(Knowledge for Development)

KIBABII UNIVERSITY

(KIBU)

UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR

SPECIAL/SUPPLEMENTARY EXAMINATIONS
YEAR ONE SEMESTER TWO EXAMINATIONS

FOR THE DEGREE OF
(INFORMATION TECHNOLOGY)

COURSE CODE : BIT 121

COURSE TITLE : DATA STRUCTURES AND ALGORITHMS

DATE: 17/02/2021 **TIME: 11.00 A.M. – 1.00 P.M.**

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

QUESTION ONE (COMPULSORY) [30 MARKS]

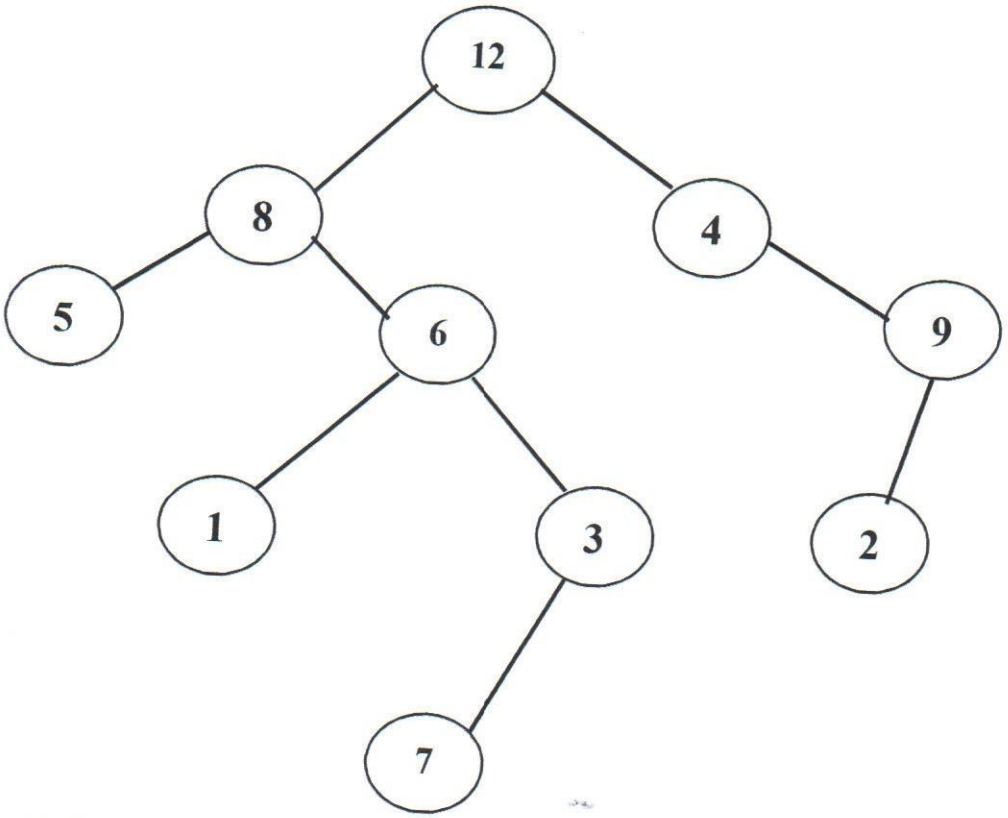
a. Consider the following tree and its four traversals.

i. Pre-Order [2 marks]

ii. In-Order [2 Marks]

iii. Post-Order [2 marks]

iv. Level Order [2 marks]

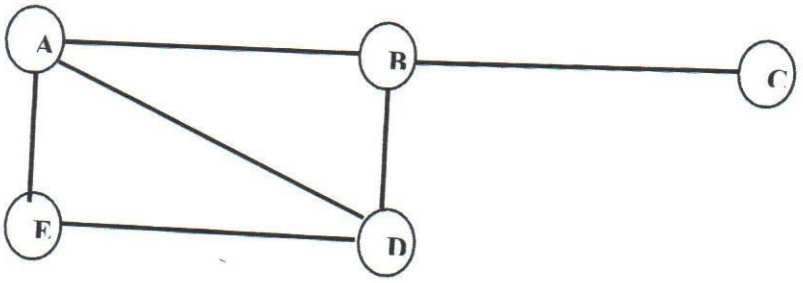


b. Define the following four types of trees [4 marks]

i. Full Binary Tree
ii. Complete Binary Tree
iii. Perfect Binary Tree
iv. Balanced Binary Tree

c. Define Heap Sort Algorithm [2 marks]

d. Consider the graph below as an example for understanding adjacency lists and adjacency matrices, Carrying out graph algorithms using the adjacency lists and adjacency matrices representation [6 marks]



e. Which data structure is used in redo-undo feature? **[1 Mark]**

(A) Stack

(B) Queue

(C) Tree

(D) Graph

[I]. Explain your answer above **[2 marks]**

f. Consider a situation where a client receives packets from a server. There may be differences in speed of the client and the server. Which data structure is best suited for synchronization? **[1 Mark]**

