UNIVERSITY OF GHANA

B.Sc. ENGINEERING/FIRST SEMESTER EXAMINATIONS: 2018/2019

DEPARTMENT OF COMPUTER ENGINEERING

CPEN 101: ENGINEERING COMPUTATIONAL TOOLS (2 CREDITS)

INSTRUCTIONS:

ANSWER <u>ALL</u> QUESTIONS

ALL ANSWERS SHOULD BE WRITTEN ON THIS QUESTION PAPER

TIME ALLOWED: TWO (2) HOURS

SECTION A [30 MARKS]

ANSWER ALL QUESTIONS IN THIS SECTION BY WRITING T OR F AGAINST EACH QUESTION

Answer each question in this section with a **True (T)** or **False (F)**

Each question carries 1 mark.

1. Apple Computers was named by Steve Jobs after his favourite fruit, apple.
2. A browser is a specially-crafted software used to access the Internet.
3. The WWW was invented by Prof. Sir Tim Berners-Lee.
4. Without the Internet the WWW cannot work.
5. Internet Explorer is to Google as Chrome is to Microsoft.
6. The operating system of a computer is the *interface* between the *application software* and the *computer system hardware*.
7. For every computer, the RAM is the main memory whilst the hard disk is the primary storage area.
8. A *computer program* is just a sequence of instructions guided by a set of rules.
9. In MS Excel, the cell labeled as A1 is the intersection of column A and row 1.
10. By default, the Fill Handle appears as a *small green square* at the *bottom right corner* of an active cell in Excel 2016.
11. The Fill Handle always turns into a small black cross once it is depressed.
12. The error message # **VALUE** in MS Excel stands for "not a value."
13. The in-built function *AVERAGE ()* is used to calculate the median in MS Excel.
14. The relation cos x – ln x is written COS X –LN(X) using MS Excel syntax.
15. The MS Excel formula for computing the logarithm to the base 10 of the variable *number* is LOG (number).
16. To enter a formula in an MS Excel grid, you can also start with the plus (+) sign apart from the equal sign.

17. The subplot command in MATLAB can be used to divide a plotting window into several panes.
18. The functions *fprintf ()* and *disp ()* are both output functions in MATLAB yet it is only disp () that can format the output.
19. In a MATLAB M-file function, always the name of the file must be the same as the name of the function.
20. In MATLAB every user-defined *function* requires a corresponding *end* statement.
21. In MATLAB when assignment statements are long, we use the ellipsis to extend it to another line.
22. In a nested for loop in MATLAB, each for loop must have a *corresponding end* statement.
23. In MATLAB, array and matrix multiplications both use the same operator—the asterisk (*).
24. In a *switch statement* in MATLAB, the *otherwise* is equivalent to *else* in the *if-elseif-else statement*.
25. The plot command in MATLAB can always take on a third argument that specifies color and line styles of the graph.
26. In MATLAB, sin (x) means the sine of x, where x is in *degrees*.
27. MATLAB is a product of mathworks, based in Natick, Massachusetts, USA.
28. In MATLAB, the function log (x) is used to compute the common logarithm of x.
29. In MATLAB, the command *clc* clears the command window.
30. The *disp()* output function by default in MATLAB automatically sends the cursor to the next line after executing its statements.

SECTION B [10 MARKS]

Fill in the blanks in each of the following:

1. The MATLAB array left division operator is —————— .
2. Every *if* statement in MATLAB terminates with an ———————— statement.
3. The keyword ——————————begins every user-defined function in MATLAB.
4. ———————— is on the same level of precedence as the *division operator* in MS Excel.
5. According to arithmetic precedence rules in MS Excel, 8 + 12 * 2 − 4 = ——————
6. Removing errors from a programming language is technically called ——————
7. ———————— are used to document a computer program and improve its readability.
8. In MATLAB, the sine of 180° is written as ———————— .
9. The brain of a computer is called the ———————————— .
10. The primary storage area of a computer is the —————————— .

