XIAMEN UNIVERSITY MALAYSIA

ONLINE PRACTICAL TEST 2

Course Code:	BSC128/CST303*		
Course Name:	Numerical Methods		
Question Paper Setter:	Goh Chien Yong		
Academic Session:	2022/04	Question Paper:	A ☑ B ☐
Total No. of Pages:	1	Time Allocated:	1 hour 45 minutes
Additional Materials:	-		
Apparatus Allowed:	-		

INSTRUCTIONS TO CANDIDATES

1. This paper consists of 2 questions. Please answer ALL questions.
2. Please write programs by using MATLAB / Octave to complete the test. One program for each question.
3. The program MUST NOT a function code.
4. The program MUST NOT require for any input.
5. Indicate which software you are using in the first line of your code (as comment). Follow by student ID and Question number.
6. You need to copy all your codes, output results and images (if any) into single WORD file then save it as PDF-file. Use the given template.
7. Name your PDF-file as the format StudentID_CourseCode_PT2.pdf.
8. Name your M-files as the format StudentID_CourseCode_PT2_Q#.m.
9. Attached both the PDF-file and M-files of your code upon submission.
10. Communication between candidates in any means is forbidden. Answers must be entirely individual candidate's independent effort. If you are found sharing your solutions with other candidates, or suspected of doing so, you would be penalized accordingly.

Question 1 (20 marks)

Given the initial-value problem,

$$\frac{dy}{dx} = y - t^2 + 1, \qquad 0 \le t \le 2, \qquad y(0) = 0.5.$$

Use Runge-Kutta method of order four to approximate solution with

a) $h = 0.2$,

b) $h = 0.1$.

Compare the approximation with the exact values given by $y(t) = (t+1)^2 - 0.5e^t$.

Your output needs to display t_i, y_i, w_i and $|y_i - w_i|$.

Question 2 (30 marks)

a) Determine the LU factorization for matrix **A** in the linear system $\boldsymbol{AX} = \boldsymbol{b}$, where

$$\boldsymbol{A} = \begin{bmatrix} 1 & 1 & 0 & 3 \\ 2 & 1 & -1 & 1 \\ 3 & -1 & -1 & 2 \\ -1 & 2 & 3 & -1 \end{bmatrix}.$$

Your output needs to display both $\boldsymbol{L}$ and $\boldsymbol{U}$ matrices. [20]

b) Use the factorization in (a) to solve the system.

$$\begin{aligned} x_1 + x_2 + 3x_4 &= 8 \\ 2x_1 + x_2 - x_3 + x_4 &= 7 \\ 3x_1 - x_2 - x_3 + 2x_4 &= 14 \\ -x_1 + 2x_2 + 3x_3 - x_4 &= -7 \end{aligned}$$

Your output needs to display the vectors $\boldsymbol{Y}$ and $\boldsymbol{X}$, where $\boldsymbol{LY} = \boldsymbol{b}$ and $\boldsymbol{UX} = \boldsymbol{Y}$. [10]

- END OF PAPER -