(A) Tree

(B) Queue

(C) Stack

(D) Graph

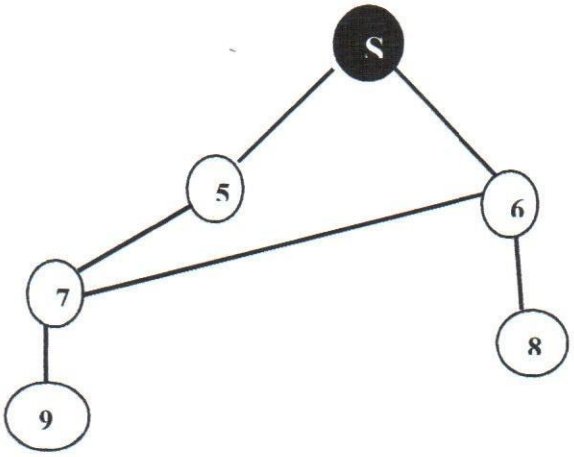
[I]. Explain your answer above **[2 marks]**

g. Give two advantages and two disadvantages of Tree sort **[4 marks]**

QUESTION TWO [20 MARKS]

a. With the aid of well labeled Breadth First Search (BFS) Graph traversals images, demonstrate Breadth First Search (BFS) from the graph below, **s** is already marked.

[8 marks]



b. What is the Difference between Binary Tree and Binary Search Tree **[6 marks]**

c. You are given an array **A** of integers, where each element indicates the time a thing takes for completion. You want to calculate the maximum number of things that you can do in the limited time that you have, this is a simple **Greedy-algorithm** problem. In each iteration, you have to greedily select the things which will take the minimum amount of time to complete while maintaining two variables **current Time** and **number Of Things**.

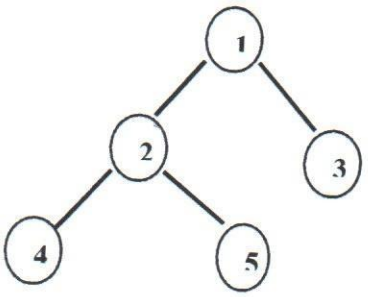
i. Name the FOUR first steps you will use to complete the calculation. **[4 marks]**

ii. From the above **Greedy-algorithm** problem, Let **A = {5, 3, 4, 2, 1}** and **T = 6,** complete the calculation.

[2 marks]

QUESTION THREE [20 MARKS]

a. Consider the graph below and demonstrate how Depth First Search (DFS) works. (Mark all the visited vertices and Show all the images.) **[4 marks]**



b. Give at least three Differences between Stack and Queue Data Structures. **[6 marks]**

c. With the aid of a well labeled diagram distinguish between Directed and Undirected graphs showing the vertices and edges **[4 marks]**

d. What is Directed Acyclic Graph? **[2 marks]**

e. **Discuss** the four basic operations performed on queue. **[4 marks]**

QUESTION FOUR [20 MARKS]

a. Discuss the three-step process we can understand **divide-and-conquer** approach **[6 marks]**

b. With the aid of a well labeled diagram distinguish between Cyclic and Acyclic graphs showing the vertices and edges. **[4 marks]**

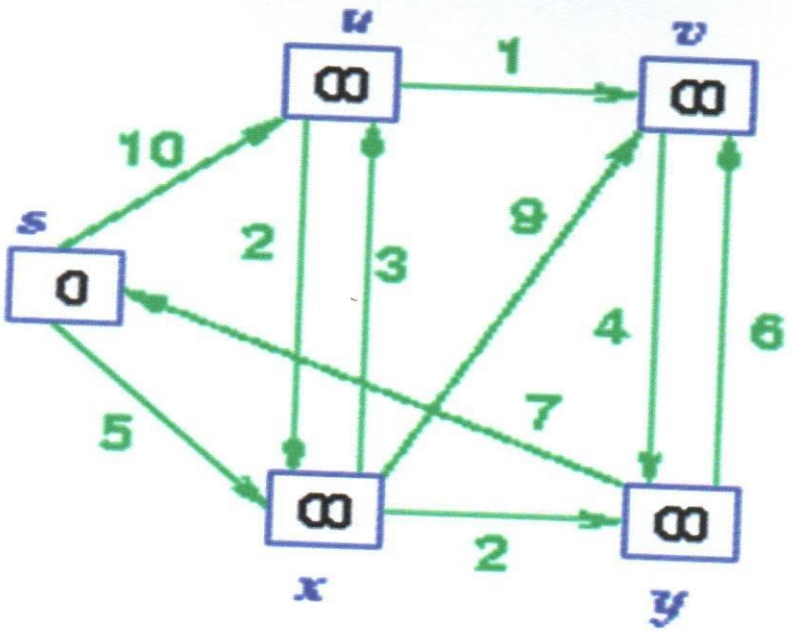
c. What is a Binary Heap? **[2 marks]**

d. **Using** recursion write a recursive function calling itself. **[3 marks]**

e. From the data structure of point of view, state and explain some important categories of algorithm **[5 marks]**

QUESTION FIVE [20 MARKS]

a. The graph below shows an initial graph with all nodes having infinite cost except the source, draw the sequence of diagrams illustrating the operation of **Dijkstra's Algorithm** **[8 marks]**



b. Using Heapify procedure perform heapification in the bottom up order for the Input data: 4, 10, 3, 5, and 1. **[3 marks]**

c. Explain the three **Execution Time Cases.** **[6 marks]**

d. Give at least three advantages **of** trees in data structures. **[3 marks]**