SECTION C [60 MARKS]

Q1.

a)

i. In Table Q1ai, match a *product* to the *organization* that owns copyright to it:

Table Q1ai: Table showing products and parent organizations

#	Product	Organization
1	Computerized contact lenses	Apple Inc.
2	Instagram	Microsoft Corp.
3	MATLAB	Facebook Inc.
4	Skype	Google Inc.
5	I-phone	Mathworks Inc.

[5 marks]

ii. In Table Q1aii, match an *organization* to the *personality* who was its *founder* or *co-founder*:

Table Q1aii: Table showing products and parent organizations

#	Organization	Founder/Co-founder
1	Microsoft Corp.	Sergey Brin
2	Alibaba.com	Eduardo Saverin
3	Facebook Inc.	Steve Wozniak
4	Google Inc.	Paul Allen
5	Apple Inc.	Jack Ma

[5 marks]

b) If the lengths of two sides of a triangle and the angle between them are known, the length of the third side can be calculated using the cosine formula. Given the lengths of two sides (*a* and *b*) of a triangle, and the angle *ab* between them in degrees, the third side *c* is calculated as:

$$c = \sqrt{(a^2 + b^2 - 2ab \cos(ab))}$$

Write a MATLAB M-file function called *thirdside* that will compute the various values of *c* given the angles *ab* in degrees for $0° \leq ab \leq 360°$, in increments of $45°$ using a *for loop*. The inputs to the function are *a*, *b*, and *ab* and the output is *c*. Display *ab* and the values of *c* in a table and label each column and format the table to show *ab* as an *integer*, and the values of *c* to *three decimal places*.

[Hint: use *disp* and *fprintf* to display *ab* and *c* in a table format as follows:

disp ('angle ab   side c')
fprintf('%3d   %4.3f\n', ab, c)

The command *disp ('angle ab   side c')* should come before the for loop whilst *fprintf('%3d   %4.3f\n', ab, c)* should be within the for loop].   [10 marks]

Q2.

a) Create a script file *pickpizza.m* in MATLAB that displays the type of pizza a customer requests. In your script, use the MATLAB *menu* function which will have as inputs the strings, *'Pick a pizza'*, *'Cheese'*, *'Shroom'*, *'Sausage'* in that order. Declare a variable *mypick* that is initialized to the value of the menu function. Use the *switch* statement to implement this program. Your outputs should display *'Order a cheese pizza'*, *'Order a mushroom pizza'*, *'Order a sausage pizza'* respectively.   [10 marks]

b) Write a simple MATLAB script called *esinplot.m* that plots the function

$$y = e^{-1.2x} \sin (10x + 5) \text{ for } 0 \leq x \leq 5.$$

Use the ***linspace*** function to create the x values up to 500 values.

Show grids on your plot using the **grid on** command. Also, label the **x-axis, y-axis, title of the graph** and also use the *gtext* function to write the equation of the function that you have plotted on the curve.   [10 marks]

Q3.

a) Convert the following to their MS Excel equivalents:

   i. $\frac{1}{2} \frac{v^2}{g}$ [1 mark]

   ii. $\log t - e^{p/qr}$ [2 marks]

   iii. $\dfrac{2V^2 \sin\theta\cos\theta}{g}$ [2 marks]

   iv. $\log_7 X^2$ [1 mark]

b) The trigonometric functions are among the many **built-in** functions in MS Excel. Given a variable "**num**," where num is in radians and generally in the range 0 to pi or −pi/2 to pi/2, write down the MS Excel equivalents of the following trigonometric functions:

   i.   secant of num   [1 mark]

   ii.   cosecant of num   [1 mark]

   iii. cotangent of num   [1 mark]
   iv. $\tan^{-1}$ of num   [1 mark]
   v. $\cos^{-1}$ of num   [1 mark]

c) The following are some of MS Excel's in-built functions. Write *very brief* (one sentence) explanations about what each does.

   i. MMULT ( )   [1 mark]
   ii. MINVERSE ( )   [1 mark]
   iii. MDETERM ( )   [1 mark]
   iv. SQRT ( )   [1 mark]
   v. AVERAGE ( )   [1 mark]
   vi. MODE ( )   [1 mark]
   vii. STDEV ( )   [1 mark]
   viii. RADIANS ( )   [1 mark]
   ix. DEGREES ( )   [1 mark]