FINAL EXAMINATION
FIRST SEMESTER SESSION 2011/2012

COURSE CODE / NAME : SQQM1053 MATHEMATICAL SOFTWARE AND ITS APPLICATION
DATE : 13 JANUARY 2012 (FRIDAY)
TIME : 9.00 – 11.30 A.M. (150 MINUTES)
VENUE : DSB K. TM

INSTRUCTION :
1. This exam paper contains NINE (9) questions in ELEVEN (11) printed pages, excluding the cover page.
2. Answer ALL QUESTIONS in spaces provided.
3. You are NOT ALLOWED to remove the exam paper from the examination hall.

MATRIC NO : ____________________________ (with word)

IDENTIFICATION CARD NO. : ____________ (with number)

LECTURER : ____________________________

GROUP : ________ TABLE NO. : __________

DO NOT OPEN THIS EXAMINATION PAPER UNTIL INSTRUCTED

CONFIDENTIAL
QUESTION 1 (7 MARKS)

a) Identify whether the following statements are **TRUE** or **FALSE**.

i) MATLAB prompt '>>' in command window indicates that the program is ready to receive instructions. ________________  (1 mark)

ii) The **workspace window** shows all global and local variables that are used in command window. ________________  (1 mark)

iii) MATLAB is a compiled language. ________________  (1 mark)

iv) The **Directory window only** shows M-file in a current directory. ____________  (1 mark)

b) Write a suitable **pseudocode** to compute the volume of rectangular box for a given length, width and height.  (3 marks)

QUESTION 2 (8 MARKS)

a) Given the following MATLAB command

```
>> A = [1 -4 7; 3 2 -6];
```

Find and show in matrix form the resulting matrices in each case.

i) $B=A(1,[1,3])$  (2 marks)
ii) \( C^t = A; \ C(2:\ \text{end}, :) = [ ] \)  

(2 marks)

b) The output of MATLAB command for polynomial operation is given as follows.

\[
\begin{align*}
>> f &= [2 \ 3 \ 4 \ 5 \ 1]; \ g = [-1 \ -2 \ -3]; \\
>> [q, r] &= \text{deconv}(f, g) \\
q &= -2 \  \ i \  \ 0 \\
r &= 0 \  0 \  0 \  8 \  1
\end{align*}
\]

Write the corresponding mathematical expression (in variable \( x \)) for the output.  
(2 marks)

c) Using the MATLAB command, \texttt{roots(2-2;2;1)} will return an error message \texttt{"Error: Unbalanced or unexpected parenthesis or bracket"}.  
Rewrite the command to get a correct answer.  
(2 marks)
QUESTION 3 (14 MARKS)

a) Given the following user-defined function:

\[
\text{function } [A, B] = \text{newstats}(u) \ % \text{Main function} \\
\quad n = \text{length}(u) \\
\quad A = \text{stat1}(u, n); \\
\quad B = \text{stat2}(u, n); \\
\text{return} \\
\text{function } a = \text{stat1}(v, n) \ % \text{Subfunction 1} \\
\quad \text{If total all elements in } v \text{ divide by number of element } \\
\quad a = \text{sum}(v)/n \\
\text{return} \\
\text{function } m = \text{stat2}(v, n) \ % \text{Subfunction 2} \\
\quad \text{If sort } v \text{ in increasing order} \\
\quad w = \text{sort}(v) \\
\quad \text{If rem}(n, 2) = 1 \ % n \text{ is odd} \\
\quad m = w((n+1)/2); \\
\quad \text{else} \ % n \text{ is even} \\
\quad m = (w(n/2) + w(n/2+1))/2; \\
\text{return} \\
\]

List the possible output in the command window for the MATLAB command,

\[
\text{>> } [vA, vB] = \text{newstats([2 2 -1 6 4 2])} \\
\]
b) Create a nested structure array namely DATA with fields NAME, MATRICNO, COLLEGE and CGPA. Under CGPA add two fields SEM1 and SEM2 for the following data using MATLAB command.

<table>
<thead>
<tr>
<th>Name</th>
<th>Matricno</th>
<th>College</th>
<th>CGPA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Semester 1</td>
</tr>
<tr>
<td>Salim</td>
<td>S123</td>
<td>PROTON</td>
<td>2.87</td>
</tr>
<tr>
<td>Jonny</td>
<td>S345</td>
<td>MAYBANK</td>
<td>3.5</td>
</tr>
<tr>
<td>Bakri</td>
<td>S567</td>
<td>MUAMALAT</td>
<td>3.7</td>
</tr>
</tbody>
</table>

(8 marks)

QUESTION 4 (14 MARKS)

a) Complete the following MATLAB script using the commands surf, xlabel, ylabel, zlabel, colormap, and title to plot the graph of parametric surface in red color given by

\[ x = u + 2; \ y = v^2; \ z = \sqrt{x^2 + y^2}. \]

% This is script to plot the parametric surface
[u, v] = meshgrid(0:0.1:2, 0:0.1:2)

(6 marks)
b) Write a MATLAB script using `plot`, `subplot` and `title` to display the following graphs. (Note that the value of x is increased by 0.1).

