MA2507 Computing Mathematics Laboratory: Mid-term test

Duration of the test: 12:00 - 1:45pm. Submission period: 1:45pm-1:50pm. Late submission will Not be marked. Submit PDF files produced by `publish` as attachments to Canvas.

MATLAB script files should start with a line like `%% Your name, student ID, and question number`. Figures should have a title generated by `title('your name, student ID, and question number')`.

Honesty Pledge:

I pledge that the answers in this examination are my own and that I will not seek or obtain an unfair advantage in producing these answers. Specifically,

(i). I will not plagiarize (copy without citation) from any source;

(ii). I will not communicate or attempt to communicate with any other person during the examination; neither will I give or attempt to give assistance to another student taking the examination;

(iii). I understand that any act of academic dishonesty can lead to disciplinary action.

Please write "I pledge to follow the Rules on Academic Honesty and understand that violations may lead to severe penalties" onto the first page.

1. (10 points).

$$C_1 = p(1+r)^n, C_2 = p * r * n.$$

Let $p = 10000$, $r = 5.25\%$, $n = 1, 2, 3, \cdots, 10$. Draw C_1 and C_2 against n using the **Subplot** command. (Do not use "for").

(Figures should have a title generated by `title('your name, student ID, and question number')`.)

2. (20 points). Let A be a 300×300 matrix and $\mathbf{s}$ be a column vector of length 300, given by

$$M = \begin{bmatrix} T & I & \mathbf{0} \\ I & T & I \\ \mathbf{0} & I & T \end{bmatrix}, \quad \mathbf{s} = \begin{bmatrix} \mathbf{s}_1 \\ \mathbf{s}_2 \\ \mathbf{s}_3 \end{bmatrix}$$

where I is the 100×100 identity matrix, T is a 100×100 matrix,

$$T = \begin{bmatrix} 1 & 1 & & & & & \\ 1 & 3 & 1 & & & & \\ & 1 & 5 & 1 & & & \\ & & 1 & \ddots & \ddots & & \\ & & & \ddots & \ddots & 1 & \\ & & & & 1 & 199 \end{bmatrix}, \quad \mathbf{s}_1 = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ \vdots \\ 100 \end{bmatrix}, \quad \mathbf{s}_2 = \begin{bmatrix} 1 \\ \frac{1}{2} \\ \frac{1}{3} \\ \frac{1}{4} \\ \vdots \\ \frac{1}{100} \end{bmatrix}, \quad \mathbf{s}_3 = \begin{bmatrix} 1 \\ 2^2 \\ 3^3 \\ 4^2 \\ \vdots \\ 100^2 \end{bmatrix}$$

Note that the diagonal elements of T are odd numbers.

Solve the linear system $M\mathbf{x} = \mathbf{s}$, and show the first five elements of $\mathbf{x}$.

3. (20 points). Given the following data points

x	0	1	2	3	4	5
y	0.2	0.221	0.244	0.270	0.298	0.330

Find the curve fit $\tilde{y} = f(x) = ae^{bx}$ based on least square approximation using the change of variables $X = x$, $Y = \ln(\tilde{y})$, to linearize the data points. (In matlab, ln is $\log(x)$).

(a). Show the results for a and b.

(b). Plot the curve fit and the data points given in the table on the same graph with x-label, y-label and title. Figures should have a title generated by `title('your name, student ID, and question number')`. You can use **hold on** to plot them in one graph.

4. (20 points). Write a function **quadsolver(a,b,c)** for solving a quadratic equation with coefficients a, b and c given by

$$ax^2 + bx + c = 0.$$

(a). In the program you need to perform the following tasks

(i) Check if a is zero (In matlab **==** means equal, i.e., a==0), then output "warning: a is zero". You can use **disp** command. **disp('warning: a is zero')**

(ii). Based on different conditions of a, b, c, display (use **disp** command) whether they have complex roots, distinct real roots and single real root. Then compute the roots based on the above conditions.

(b) Verify your program by inputting different set of values, i..e, $(a, b, c) = (1, 1, 1)$, $(a, b, c) = (1, -4, 4)$ and $(a, b, c) = (1, -5, 6)$ and output your solution.

====end of test