City University
School of Engineering and Mathematical Sciences
Common Part 1

ME1107 Computing

Coursework 4 – Matlab

Q1: In-class exercise questions in week commencing 23/3/09.
Q2: In-class exercise questions in week commencing 30/3/09.
Q3-6: Due date 6th April 2009

- Use a Word document to answer the questions, which should include all Matlab commands and the **graphic output and text output** of those Matlab commands. Save the Word document as CW4_your_name.doc.
- A hardcopy of CW4_your_name.doc should be submitted to Dr Yan before the 6th April 2009. Marking is based on the hardcopy submission.
- Softcopy submission on CitySpace should include the Word document, CW4_your_name.doc; and two Matlab programs, CW4Q5_your_name.m and CW4Q6_your_name.m. Softcopy submission is compulsory.

Q1 (20 marks) In-class exercises on '*calculator and matrix operations'* in week commencing 23/03/2009. No late submission will be accepted for this question.

Matlab stands for Matrix Laboratory. If you just need to do a few calculations it can be just as quick as a calculator, except that it will also do algebra and graphics. Unlike Fortran, which is a language and has to be compiled, built and then executed, Matlab is an interactive interpreter. You just type in one line and it does it straight away, typing out the answers on the next line.

Calculator

Log on to any of the machines in CG50. Use START- All programs- departmental software – engineering and science – MATLAB. You should find a window appearing with the prompt ' **>>** '. This means Matlab is waiting for input. Try typing **2+2** *enter* and see what happens. Try typing **area=pi*2.15^2** *enter* .

Try typing:-

```
format short
area = pi*3.7^2
format long
b=sin (0.4)
x=sqrt(4.0)
quit
```

Here we are using Matlab exactly like a calculator. Try the following functions:-

+, - , *, /, ^
sin, cos, log, tan
asin, acos, atan, exp

Exercises(10 marks): Write commands and results on paper and submit the paper before the end of the class

Use Matlab to evaluate:-

- $2^5/(2^5-1)$ and compare with $(1-1/2^5)^{-1}$
- Area=πr^2 with r= $\pi^{1/3}-1$
- e^3, $\ln(e^3)$
- solve $3^x=17$ (try x= ln(17)/ln(3))

Matrix Operations

Try following commands on the Matlab command window:-

- Create a 1-D matrix (1 row)
  t=linspace(t1,t2,N)
  x=linspace(0,20,100)
  x=linspace(0,2*pi,100)
  t = t1 : dt : t2
  x = 0 : 0.2 : 20
  x = 0 : pi/50 : 2*pi
  x = [1 5 6 9 7 1]
  x = [1, 5, 6, 9, 7, 1]
- Transpose 1 row to 1 column
  x = x'
- Create a 3x3 matrix
  x = [1 1 1; 1 2 3; 1 3 6]

Exercises (10 marks): Write the results of the following commands on paper and explain the answers you get. Are they what you expect from MATRIX algenbra?

```
>> x = [1 2 3]
>>y=[2; 1; 3;]
>>z = [ 2 1 0 ]
>>a = x + z
>>b= x + y
>>a=x.*z
>>b=2*a
>>x= linspace (0,10,5)
>> y=sin (x)
>>z= sqrt (x).*y
```

Q2 (10 marks) In-class exercises on '*graphs, script M-files and function M-files'* in week commencing 30/03/2009. No late submission will be accepted for this question.

Exercise1: A Script M-file is a list of MATLAB statements that are saved in a file. Open a new M-file; type in the following commands; save it as Circle.m; and use the 'save&run' button to execute the program. Demonstrate the execution of the program to a class tutor before the end of the class.

```
%circle – A script file to draw a unit circle
%File written by ….
% last modified on …
%--------------
theta = linspace (0,2*pi,100)
x=cos(theta)
y=sin(theta)
plot(x,y)
axis ('equal')
xlabel('x')
ylabel('y')
title ('Circle of unit radius by your name ')
```

next try

```
>>help circle
>>circle
```

Exercise2: A function M-file is a user-defined function. Now try

```
function [x,y] = circlefn(r);
%circlfn – function to draw circles
%call syntax: [x,y]=circlefn( r ); or just circlefn(r);
%inputs – r=radius
%outputs= [x,y] x and y cords of data points
theta=linspace(0,2*pi,100);      %create vector theata
x=r*cos(theta);                  %generate x coordinates
y=r*sin(theta);                  %generate y coordinates
plot(x,y)                        %plot the circle
axis('equal')                    %set equal scales on axis
title(['Circle of radius r=',num2str(r), '  drawn by your name'])
```

Save the file with name circlefn.m. Next try:-

```
>>R=5;
>>[x,y] = circlefn(R);
>>[cx,cy]=circlefn(2.5);
>>circlefn(1);
>>circlefn(R^2/(R+5*sin(R)) );
```

Q3-6: Use a Word document to answer question3-6, which should include all Matlab commands used and the **graphic output and text output** of those Matlab commands. Save the Word document as CW4_your_name.doc.

Q3 (20 marks) Create a matrix x, $x = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 3 & 6 \end{vmatrix}$

What are the results of x*x and x·*x? Use one number in each result matrix to explain how it is computed.

Q4 (20 marks) Create a matrix and prove it is a magic square. (Use the HELP menu and select GETTING STARTED. Work through the magic square tutorial) Calculate the inverse of the matrix.

Q5 (10 marks) Plot y = sin(x) and z = cos(x). Use an example to explain how to change line colour and style?

Save Matlab commands in an M-file: CW4Q5_your_name.m

Commands:

```
x= 0:pi/20:pi/2;
y= sin(x);
z= cos(x);
plot (x, y, 'r-*', x, z,'g--o')
legend ( 'sin(x)','cos(x)')
xlabel ('x'), ylabel('functions')
title ('plot created by your name')
```

Q6 (20 marks) Plot the graph of y=sin(x) and z=x·sin(x) for $0 \leq x \leq \tilde{\pi}$. Take 15 linearly spaced points in the given interval. Label the axes. Put 'Matlab course work created by your name' in the graph title. Two curves should be distinguished by using different colours, symbols or line styles.

Save Matlab commands in an M-file: CW4Q6_your_name.m