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:

___

Comments: I’ve attached another file with all my workings as it’s easier to type them up in latex than in word, thank you.

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

It's a third-degree equation so a 0 gets put in where there's no value

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 – AN identity matrix is made using eye(), then replaces any 0 it lands on in the for loop with a start of 1, step of 2 and end of 3. Doesn't index into other rows.=, so only first row is affected.

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. Array

6	7	8
-1	0	1
5	6	7

Is created then the third column is taken and transposed using the " ' " modifier. The size then gives the dimensions of the array.

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. In solutions

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. In solutions pdf

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. In solutions

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 . In solutions

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. In solutions

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. In solutions

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. In solutions