Numerical Methods CSI 401/501 **Fall 2018: Assignment #3**

Due date: November 14, 2018

Instructions:

- Write your name and email address. If you are using more than one sheet of paper, make sure that you staple all the sheets together.
- Remember that collaboration of any kind is not allowed.

Total points = 10

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1. Calculate the LU factorization of the matrix

$$\mathbf{A} = \begin{bmatrix} 2 & 1 & -1 & -2 \\ 4 & 4 & 1 & 3 \\ -6 & -1 & 10 & 10 \\ -2 & 1 & 8 & 4 \end{bmatrix}$$

3points

2. To compute $\int_a^b f(x)dx$, let $S_n(f)$ denote the approximation using the Simpson's rule when n subdivisions are used (n is an even integer). Print a table of values of $S_n(f)$ for $n = 2, 4, 8, 16, 32, 64, 128, 256$ for the integral

$$\int_0^5 x^{\frac{5}{2}} dx = \frac{2}{7}$$

Also, print the errors (by comparing each $S_n(f)$ with the actual value $\frac{2}{7}$ of the integral) and also the ratios by which the errors decrease. (Hint: You may need to write a simple computer program or use a programmable calculator to do the computation but you need only to submit the output table and no need to submit the code.)

4 points

3. Find the solution of the nonlinear system:

$$x^2 + xy^3 = 9, \quad 3x^2y - y^3 = 4$$

using the Newton's method. (Hint: You may use the initial guess $(x_0, y_0) = (2.98, 0.15)$ and the stopping condition $|x_{k+1} - x_k| \leq 10^{-12}$ where x_k denotes the k th iteration; show that the method stops just after at most 4 iterations.)

3 points