(8 marks)
QUESTION 5 (7 MARKS)

Write a MATLAB script to solve the following linear equations using Cramer's rule.

\[-x_1 + x_2 + 2x_3 = 2\]
\[3x_1 - x_2 + x_3 = 6\]
\[-x_1 + 3x_2 + 4x_3 = 4\]

QUESTION 6 (14 MARKS)

a) Determine the output for the following relational and logical operator.

(i) \[>> a = [1 \ 2 \ 3]; \ b = [3 \ 2 \ 1];\]
\[>> a \sim = b\]

(2 marks)

(ii) \[>> ([2 \ 3 \ 4] \ | \ [4 \ 3 \ 5]) \ & \ [0 \ 1 \ 2]\]

(2 marks)

(iii) \[>> A=[3 \ 2;1 \ 2;1 \ 4];\]
\[>> [r, c] = \text{find}(A \geq 3)\]

(2 marks)
b) Write a MATLAB script using `switch-case` construction, `input` and `sprintf` commands based on the following flowchart.

```
Request user input for value x from 1 to 5

Switch variable x

x = 1, 3, 5  
Yes

y = (x^2 + 2x + 1)^4  
Display y in 6 significant figures with 3 decimal points

x = 2, 4

No

x = 2, 4  
Yes

z = 1 / (x^2 + 2e^x) + sin(4x)  
Display z in 6 significant figures with 3 decimal points

No

State "unknown input" and display the number

Exit
```

(8 marks)
QUESTION 7 (14 MARKS)

a) A mathematical model for the following data is $Y = A_0 + A_1 X_1 + A_2 X_2 + A_3 X_3$.

$$
\begin{array}{ccccccc}
X_1 & 0.2 & 0.5 & 0.6 & 0.8 & 1.0 & 1.1 \\
X_2 & 0.1 & 0.3 & 0.4 & 0.9 & 1.1 & 1.4 \\
X_3 & 0.3 & 0.35 & 0.5 & 0.75 & 1.3 & 1.5 \\
Y & 1.17 & 1.26 & 1.28 & 1.23 & 1.27 & 1.24 \\
\end{array}
$$

Write a MATLAB command to

i) enter the above data in the command window

(4 marks)

ii) solve for $A_0$, $A_1$, $A_2$ and $A_3$

(3 marks)
b) Given the following table of experimental results,

<table>
<thead>
<tr>
<th>x</th>
<th>0.5</th>
<th>0.7</th>
<th>0.9</th>
<th>1.3</th>
<th>1.7</th>
<th>1.8</th>
<th>1.9</th>
<th>2.1</th>
<th>2.3</th>
<th>2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>0.1</td>
<td>0.2</td>
<td>0.75</td>
<td>1.5</td>
<td>2.1</td>
<td>2.4</td>
<td>2.7</td>
<td>3.1</td>
<td>3.6</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Write a MATLAB script using `polyfit`, `polyval` and `plot` to fit the given data with degree four polynomial and plot the graph with 0.01 increment value of $x$.

(7 marks)

**QUESTION 8 (8 MARKS)**

Write an equivalent mathematical expression for the following MATLAB commands,

i) $\gg f = \text{inline}('x.^3+2.*x-5'); \quad k = \text{quad}(f, 10, 80)$

(3 marks)

ii) $z = \text{inline}('y.*\sin(x)+x.*\cos(y)'); \quad I = \text{dblquad}(z, \pi, 2*\pi, 0, \pi)$

(5 marks)
QUESTION 9 (14 marks)

a) Write a MATLAB command using symbolic processing for the following problems.

i) \( x^6 - 17x^2 + 16 \) in a factorized form. \( \quad \) (2 marks)

ii) the solution of \( 3x - 2y = 11 \) and \( 2y + 4x = 5 \). \( \quad \) (2 marks)

iii) definite integral of \( x^3e^x \) for \( 0 \leq x \leq 2 \). \( \quad \) (2 marks)

iii) the solution of second order differentiation

\[
\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = 0, \quad y(0) = 1, \quad y'(0) = 0.
\] \( \quad \) (3 marks)
b) Write an expected output for the following MATLAB commands.

i) \[ \text{	exttt{>> syms x y}} \\
\text{	exttt{>> subs(x+2*y, [x,y], [2,4])}} \] 

\vspace{1cm}

ii) \[ \text{	exttt{>> syms x y; a = x.(2:4).*y}} \] 

\vspace{1cm}

END OF QUESTIONS