Bridge To Mathematics

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Course Details

Description
This is a project based course designed as a 4 – 8 day (16 hour) course introducing students with little or no programing background to the basics of writing code with MATLAB. In this course, students will learn how to use MATLAB to analyze the basic structures of mathematics using the basic structures of programing. This course has been designed by North Eastern University for a STEM outreach program Bridge To Calculus.
A partial list of topics:
Mathematical topics: *plotting functions, polynomial factorization, coordinate geometry, finite sums and products, the Fibonacci sequence, probability, multivariable functions, random walks, differentiation, integration, waves.*
Programing topics: *Variables and lists, plots and their properties, functions, for loops, conditional statements, logical operands.*
As a project based curriculum, when new programing structures are introduced student will be expected to immediately write code using the new structure to solve a problem. For this reason, it is necessary that each student have access to a computer for the duration of the course. At the end of the course, students work in teams on projects that apply their new programing skills to mathematical problems ranging from trigonometry to waveform analysis to calculus. These projects are then presented to the class.

Learning Objectives

In this course students will learn how to use MATLAB to

- Create scripts and functions.
- Create plots from vectors of discrete points.
- Plot functions.
- Use loops to compute finite sums and products.
- Use loops to draw many geometric objects.

- Understand the use and syntax of for loops and if-then statements.
- Use MATLAB to explore a math problem of their choice.

Prerequisites

- Assume knowledge of basic algebra and geometry
- Little to no prior programming background

Original Course Documents and Description
Instructor Guide: This document is a verbose guide to programing in MATLAB for the instructor. It can be studied by those little or no programing knowledge. It roughly covers the course curriculum, although in more depth. It may be optionally shared with the students, with exercise assignable as homework.
Section 9 includes guides for final projects, although students should be encouraged to develop their own questions and projects or explore any subject they found interesting.

Handouts Day 1/Day 2: These documents are handouts for the students to use to follow along in the lab-lectures. The instructor can follow the text of these worksheets, implementing the included code over a projector. When an exercise is reached, the instructor should pause to let the students solve the problem at their own machine. After students have had enough time to try to implement the code (dependent on the particular group of students) the instructor can present all arrived at solutions to the class.
Project Grading Rubric: An evaluation for students project presentations. In their presentations, students should describe what the project was trying to do, how the code they implemented achieved the project goals, and what problems, if any, did they encounter. *(The last part is very important: almost any project a student comes up with will be far out of the scope of what can be achieved in the allotted time. However, by understanding how to redefine the scope of a project student learn about what kind of problems can be solved with a computer.)*
Solutions: These are solutions to the exercises for the Day 1/Day 2 worksheets. They are not meant to be the only, or even the best, solutions to any of the problems and should not be given to the students

Course Contents

Day 1

- Plots and Loops

Day 2

- Conditionals, Probability, Functions

Project

Project Details
Students prepare projects to present based on the concepts they have learnt so far. Handout Day 2 list some project ideas and Example Projects lists actual student projects.