CSU33081 Assignment 1

<u>Instructions</u>

- There are 10 Multiple Choice Questions in this assignment.
- Answer **ALL** questions by entering A, B, C, D or E on the **Answer Sheet** provided.
- Upload to Blackboard the filled out Answer Sheet with your **type written solutions as a .docx file**.
- **Submissions without worked solutions will receive zero marks.**

Q1.

What is the displayed result when the following MATLAB script file is executed?

```
x=[7:9; 6 12 19;-2:0];

y=x(3,:);

w=y(1,3);

size(w’)
```

Choose your answer from the following:

A. 3 1
B. 1 3
C. 3 3
D. 1 1
E. None of these

Q2.

How would we represent the summation of the following two polynomials in MATLAB?

$$6x^3 + 12x + 12$$

and

$$6x^2 + 12x$$

Choose your answer from the following:

A. [6 12 6]+[6 12]
B. [0 6 12]+[6 12 12]
C. [6 0 12 12]+[0 6 12 0]
D. [6 12 0 0]+[12 6 12 0]
E. None of these

Q3.

What is the displayed result when the following MATLAB script file is executed?

```
x=[7:9; 6 12 19;-2:0];

y=x(3,:);

w=y(1,3);

size(w')
```

Choose your answer from the following:

A. 3 1
B. 1 3
C. 3 3
D. 1 1
E. None of these

Q4.

Consider calculating an approximation to $\cos(1)$ using a Taylor polynomial $P_n(x)$ expanded about the point $a = 0$ for the function $\cos(x)$. What is the minimum degree of the Taylor Polynomial $P_n(x)$ which will ensure that $|\cos(1) - P_n(1)| \leq \epsilon$ where $\epsilon = 1.0 \times 10^{-5}$?

Choose your answer from the following:

A. 5
B. 6
C. 4
D. 3
E. None of these

Q5.

Consider applying the Bisection Method on the initial interval $[a, b] = [0.5, 2]$ with an accuracy of $\epsilon = 0.001$. What is the minimum number of iterations of the Bisection method that are needed to achieve this accuracy, that is, to ensure that $|\alpha - c_n| \leq 0.001$, where α is the root and c_n is the n^{th} approximation to the root generated by the Bisection Method.

Choose your answer from the following:

A. 9
B. 10
C. 11
D. 12
E. None of these

Q6.

Use Gauss Jordan elimination with pivoting to find the inverse of the matrix, A:

$$A = \begin{pmatrix} -1 & 1 & -4 \\ 2 & 2 & 1 \\ 3 & 3 & 2 \end{pmatrix}$$

The answer is to a best approximation:

A. $\begin{pmatrix} 0.5 & 1.75 & -1.0 \\ 0.5 & -1.25 & -1.0 \\ 0 & 0.75 & 0.5 \end{pmatrix}$

B. $\begin{pmatrix} -0.5 & 1.75 & -1.0 \\ 0.5 & -1.25 & 1.0 \\ 0 & -0.75 & 0.5 \end{pmatrix}$

C. $\begin{pmatrix} -0.5 & 1.75 & 1.0 \\ 0.5 & 1.25 & 1.0 \\ 0 & -0.75 & 1.5 \end{pmatrix}$

D. $\begin{pmatrix} 0.5 & 1.25 & -1.0 \\ 0.5 & -1.65 & -1.0 \\ 0 & -0.75 & 0.5 \end{pmatrix}$

E. None of these

Q7.

Solve the following matrix equation for $x = (x_1, x_2, x_3)^T$ using LU Decomposition.

$$\begin{pmatrix} 0 & 4 & 1 \\ 1 & 1 & 3 \\ 2 & -2 & 1 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 9 \\ 6 \\ -1 \end{pmatrix}$$

You should find the elements of L and U via a Gaussian elimination procedure with pivoting.

A. $x = (1,2,3)^T$
B. $x = (2,2,1)^T$
C. $x = (2,2,2)^T$
D. $x = (1,2,1)^T$
E. None of these

Q8.

Using $x_1 = 2, x_2 = 4, x_3 = 5$ as an initial guess at the solution, determine the values of x_1, x_2 and x_3 that result from three iterations of the Gauss-Seidel method applied to this matrix equation:

$$\begin{pmatrix} 1 & 8 & 6 \\ 7 & 3 & 1 \\ 6 & 7 & 12 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 6 \\ -8 \\ 2 \end{pmatrix}$$

Choose your answer from the following:

A. $x_1 = 5.6742, x_2 = -1.8777, x_3 = -6.7327$
B. $x_1 = 2.4692, x_2 = -7.8538, x_3 = 6.8319$
C. $x_1 = 5.7376, x_2 = 1.5482, x_3 = -6.8043$
D. $x_1 = 10.1148, x_2 = -3.8222, x_3 = -0.6111$
E. None of these

Q9.

Perform LU Decomposition on the following matrix A using Craut's Method and use the decomposition to find A^{-1}. What is A^{-1} to a best approximation?

$$A = \begin{pmatrix} 2 & 3 & -1 \\ 4 & 4 & -3 \\ -2 & 3 & -1 \end{pmatrix}$$

A. $\begin{pmatrix} 0.25 & 0 & -0.25 \\ 0.5 & -0.2 & -0.1 \\ -1 & -0.6 & -0.2 \end{pmatrix}$

B. $\begin{pmatrix} 0.25 & 0 & -0.25 \\ 0.5 & -0.2 & 0.1 \\ 1 & -0.6 & -0.2 \end{pmatrix}$

C. $\begin{pmatrix} -0.25 & 0 & -1 \\ -0.5 & 0.2 & -0.2 \\ -2 & -0.6 & 0.2 \end{pmatrix}$

D. $\begin{pmatrix} 0.25 & 0.3 & -1 \\ 0.5 & 0.2 & -0.1 \\ 1 & -0.6 & -0.2 \end{pmatrix}$

E. None of these

Q10.

Use Newton's Method with an initial guess (1,2) to find a solution to the following system of non-linear equations:

$$v - u^3 = 0$$
$$u^2 + v^2 - 1 = 0$$

Perform five iterations (initial estimation + 4 repetitions). The approximate value for the solution is:

A. $u = 0.8487, v = 0.5274$
B. $u = 0.8424, v = 0.5138$
C. $u = 0.9710, v = 0.5001$
D. $u = 0.8260, v = 0.5636$
E. None of these