(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS
YEAR TWO SEMESTER TWO

FOR THE DEGREE OF
COMPUTER SCIENCE

COURSE CODE : CSC 225

COURSE TITLE : DATA STRUCTURES

DATE: 12/02/2021 **TIME: 2.00 P.M – 4.00 P.M**

INSTRUCTIONS:

ANSWER QUESTIONS ONE AND ANY OTHER TWO

QUESTION ONE [COMPULSORY] [30 MARKS]

a) Distinguish between a queue and a stack. [4 marks]

b) Why is sorting necessary? [1 marks]

c) Describe briefly

i. any one sorting algorithm and [3 marks]

ii. any one searching algorithm [3 marks]

d) Illustrate the operation of the sorting algorithm described in part (c) i above on the following list of integers: [4 marks]

57, 23, 11, 74, 39, 40, 65

e) The diagram below shows an array representation of a binary tree. Draw the tree.

[3 marks]

D	A	T	A	S	T	R	U	C	T	U	R	E

f) Suppose we begin with an empty stack, and perform the following operations: push 7, push 2, push 9, push 6, pop, pop, peek, push 1, push 3, peek, push 8, pop, peek, pop, pop, push 5, push 4, pop, pop, pop, push 8. What is contained on the stack when we are done? Write out the contents from top to bottom. [4 marks]

g) Given two scenarios: the first in which a problem solution involves a dynamic list (i.e. list in which there are a lot of deletions and insertions) and the second in which a problem involves many accesses to the interior values of a list. State with reasons which data structure will be suitable for each of the two scenarios? [3 marks]

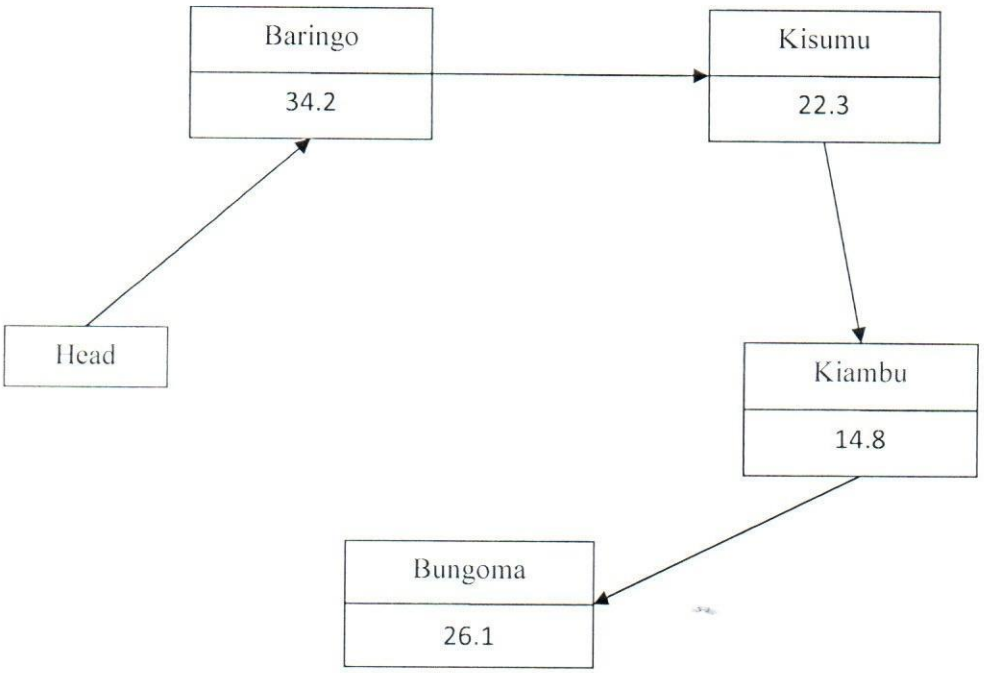
h) Construct a Huffman code for the following data and hence decode the following message:

01011101100011010101110 [5 marks]

Character	E	B	A	D	R
Probability	0.35	0.2	0.15	0.1	0.2

QUESTION TWO [20 MARKS]

a) The diagram of a linked list below contains nodes with data items of type String that contains the name of a County and type double that contains the poverty index of the County. Define a class to model a generic Node as indicated. Your class should include all the accessor and mutator methods and the default constructor that appropriately initializes the fields. [10 marks]



b) Using the Node class in Q. (a) above the following skeleton for a linked list implementation is given:

Provide implementations for the methods `insertAtFront`, `display` and `insertAtEnd` [10 marks]

```
public class LinkedList {
     private Node head;
     public LList ()
     {
```

```
        head=null;
    }

    public void insertAtFront(String t, double p)
    {
    // provide implementation to insert at the head
    }
    public void display()//displays linked list data
    {
    //provide implementation.
    }


    public void insertAtEnd(String t, double p)
    {
    // provide implementation to insert at the end of the
    list
    }
}
```

QUESTION THREE [20 MARKS]

a) What is a binary tree? [2 marks]

b) i. How is a binary search tree different from a binary tree? [3 marks]

ii. Draw the resulting binary search tree inserting the following values in the given order:

7, 10, 5, 12, 1, 3, 9. [5 marks]

iii. Name the three traversal orders for binary trees and show the result of each of these traversals on the above binary search tree. [6 marks]

c) Describe any two methods for storing binary trees in the computer [4 marks]

QUESTION FOUR [20 MARKS]

a) Explain how a stack can be used to determine if an infix expression is correctly parenthesized. [5 marks]

b) Describe how a stack can be used to solve postfix expressions. [3 marks]

c) Evaluate the following postfix expression: [4 marks]

```
7 4 5 1 - * 8 / 9 4 - + /
```

d) Describe one implementation strategy for a stack and one for a queue. [8 marks]

QUESTION FIVE [20 MARKS]

a) What is the difference between a graph and a tree? [2 marks]

b) Draw the directed graph that is represented by the following: [4 marks]

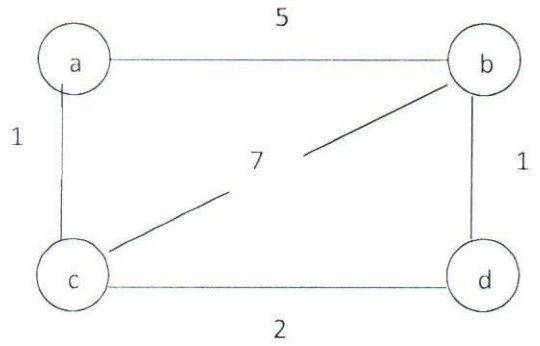
Vertices: 1, 2, 3, 4, 5, 6, 7

Edges: (1, 2), (1, 4), (2, 3), (2, 4), (3, 7), (4, 7), (4, 6), (5, 6), (5, 7), (6, 7)

c) Describe two principal methods for representing graphs for computer algorithms [6 marks]

d) If a graph is sparse which representation will you use and why? [2 marks]

e) Consider the weighted graph given below:



Represent the weighted graph using the two representation methods described in part (c) above.

[6 marks]