
Math 4610 Table of Contents for Lectures by Topic:

The topics listed below form the content for lectures in the class. The course will start with the first topic and will move through each topic in order. The idea is to go through as many topics as possible. If a topic is not needed, it can be skipped or maybe come back during a later lecture. The topics are self-contained. There is no set number of topics that can/will be covered in a single lecture. For example, during the first class it is likely that three or four topics will be covered based on the instructor and how many questions are being asked. The contents will likely change from semester to semester. So, the guide for this course is the table of contents listed here.

1. Introductory Comments: This course presents fundamental content from numerical methods/analysis....
2. The Syllabus for Math 4610 Fundamentals of Numerical Analysis: This course presents fundamental topics and algorithms that are common to many areas of computational mathematics....
3. Github Account: You will create a repository with a specific name. The name will be

`math4610`

4. Building a Github Repository for Math 4610: You will learn how to build a repository on Github that will be used to turn in your homework and projects.
5. Using a Terminal: It will be imperative that you are able to work in a terminal. There are a number of applications that can be used to bring up a terminal running a Linux/Unix operating system or an emulator. A few of these are PowerShell, Cygwin/MinGW terminals, Bash on Windows.
6. A Few Shell Commands: A brief primer on how to use commands in a terminal are necessary.
7. A coding example in C and Fortran: This example will show you how to use a command line terminal to write, compile, and execute a program.
8. How to Build Shared Libraries: Reuse of code requires a way to store and link to the code.
9. Testing the Library:
10. Using git to work locally: Having a repository on Github is great. However, to work locally, git, will let you work locally and easily transfer files to/from your repositories.
11. Taylor Series Review: In an initial course in numerical analysis, Taylor series are used in the evaluation of accuracy.
12. Compiling and Executing Computer Programs:
13. Creating a Shared Library:
14. Linking to a Shared Library:
15. An Example of Arithmetic Accuracy - Approximating the Value of a Derivative: We will analyze the approximation of a first derivative with a finite difference quotient.
16. Taylor Series Analysis of the Difference Quotient:
17. Testing the Difference Quotient Example: We will write a code to test the difference quotient approximation.
18. An Introduction to the Root Finding Problem:

19. The Intermediate Value Theorem for Continuous Functions:
 20. The Bisection Method: A simple application of the Intermediate Value Theorem results in a root finding method.
 21. A Recursive Definition for the Bisection Method:
 22. Rewriting the Bisection Method for Efficiency:
 23. Truncation Error: A definition of truncation error is
 24. Roundoff Error:
 25. Absolute and Relative Error:
 26. Examples of Roundoff Error in Real Life: Roundoff error can accumulate in computationally intensive algorithms.
 27. Solving a linear system using Gaussian Elimination and Roundoff Error:
 28. Truncation Error vs. Roundoff Error in the Finite Difference Approximation:
 29. Bounds on Error: Interval Analysis and Accumulation of Roundoff Error:
 30. Stable Algorithms and Computation: related topic involves selecting “stable” algorithms for solution of real problems. Stable algorithms are less sensitive to accumulation of errors.
 31. FLOPS:
 32. Efficiency of an Algorithm: Counting the number of computations in the execution of an algorithm.
 33. Tradeoffs between Accuracy and Efficiency:
 34. Number of Operations for Bisection:
 35. Newton’s Method for Finding Roots:
 36. The Secant Method:
 37. Review of Linear Systems: Gaussian Elimination:
 38. Review of Linear Systems: Back Substitution:
 39. Direct Methods versus Iterative Methods for Solving Linear Systems:
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