MATH1027

MATLAB

The University of Nottingham

School of Mathematical Sciences

A LEVEL 1 MODULE, AUTUMN 2019-2020

CALCULUS

COURSEWORK

Submission Deadline: 4pm December 20th 2019

Candidates' submission status will be recorded after collection, then all submission will be passed to relevant module convenor for marking.

Candidates' MATLAB scripts should be clearly set out, with comment statements.

To submit your coursework, please compress all the relevant files into a zip file.

Problem 1: [7 marks]

(a) Use `plot()` to plot $\sin(x)$ and $\cos(x)$ in two different figures, respectively. You should define x as 1,000 linearly spaced values between -2π and 2π:

- Fig. 1: $\sin(x)$ with black dotted line and line width of 2;
- Fig. 2: $\cos(x)$ with blue dash-dotted line and line width of 2;

You should also add a title, x- and y-axis labels for each of the figure and specify the tick value in terms of π. In addition, you should display the grid lines for the two plots and set the figure background color to white.

(b) Plot a 3-D surface of the function $f(x, y) = x \exp(-x^2 - y^2)$ with a contour plot underneath. You should specify the colors using a colormap and also add a title, x-, y- and z-axis labels for the plot. Set the figure background color to white.

(c) Download the 'drawLA', which is a draw toolbox for linear algebra, from Mathworks® File Exchange. Use `drawVector()` to draw two 3-D vectors:

$$\mathbf{a} = \begin{pmatrix} -2 \\ 0 \\ 1 \end{pmatrix}; \mathbf{b} = \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}$$

You should also add a title, x-, y- and z-axis labels for the plot and label the two vectors. Set the figure background color to white.

Problem 2: [7 marks]

Load the three M-files: `CSI300.mat`, `SSE.mat`, and `SZSE.mat`, which contain date (Column 1), stock return volatility (Column 2), and stock return (Column 3) of the CSI300 index,

Shanghai Stock Exchange (SSE) composite index and Shenzhen Stock Exchange (SZSE) component index.

(a) Use `subplot()` to create a figure with three stacked subplots and plot the stock returns of the three indices:

- Top row: CSI300 index with red dashed line;
- Middle row: SSE composite index with blue dash-dot line;
- Bottom row: SZSE component index with black solid line.

You should also add a title, x- and y-axis labels for each of the subplot. The font size of the titles needs to be 12. Format the tick labels of the x-axis with 4-digit years (i.e., 'yyyy') and then set the figure background color to white.

(b) Use `plot()` to create a figure which plots the stock return and stock return volatility of the CSI300 index with two y-axes. The color of the right y-axis should be black.

- Stock return: CSI300 index with blue solid line. Set the y-axis limits to range from 0 to 1.5.
- Stock return volatility: CSI300 index with red solid line. Set the y-axis limits to range from -1 to 1.

You should also add a title, a legend in the northwest area of the axes, x- and y-axis labels for the plot. The font size of the figure needs to be 24. Format the tick labels of the x-axis with 4-digit years and 2-digit month (i.e., 'yyyymm') and then set the figure background color to white.

Professional marks will be awarded for the format, style and structure of your answers. [1 marks]

END OF THE COURSEWORK