M439 Numerical Analysis Review Guide for Final Exam Semester 102

This exam is an open book, open notes (your own notes, own old tests, class handouts only). You will be able to use materials on the course web page, MATLAB, and your calculators. It will consist of problems to solve selected from the following types:

1. Given an approximate value and true value, determine relative error, absolute error, number of significant digits.
2. Perform fixed point iteration for a given function to find a fixed point. Determine whether a fixed point exists for a function.
3. Given a simple function f(x), and an interval containing a root
a) Compute iterations with the bisection method , false position method, Newton-Raphson, and or Secant methods, b) Give an error bound of method after n iterations.
4. Given a function a) calculate the Taylor polynomial of degree ____, at center ____ and determine an upper bound of the error in the approximation over a given interval.
5. Given a set of n+1 data points, compute the interpolating polynomial of degree n using Lagrange Interpolating Polynomial and/or the Newton Interpolating Polynomial Give the error bound E_n for your approximation.
6. Given a small set of data points
a) use the normal equations to find the least squares line, and calculate the Root Mean Square Error
b) find the power fit using equation (16), and calculate Root Mean Square
and/or
c) Fit some other curve (logistic, etc) using data linearization.
7. a) Using the Forward Difference formula or the Central Difference formula for numerical differentiation for a given set of values of a function or a function, numerically approximate its derivative at a particular point x.
b) Give an upper bound on the rounding error, truncation error, and total error in an approximation using Central Difference formula for a given value of h and the inherent round-off error of the computer/calculator used.
8. a) Apply either the composite Trapezoidal or Simpson numerical integration formulas to approximate the integral of a function over a given interval.
b) Given an upper bound on the error and/or estimate the step size and number of intervals required to get a given accuracy.
9. Solve a linear equation using LU decomposition.
10. Given a small matrix, reduce to to upper triangular form using no pivoting, partial pivoting, and/or scaled partial pivoting. Determine what the matrix L will be for in LU decomposition.
11. Use Euler's, Heun's and Runge Kutta method to numerically approximate solution to differential equation. Give an upper bound on the error.