CSU33081 Exam Paper 2020

Instructions

- There are 10 Multiple Choice Questions. Answer **ALL** questions by entering A, B, C, D or E where asked for an answer.
- You have 24 hours to complete the paper, type up the solutions and upload all documents to Blackboard.
- If you have a registered disability then you have 28 hours to do this.
- This is a 'Books-Open' exam. Use of the text(s) and notes is allowed.
- Use of non-programmable calculators is allowed.
- You may not use MATLAB or similar software for this examination.
- You must upload your typeset solutions along with the filled out Multiple Choice Questionnaire and a checked declaration that this is your own work to Blackboard.
- If you have a registered disability please check the declaration to that effect.
- **ALL** documents submitted should be .pdfs
- You will only receive marks for a question if your answer is accompanied with a bona-fide solution as above.

Please place an 'X' where appropriate:

I declare that my solutions for this exam are entirely my own work: **X**

I am submitting after the general deadline and I have a LENS report that confirms that I am entitled to the additional time I have taken:

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Comments:

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Q1.

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

$$2x^2 + 2x - 6$$

and

$$x^3 + 2x - 4$$

Choose your answer from the following:

A. [-6 2 2]+[-4 2 1]
B. [2 2 -6]+[1 2 4]
C. [0 2 2 -6]+[1 0 2 -4]
D. [2 2 -6]+[1 2 -4]
E. None of these

Answer: **C**

Q2.

What is the final value of the matrix A when the following MATLAB commands are executed?

```
A=eye(3,3);
for x=1:2:3
A(1,x)=1;
end
```

Choose your answer from the following:

A. $\begin{pmatrix} 1 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 1 \end{pmatrix}$

B. $\begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

C. $\begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix}$

D. $\begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$

E. None of these

Answer: **B**

Q3.

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

```
x=[6:8;-1:1;5 6 7];
y=x(:,3);
size(y')
```

Choose your answer from the following:

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

Answer: **C**

Q4.

Calculate the Truncation Error, $f(x) - P_2(x)$ at $x = 2.5$, in approximating the function $f(x) = 3 - 17x^3$.
For the approximation use the Taylor Series polynomial approximation of degree two, $P_2(x)$, expanded about the point $x_0 = 2.0$.

Choose your answer, to a best approximation, from the following:

A. -7.171875
B. -7.645227

C. -4.358405
D. -7.994173
E. None of these

Answer: **E**

Q5.

Use the Secant Method to find a root of the function

$$f(x) = 16x^5 - 73x^2 - 133$$

accurate to within an error of $\epsilon = x_n - x_{n-1} = 0.001$, where x_n is the value of x at the n^{th} iteration. Use starting points $x_0 = 3$ and $x_1 = 2.5$

Choose your answer, to a best approximation, from the following:

A. 0.982274
B. 0.342803
C. 1.900475
D. 1.513896
E. None of these

Answer: **C**

Q6.

Find the upper triangular matrix [U] in the [L][U] decomposition of the matrix given here:

$$\begin{pmatrix} 25 & 5 & 4 \\ 10 & 8 & 16 \\ 8 & 12 & 22 \end{pmatrix}$$

Choose your answer, to a best approximation, from the following:

A. $\begin{pmatrix} 1 & 0 & 0 \\ 0.4000 & 1 & 0 \\ 0.3200 & 1.7333 & 1 \end{pmatrix}$

B. $\begin{pmatrix} 25 & 5 & -4 \\ 0 & 6 & 14.400 \\ 0 & 0 & -4.2400 \end{pmatrix}$

C. $\begin{pmatrix} 25 & 5 & 4 \\ 0 & 6 & 14.400 \\ 0 & 0 & -4.2400 \end{pmatrix}$

D. $\begin{pmatrix} 25 & 5 & 4 \\ 0 & 8 & 16 \\ 0 & 0 & -2 \end{pmatrix}$

E. None of these

Answer: **C**

Q.7

Using $x_1 = 1, x_2 = 3, x_3 = 5$ 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:

$$\begin{pmatrix} 12 & 7 & 3 \\ 1 & 5 & 1 \\ 2 & 7 & -11 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 2 \\ -5 \\ 6 \end{pmatrix}$$

Choose your answer, to a best approximation, from the following:

A. $x_1 = -2.833, x_2 = -1.4333, x_3 = -1.9727$
B. $x_1 = 1.4959, x_2 = -0.90464, x_3 = -0.84914$
C. $x_1 = 0.90666, x_2 = -1.0115, x_3 = -1.0243$
D. $x_1 = 1.2148, x_2 = -0.72060, x_3 = -0.82451$
E. None of these

Answer: **C**

Q8.

Calculate the dominant eigenvalue and an associated eigenvector using the Power Method for the following matrix. Perform four iterations beginning with an initial estimate of $\begin{pmatrix}1\\1\end{pmatrix}$.

$$\begin{pmatrix}4 & 5\\6 & 5\end{pmatrix}$$

Choose your answer, to a best approximation, from the following:

A. 8.65, $\begin{pmatrix}0.785\\0.982\end{pmatrix}$

B. 6.85, $\begin{pmatrix}0.085\\0.981\end{pmatrix}$

C. 10.00, $\begin{pmatrix}0.833\\1.000\end{pmatrix}$

D. 8.65, $\begin{pmatrix}0.833\\0.982\end{pmatrix}$

E. None of these

Answer: **C**

Q9.

For the function $f(x) = x^2 \log_2(x)$ and the points $x_0 = 2$, $x_1 = 3$ and $x_2 = 7$ calculate Newton's second divided difference $f[x_2, x_1, x_0]$.

Choose your answer, to a best approximation, from the following:

A. 3.82975
B. 3.45287
C. 3.89453
D. 4.11185
E. None of these

Answer: **D**

Q10.

Evaluate the following integral using three-point Gaussian Quadrature:

$$\int_0^{2\pi} \frac{1}{2 + \cos x} \, dx$$

Choose your answer, to a best approximation, from the following:

A. 4.05745
B. 3.49066
C. 3.66519
D. 3.22703
E. None of these

Answer: **A**