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**KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY  
UNIVERSITY EXAMINATION, 2017/2018 ACADEMIC YEAR  
DIPLOMA IN BUSINESS INFORMATION TECHNOLOGY**

**DBT 013 - THEORY OF ALGORITHMS**

Date:

Time:

**INSTRUCTIONS TO CANDIDATES**

**ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS**

**QUESTION ONE (30 MARKS)**

a) Explain briefly the meaning of the following terms

- i. Data type
- ii. Abstract data type (ADT)
- iii. Pointers
- iv. Data structure

(4 Marks)

b) For each of the following situations, which of these ADT's (1 through 4) would be most appropriate.

- i. a queue,
- ii. a stack,
- iii. a list,
- iv. none of these

- (a) The customers at a Kenchicken's counter who take numbers to make their turn
- (b) Integers that need to be sorted
- (c) Arranging plates in the cafeteria
- (d) People who are put on hold when they call Kenya Airways to make reservations
- (e) Converting infix to postfix expression

(5 Marks)

c) Explain why a test for an empty stack must be carried out when performing stack operations. Write a procedure/ function for the function EMPTY of a stack identifier

(4 Marks)

- d) (i) If you push the letters A, B, C and D in order onto a stack of characters and then POP them ,  
in what order will they be deleted from the stack. (2 Marks)
- (ii).Represent the following expression as binary tree and write prefix and postfix form of  
the expression.  
 $(A+B+C*D)-(A/B-CD+E)$  (4 Marks)
- e) (i) Define a Queue and explain why it is also referred to as a FIFO. (2 Marks)
- (ii).What is a priority Queue? Give an example (3 Marks)
- f) State and define all the possible operations on a stack data structure. (6 Marks)

### **QUESTION TWO (20 MARKS)**

- a) Describe how deletion of a node in between the linked list can be carried out illustrated your answer  
with a diagram. (5 Marks)
- b) Beginning with an empty binary search tree what binary search tree is formed when you insert the  
following values in the order.
- i. W,T,N,J,E,B,A  
ii. A,B,W,J,N,T,E (4 Marks)
- c) i. Explain the importance of a head node. (1 Marks)
- ii. State two advantages of linked list over arrays. (2 Marks)
- iii. Each element of a doubly linked structure has three fields. State the three fields illustrating your  
answer with a diagram. (2 Marks)
- iv. Describe the procedure of deleting an element at position P in a doubly linked list, illustrating your  
answer with a diagram. (4 Marks)
- v. State one advantage of circular list. (2 Marks)

### **QUESTION THREE (20 MARKS)**

- a) Convert the following infix arithmetic expression into its equivalent reverse polish form
- i.  $A+B*C$   
ii.  $(A+B)*C$   
iii.  $A/CB-(C+D)*(E-A)*C$   
iv.  $A/B-C+D*E+A+C$  (4 Marks)
- b) Use stack to evaluate the postfix expression  $ABC+D*+E+$ . Show the status of the stack after each step  
of the algorithm. Assume the following values for the identifiers: A=8, B=5, C=3, D=9, E=4.  
(4 marks)

- c) (i) Suppose that the vowels form a tree with “O” as the root and its children are “U”, “I”, ”A”, left-to-right and “E” is the only child of “I”. Reconstruct this tree as a binary tree. (3 Marks)
- (ii). Trace the bubble sort algorithm as it sort the following array into ascending order  
20 80 40 25 60 30. (2 Marks)
- d) Write an algorithm for converting Numbers from Base 10 to any other given base. Use an example program to implement the algorithm. (7 Marks)

#### **QUESTION FOUR (20 MARKS)**

- a) State the algorithm of fibonacci sequence. Use your algorithm to write a program for computing fibonacci sequence. (5 Marks)
- b) i). Briefly define the quicksort algorithm. (2 Marks)
- ii). Write the algorithm for the quicksort . (4 Marks)
- iii). Using quicksort technique sort the following data elements. Use diagrams to trace the algorithm  
5 6 20 80 105 89 40 6 204 76. (9 Marks)

#### **QUESTION FIVE (20 MARKS)**

- i) Construct a binary search tree using the following data  
50 0 25 90 30 55 25 15 25 . (3 Marks)
- ii) Using the above information trace the algorithm for deleting node 30. (6 Marks)
- iii) Using the linked list concept, write a program for manipulating a Queue structure. (11 Marks)