

Assignment Topics

Here are some potential assignment topics based on the course content:

****Error Analysis****

1. Investigate the effects of floating-point arithmetic on the accuracy of numerical computations. Provide examples and discuss mitigation strategies.
2. Compare and contrast the sources of error in numerical computations, including truncation errors, round-off errors, and cancellation errors.

****Nonlinear Equations****

1. Implement the bisection method to find the roots of a given nonlinear equation. Compare its efficiency with other root-finding methods.
2. Develop a program to solve a nonlinear equation using the fixed point iteration method. Analyze the convergence behavior.
3. Compare the Newton-Raphson method with the secant method for solving nonlinear equations. Discuss their advantages and disadvantages.

****Interpolation and Polynomial Approximation****

1. Use Lagrange interpolation to approximate a function at a given point. Compare the results with Newton's interpolation method.
2. Develop a program to implement forward, backward, and centered difference formulae for interpolation.
3. Investigate the application of polynomial approximation in curve fitting. Use a real-world example to illustrate the process.

****Numerical Differentiation****

1. Implement forward, backward, and central difference formulae to approximate the derivative of a given function.
2. Use numerical differentiation to find the maximum or minimum of a function. Analyze the results and discuss the impact of step size.

****Numerical Integration****

1. Implement the rectangular rule, trapezoidal rule, Simpson's 1/3 rule, and Simpson's 3/8 rule to approximate the integral of a function.
2. Use numerical integration to solve a real-world problem, such as calculating the area under a curve or the volume of a solid.

****Numerical Solution of Linear Equations****

1. Implement the Jacobi method to solve a system of linear equations. Analyze the convergence of the method.
2. Compare the Gauss-Seidel method with the Jacobi method for solving a system of linear equations. Discuss their convergence rates.
3. Use numerical methods to solve a system of linear equations and analyze the effects of round-off errors on the solution.

These topics should provide a good starting point for assignments that cover the key concepts in the course.