University of KwaZulu-Natal
School of Electrical, Electronic and Computer Engineering
EXAMINATION : **June 2014**

SUBJECT, COURSE AND CODE: **Applied Computer Methods**
ENEL2CMH1

DURATION: **Two Hours**   TOTAL MARKS: **60**

This question paper contains a total of **6 pages**

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Instructions:

- This exam comprises of 3 Sections. Answer all the questions.
- Calculators are permitted.
- **Answer Section A in the multiple-choice answer sheet.**
- **Two** answer books are supplied and are to be used as follows:
    - **One for Section B and C.**
    - **One for rough work. <u>Do not</u> clutter your answer books with unnecessary rough work. Marks are awarded for the manner in which you present your solution.** Hand in your rough-work book. This book will not be marked.
- **<u>Clearly indicate which book contains Sections B and C and the rough work</u>.**

Additional Material Supplied:
  A multiple-choice answer sheet is provided. Indicate your answers to section A on this multiple-choice answer sheet. Please read the instructions on this sheet. **You <u>MUST</u> fill in your Student AND seat Number on this sheet.** Ask the invigilator for assistance in this regard if you require.

Section A

Given the following declarations:

x = [true true false];

y = [false true true];

z = [false true false];

1. What will be the result of **x & y | y** ?

      A) 0   1   1   B) 1   0   1   C) 1   1   1   D) None of these

2. What will be the result of **'nor' == 'for' & x** ?

      A) 1   0   1   B) 0   1   0   C) 0   1   1   D) 1   0   0

_____

Study the following lines of code and answer the questions that follow:

```
rows = 4;
cols = 3;
TwoDArr = zeros(rows,cols);

i = 1;
while i <= rows
    for j = cols:-2:1
        TwoDArr(i,j) = i + j;
    end
    i = i + 1;
end
fprintf('%d\n',j);
fprintf('%d\n',TwoDArr(rows,cols));
```

3. What is the value of j printed in the first fprintf statement?

    A) 3   B) -2   C) 2   D) 1

4. How many of the elements of the array have been changed as a result of the two loops?

    A) 4   B) 9   C) 8   D) 12

5. What is value is printed in the second fprintf statement?

    A) 4   B) 7   C) 5   D) 1

_____

The code below is for a function that takes an integer as an input and outputs the factorial of that number. Study the code and choose the missing lines in the following questions that will output the correct result from the function.

```
function r = factFunc(n)

fact = 1;
c=0;
while $$6$$
    $$7$$
    $$8$$
end
r = fact;
```

6. What is missing in position **$$6$$**?
  A) c < n B) c <= n   C) n < c   D) c < n+1

7. What is missing in position **$$7$$**?
  A) c=c-1; B) c=c*1;   C) c=c+1;   D) c=c+2;

8. What is missing in position **$$8$$**?
  A) fact = c/fact;
  B) fact = c+fact;
  C) fact = c-fact;
  D) fact = c*fact;

9. Given B = magic(4), the following assignment is made:

```
C = {B(3:4,2:3) sum(B) 'ACM rulz'}
```

Which of the following is valid in accessing the **contents** of the second element of the cell array C?
  A) C(2)   B) B(2)   C) C{2}   D) B{2}

10. Assuming you have a vector v = [1 2 3], which of the following statements is valid in storing it into a '.mat' file ?
A) save v myVars.mat
B) save myVars.mat v
C) save v mat.myVars
D) store v myVars.mat

Section B

Question 11 [5 marks]

`A = magic(4)` gives the following matrix:

```
16   2    3   13
 5  11   10    8
 9   7    6   12
 4  14   15    1
```
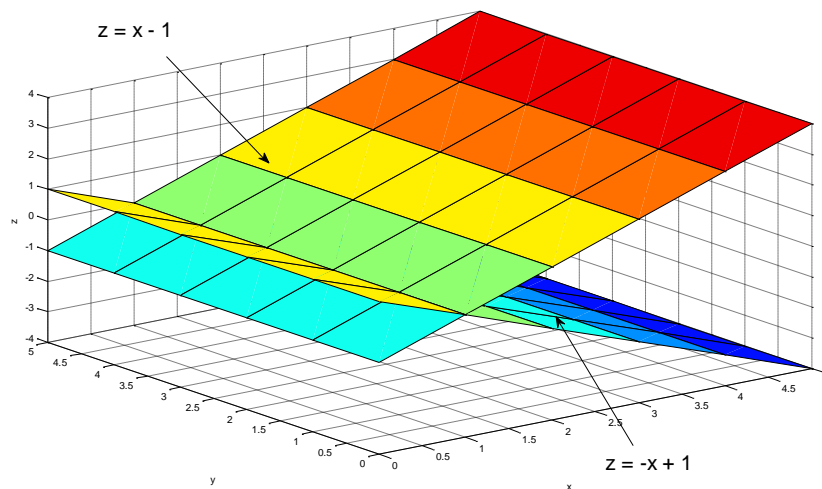
a) Write **a single line** Matlab instruction to create a matrix B that will contain the elements of A that are greater or equal to 5 and are divisible by 5. Give the values in B.

b) What will be output to the command window if the 'find' function is used with the logical condition in Question a)?

Question 12 [5 marks]

Write the MATLAB code required to generate the figure below.

Question 13   [5 marks]

Assume that the following set of temperature measurements is taken from an experiment.

Time, sec	Temperature, C
0	0
1.0	20
2.0	60
3.0	68
4.0	77
5.0	110

Write the appropriate MATLAB code to achieve the following.
a) Determine the temperature at time = 3.7 seconds.
b) Determine the Internal Energy at 0.2 second intervals between 1 and 4 seconds. Use the **cubic spline** interpolation method.
c) Use '**polyfit**' to compute the coefficients of a polynomial of degree 3 that best matches the temperature and time interval data.
d) Use '**polyval**' to interpolate on the above coefficients to plot the polynomial using the time vector produced in question b.
e) Plot the polynomial derived in Question d).

Section C

Question 14   [25 marks]

The 'magic' function in Matlab is described as follows:

M = magic(n) returns an n-by-n matrix constructed from the integers 1 through n^2 with equal row and column sums. The order n must be a scalar greater than or equal to 3.

Write your own script that generates a magic matrix of size determined by the user input '*n*'.
Your algorithm must include the following steps:
1. Make sure that the user input is greater than or equal to 3.
2. Generate a *nxn* matrix of (appropriate) random numbers.
3. Check if the matrix is a magic matrix by testing if the sums of all the numbers in the rows are the same, and the sums of all the numbers in the columns are the same.
4. Repeat step 2 until a magic matrix is found.
5. Count the number of times it took your program to generate the matrix and output this count to the user with the following statement:

`WOW it took me `**`XXXXX`**` tries to finally find a magic matrix`

where **XXXXX** is the final value of the count in step 5.

Note:
You are **not permitted** to use Matlab's 'sum' function and must **write and use your own**.

You are to manipulate the following lines of code to **write your function** that generates the matrix of random numbers.

This line produces a number between 1 and 6:

```
floor(mod(rand*10, 6)) + 1
```

NB: Marks are awarded for comments and neatness of code.