do, seeing first-hand that creating models that can be manipulated in real time helps greatly in understanding the underlying symmetries and properties of a problem.

Course Materials: Documentation and all things Mathematica can be found at the Wolfram Language and System Documentation Center. As a UMD student, you have a free subscription to Wolfram Mathematica for Windows, MacOS, or Linux that you can download from TERPware.

Course Overview: The course will be composed of homeworks, models, projects, and one take home midterm exam. The weighting of grades will be as follows:

- Participation (11%)
- Homework (34%)
- Midterm Exam (10%)
- Midterm Project (10%)
- Final Project (35%)

The grading cutoffs will be as follows:

$$\cdots < 80 \leq B- < 83 \leq B < 87 \leq B+ < 90 \leq A- < 93 \leq A$$

Students who attain a grade greater than or equal to 95% and present their final project to the class will receive an A+.

Participation: Lectures are the lifeblood of *Visualization Through Mathematica* – your attendance is important for your own enrichment as well as because your participation will make the course richer for everyone else as well. If you must miss class for some reason send us an ELMS message ahead of time and we'll pardon your absence. There will be several participation quizzes on ELMS throughout the semester, the lowest three scores will be dropped.

Homework Assignments and Models: As this is a 1-credit STICs course, we do not expect you to spend more than one to two hours of your time per homework. However, we expect homeworks to be turned in in a timely manner. If, for any reason, you need an extension or need help on the homework, feel free to contact us ASAP. Homeworks will be turned in on ELMS as a `.nb` Mathematica notebook file. We will not accept email homework submissions.

The first three homework assignments are close-ended and are meant to help introduce you to using Mathematica including basic syntax, software use, and language constructs.

Following those homeworks will be open-ended homework models meant to allow you to explore Mathematica's cornerstone features and abilities as a tool for visualization. You will be asked to use the week's lecture topic to visualize some concept.

Midterms: The course will have two midterms consisting of a take-home exam and a project.

The take-home exam will be assigned one week in advance of its due date and will be based off of previous lessons and homeworks. It will test you on using basic Mathematica functionality.

The midterm project will ask you to revisit topics that you learned in a 100 or 200 level course and visualize it. For example, students who have taken MATH246 - Differential Equations may create a visualization related to the behavior of systems of differential equations, or students who have taken MATH240 - Linear Algebra may choose to create a visualization related to matrix transformations or eigenvalues and eigenvectors. Regardless, the project will be on a topic you already understand. Furthermore, said topic does not need to be from a class in the MATH or CMSC department; any department is fine.

Final Project: The last month students will be working on their Final Project. Each student will have their own topic of choice (We'll help you pick something that will be cool to model and relevant to your interests!). During our final exam slot instead of taking a final exam, we will be doing short presentations of volunteers' Final Projects! Volunteering to present will give you a 5% boost to your final project grade in the class and additionally make you eligible to earn an A+ in the class.

Important Dates:

Midterm Exam	March 6, 2020
Midterm Project	April 17, 2020
Final Project/Presentation	TBA

Tentative Course Schedule:

Wk	Date	Lesson	Assignments
1	Jan 31	Introductions	Assigned: Usage Agreement
2	Feb 7	Basics I: Cells, Syntax, Variables, Computation, and Functions	Due: Usage Agreement Assigned: HW 1: Basics
3	Feb 14	Basics II: Lists and Pure Functions	Due: HW 1 Assigned: HW 2: Lists
4	Feb 21	Plots and Manipulate I	Due: HW 2 Assigned: HW 3: Plots
5	Feb 28	2D Plots: List, Parametric, Polar, Region, Contour, and Complex Plots	Due: HW 3 Assigned: HW 4.1: Integrals or HW 4.2: Gravitation or HW 4.3: Waves
6	Mar 6	3D Plots: Plot3D, Contour, and Parametric Plots	Due: HW 4 Assigned: Midterm Exam
7	Mar 13	Misc. Topics I	Due: Midterm Exam Assigned: π Day EC Assigned: Enjoy break! (required)
X	Mar 20	No class	No class
8	Mar 27	Graphics: Points, Lines, Shapes, and Images	Assigned: Mandelbrot Set EC Assigned: HW 5: Baudhayana
9	Apr 3	Scripting: Conditionals, Loops, Blocks, and Modules	Due: HW 5 Assigned: HW 6.1 Numerical Analysis or HW 6.2 Sorting Assigned: Gaussian Elimination EC
10	Apr 10	Manipulate II: Dynamic, Locators, and Other Interaction	Due: HW 6 Assigned: HW 7: Locators Assigned: Midterm Project
11	Apr 17	Advanced Dynamic: Dynamic and Dynamic Module	Due: HW 7 Assigned: DIY Manipulate EC
12	Apr 24	Development & Precomputation: Import and Export	Due: Midterm Project Assigned: HW 8: Precomputation Assigned: Final Project Assigned: Final Project Topic
13	May 1	Evaluation Control: Delayed Assignment, Evaluate, and Hold	Due: HW 8 Due: Final Project Topic
14	May 8	Misc. Topics II	Work on Final Project
X	May 12	Last Day of Classes (Tuesday)	All extra credit assignments due

Course Policies: Students are allowed and encouraged to collaborate on all assignments except the Midterm Exam, Midterm Project, and Final Project. Each student must submit unique code for each assignment. At the bottom of each assignment you should list the names of the students you collaborated with. Copying another student's code is not permitted. The standard course policies apply. Finally, students must also fill out the Usage Agreement (uploaded on ELMS) regarding distribution of course materials.

Disclaimer: The syllabus and schedule are subject to change without notice.