THE CO-OPERATIVE UNIVERSITY OF KENYA
SPECIAL / SUPPLEMENTARY EXAMINATION OCTOBER -2022
EXAMINATION FOR BACHELORS OF SCIENCE IN COMPUTER SCIENCE, INFORMATION TECHNOLOGY
UNIT CODE: BCSC 2207
UNIT TITLE: SCIENTIFIC COMPUTING

DATE: FRIDAY 28TH OCTOBER, 2022 **TIME: 2:30 PM – 4:30 PM**

INSTRUCTIONS: Answer question **ONE (compulsory)** and any other **TWO** questions

QUESTION ONE

a) Distinguish between the following terms as used in Scientific Computing: **(4 Marks)**

i) Function and Script

ii) Vector and Scalar

b) A vector is defined by: **v = linspace(i, f, p).** State what element p in the vector denote. **(2 Marks)**

c) Given that >> **A = [1 2; 3 4]; B = [5 6; 7 8];** What would be the value of function >> **twosum(A,B)**? **(3 Marks)**

d) A MATLAB command extract is as shown below:

```
» a=3;

» b=[1, 2, 3; 4, 5, 6];

» c = b / a
```

Write the expected output of the script. **(3 Marks)**

e) You are creating a plot in matlab and after defining your matrix >>B= [1:4; linspace(1,4,5)] the plot returns below error:

??? Error using ==> vertcat

CAT arguments dimensions are not consistent.

i) State the problem that caused the error identified above. **(2 Marks)**

ii) Suggest a solution for the problem stated in (i) above. **(2 Marks)**

f) Write the anonymous function called fun for the following integral: $□(□) = \frac{□}{□^{□}-1} - 1$ **(3 Marks)**

g) i) Define the term System objects. **(1 Mark)**

ii) Explain the general structure of a system object in Matlab language **(4 Marks)**

h) Outline three properties of basic function m-files. **(6 Marks)**

QUESTION TWO

a) Differentiate between dynamic and static system modelling **(4 Marks)**

b) Explain the general structure of a matlab function. **(4 Marks)**

c) i) Write a Matlab function that takes six numbers and returns the maximum of the numbers. **(5 Marks)**

ii) By using six random numbers, show how you would call the function in i) above. **(2 Marks)**

d) A Matlab bar graph is represented by image below:

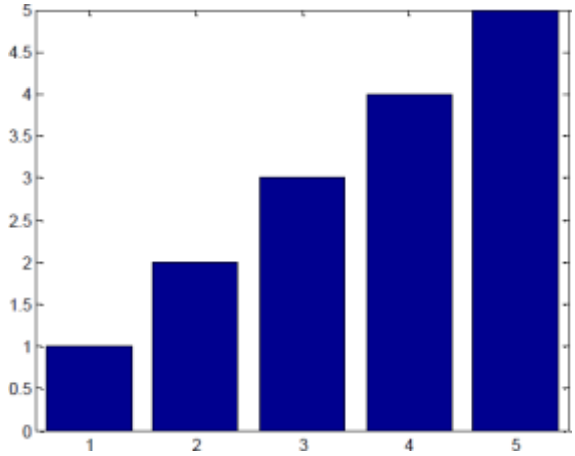

Figure 1: bar graph

Write a Matlab expressions that would create the graph shown in figure 1 above. **(5 Marks)**

QUESTION THREE

a) An m-file can contain more than one function. Differentiate between the **main function**, a **local function** and an **anonymous function.** **(6 Marks)**

b) (i) Write a user-defined MATLAB function that determines the area of a triangle when the lengths of the sides are given. For the function name and arguments use [Area] = triangle(a,b,c). **(4 Marks)**

(ii) Use the function you have written in (i) to determine the areas of triangles with the following sides:

a. a = 3, b = 8, c = 10. **(2 Marks)**

b. a = 7, b = 7, c = 5. **(2 Marks)**

c) With the aid of diagrams, differentiate between Stem, Plot and Stairs functions. **(6 Marks)**

QUESTION FOUR

a) Given that linear matrix M2 is: M2 = [1,2,3;4,5,6;7,8,9], What would be the resultant vector **Vec** given by: Vec = M2(2:2, 1:3)? **(2 Marks)**

b) A system is made of linear equations:

$$2\alpha + 8\beta + \gamma + 3\delta = 100$$
$$\alpha + \beta + 9\gamma + 7\delta = 143$$
$$4\alpha + 9\beta + \gamma + 5\delta = 111$$
$$4\alpha + 8\beta + 8\gamma + 2\delta = 264$$

By use of linear decomposition, show that X=Inv(A)*B where X=α; β; γ; δ and A and B are matrices.

(5 Marks)

c) Given the mathematical expression: $□(□) = -0.2□^4 + □^{-0.5□}□^3 + 7□^2$, where the input to the function is ***x*** and the output is ***y***,

i) Write a Matlab function such that ***x*** can be a vector (use element-by-element operations).

(5 Marks)

ii) Use the function to calculate ***y(–2.5)***, and ***y(3)***. **(4 Marks)**

iii) Use the function to make a plot of the function ***y(x)*** for **$-3 \le x \le 4$**. **(4 Marks)**

QUESTION FIVE

a) Given that function $□ = □^3 - 1$, where vector is [-4:2].

i How would you plot this parabolic function using Matlab or Octave? Format the line to red color and dashed line style. **(3 Marks)**

i. Show how you would label the X and Y axis as "Horizontal axis" and "Vertical axis" respectively? **(2 Marks)**

ii. How you would plot a second function in same current graph without replacing the first graph? **(2 Marks)**

b) You have been asked to give 2D plots for these two equations in one graph using inbuilt 2D functions in Matlab:

$$\square 1 = \cos(\square)$$
$$\square 2 = \square 2 - 1$$

Considering x = -1:1.5, give a matlab function steps of how you would plot these. The y1 should be blue and y2 red in colour. **(5 Marks)**

c) Solve the following system of linear first-order differential equations using ***dsolve***

i. $dx/d\square = 9x+5y,$ **(4 Marks)**

ii. $dy/d\square = -7x+2y$ **(4 Marks)**