TECHNICAL UNIVERSITY OF MOMBASA

Institute of Computing & Informatics

UNIVERSITY EXAMINATION FOR:

BTIT/2016M/S-PT Y2S2

ICS2105/**EIT 4213 DATA STRUCTURES & ALGORITHMS**

END OF SEMESTER EXAMINATION

SERIES: JULY, 2017

TIME: 2 HOURS

Paper 2

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of Five questions. Attempt Question One and any two other

Do not write on the question paper.

Question 1

(a) Identify and justify an appropriate ADT or data structure that is most appropriate for each of the following problems:

[6marks]

(i) You want to build an address book with entries in alphabetical order by last name.

(ii) You want to build a meeting reminder for a PDA that keeps track of events you schedule and periodically checks the next event to sound an alarm to remind you of the next thing you need to do.

(iii) You want to build a table of contents for a textbook. The textbook consists of chapters, chapters consist of sections, and sections consist of subsections.

(b)

(i) List any four properties of an algorithm [4marks]

(ii) Why is analysis of algorithms important [2 marks]

(iii) What is the Big Oh notation in the analysis of algorithms [2marks]

(c) What is the difference between a recursion and iteration in program development? use a high level language example to make your point clear [4 marks]

(d) Sorting algorithms are used to arrange records in a collection of records, write algorithms to demonstrate the following sorting techniques.

(i) Selection sort algorithm [5marks]

(ii) Bubble sort algorithm [5marks]

(ii) State the most efficient of the two algorithms, justify your answer. [2marks]

Question 2.

a) Define an array data structure. [2marks]

b) The table below displays student exam marks per question where each row represent one student script and each column represents an exam question.

Exam marks table

Student	Q1	Q2	Q3	Q4	Q5
1	13	11	20	0	18
2	8	10	0	12	11
3	20	18	23	16	0
4	11	14	0	10	9
5	9	6	0	5	11
6	21	17	15	0	19
7	17	0	13	15	14

Each cell contains a grade out of 25.
0 indicates question not attempted.

Using a high level language write a program to:

i) Declares the array statement [2marks]

ii) Initialize the array [4marks]

iii) Output the variables of the elements in the array [3marks]

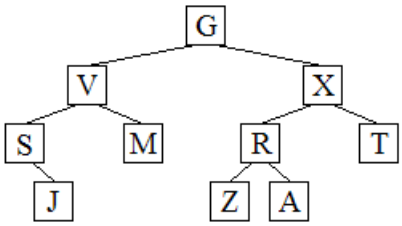
iv) Print the average mark for question 1 [3marks]

c) Differentiate between Static and Dynamic memory allocation into a data structure [4marks]

d)List any two conditions that should be satisfied when one chooses an array type as an appropriate abstract data type. [2 mark]

Question 3.

Consider the binary tree below to answer the following questions.



(a) Identify the depth of the Binary Tree, justify your answer [2marks]

(b) What is the degree of node A? justify your answer. [2marks]

(c) Write algorithms for the following binary three traversal strategies and determine the respective output.

(i) Preorder [3marks]

(ii) In order [3marks]

(iii) Post order [3marks]

(d) Write an algorithm to delete a node from a binary tree [4marks]

(i) List any two applications for the tree data structure? [2marks]

(ii) State one disadvantage of Binary Tree Data structure? [1 marks]

Question 4.

a)Give two properties that a linear list must adhere to [2 marks]

b) Write an algorithm that explains a linear list insertion. [6marks]

c) Write an algorithm that explains the Pop & Push operations in a Stack [8 marks]

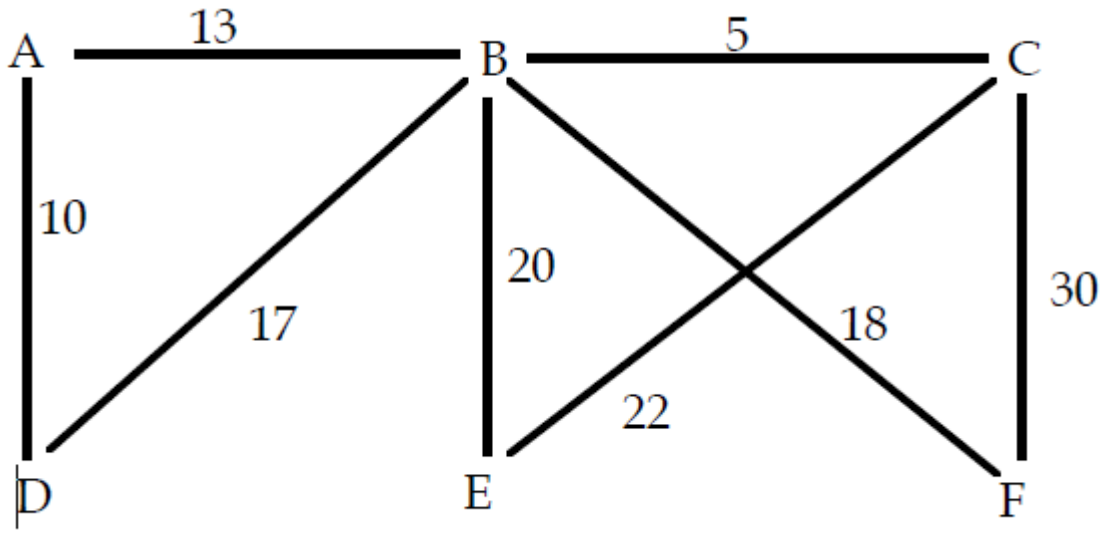
d) With an illustration differentiate between a doubly linked list and a Circular list [4marks]

Question 5

a) Define a graph data structure. [2marks]

b) Identify any three areas where Graphs ADTs' are used in day to day life. [3marks]

c) Consider the following graph:



(i) What type of graph is it? [1marks]

(ii) Identify the maximum degree in the graph, justify your answer. [2marks]

(iii) Perform a depth-first traversal of the graph shown above, starting with vertex C. Select the smallest edge first when appropriate. List the vertices in the order in which they are visited. [4marks]

(iv) Perform a breadth-first traversal of the graph shown above, starting with vertex C. Select the smallest edge first when appropriate. List the vertices in the order in which they are visited. [4marks]

(d) Use DIJSTRKA'S algorithm to find the shortest path from vertex D to vertex E. [4marks]