Numerical Methods in Engineering Sciences
4/2/2021

Written Exam

First name: _____

Last name: _____

Student ID: _____

☐ I want to take the BASIC EXAM
☐ I want to take the ADVANCED EXAM

Exam rules:

- Basic exam: the maximum grade is 24/30.

- Advanced exam: the maximum grade is 30/30 cum laude.

Total time is 1 hour. Students who get a positive grade in the written part (i.e., at least 18/30) *might* choose to take an oral exam. For students who choose the basic written exam, the maximum grade obtainable can never exceed 24/30.

BASIC EXAM

1. Apply the Gaussian elimination method, without pivoting, to solve the linear system $Ax = b$, where

$$\begin{bmatrix} 3 & -2 & 4 \\ 2 & 2 & 2 \\ 1 & 1 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 5 \end{bmatrix}$$

showing the intermediate computations.

2. Write the pseudocode of the Newton method. Then, with initial guess $x_0 = 1$ apply one Newton iteration to the equation

$$(6x + 4)(x + 2) = 0$$

ADVANCED EXAM

3. Write the pseudo-code of the composite midpoint quadrature rule, then use the composite midpoint quadrature rule to compute an approximation of

$$\int_{-1}^{2} (t + 2t^2)\, dt$$

by splitting the integration interval $[-1, 2]$ into three subintervals. Report the intermediate computations.

4. Write the pseudo-code of the Jacobi method (for solving linear systems) and prove its convergence for diagonally dominant matrices.