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UNIVERSITY OF NEW SOUTH WALES

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MATH2089 Numerical Methods

Class Test 1(Session 2, 2011)

Version 1B (Time allowed: 30 minutes)

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First name or initials:

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Mark:

Question 1 (2 marks)

In command window try the following operations in Matlab and explain your answers (one sentence of explanation per each operation will be sufficient).

(a)  $0.55 * 0.2 - 0.11$

(b)  $\text{floor}(3/1)$ ,  $\text{floor}(0.3/0.1)$   $\text{floor}(x)$  is the largest integer  $\leq x$ .

Hint: Check the value of  $(0.3/0.1)$  by using the command 'format long'.

Question 2 (2 marks)

(a) In command window create a row vector  $x$  of 101 equally spaced points on  $[-1, 1]$ .

(b) Then create a vector  $y = \ln(x^2) - 0.7$

Check the value for  $y(51)$ . What is the value? Give explanation. What is the value of  $y(52)$ ?

Question 3 (5marks)

For the equation  $x^2 - 2x - 5 = 0$

(a) Create a function M-file myfun.m to calculate  $f(x) = x^2 - 2x - 5$

(b) In command window create a vector  $x$  in the range  $[0, 5]$  and plot  $f(x)$ . Find the initial estimate  $x_0$  for the root of the equation by using a graphical method.

(c) In command window use built-in Matlab function  $\text{fzero}(\text{'myfun'}, x_0)$  to find the root of equation (1).

Write down your function myfun.m, all commands you used and final answer.

Question 4 (3 marks)

Solve in Matlab the system of equations

$$4x_1 - 2x_2 + x_3 = 11$$

$$x_1 + 5x_2 - 3x_3 = -6$$

$$2x_1 + 2x_2 + 5x_3 = 7$$

Write a script or in command window define your coefficient matrix,  $[A]$  and constant vector,  $\vec{b}$ . Then use backslash operator  $x = A \backslash b$  which denotes the solution to the matrix equation  $Ax = b$ .

Write down all commands you used and final answers.

1a  $0.55 * 0.2 - 0.11 = 1.3878 e^{-017}$ .

This occurs because 0.55, 0.2, and 0.11 cannot be represented in the form  $2^n$ . Therefore matlab approximates them using a sum, and leads to an incorrect answer.

b.  $\text{floor}(3/1) = 3$ ,  $\frac{3}{1} = 3$ ,  $\frac{0.3}{0.1} = 3.0000000000000000$ ,  $\text{floor}(\frac{0.3}{0.1}) = 2$ .

Same as above. 0.3 and 0.1 cannot be represented as  $2^n$ , and so matlab approximates them. This approximation is  $\neq 3$ , and hence the answer becomes 2. (2)

Question 2.

a.  $x = \text{linspace}(-1, 1, 101);$

b.  $y = \log(x.^2) - 0.7$  (2)

$y(52) = -8.524046010856290$

$y(51) = -\text{Inf}$ .

This occurs because in the vector  $x$ , the 51st/middle value is 0. Hence, Matlab evaluates  $\log(0^2)$  as  $-\text{Inf}$ .

Q37a.

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Q 3 a.

```
function [f] = myfun(a)
f = @(x) x.^2 - 2.*x - 5;
f(a)
```

```
fb.f = @(x) x.^2 - 2.*x - 5;
```

```
x = linspace(0, 5);
```

```
plot(f(x), x)
```

```
x0 = 3.5
```

C.  $f_{\text{zero}}(f, 3.5)$

(5)

ans = 3.4494891742783178.

Question 4.

$$A = \begin{bmatrix} 4 & -2 & 1 \\ 1 & 5 & -3 \\ 2 & 2 & 5 \end{bmatrix}$$

$$A = \begin{pmatrix} 4 & -2 & 1 \\ 1 & 5 & -3 \\ 2 & 2 & 5 \end{pmatrix}$$

$$b = [11; -6; 7]$$

$$b = \begin{pmatrix} 11 \\ -6 \\ 7 \end{pmatrix}$$

$$x = A \setminus b$$

$$x = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix}$$

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