



# TECHNICAL UNIVERSITY OF MOMBASA

## *Faculty of Engineering & Technology*

DEPARTMENT OF COMPUTER SCIENCE & IT

UNIVERSITY EXAMINATIONS 2012/2013  
FOR THE DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY

### ICS 2105; EIT 4213: DATA STRUCTURES & ALGORITHMS

SUPPLEMENTARY/SPECIAL EXAMINATIONS

**SERIES:** FEBRUARY 2013

**TIME:** 2 HOURS

#### **INSTRUCTIONS:**

- This paper consists of **FIVE** questions
- Answer questions **ONE** and any other **TWO** questions.

***This paper consists of Four printed pages.***

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#### QUESTION 1

- a) Using a high level language write statements to accomplish the following:
- i) Define a structure called table to be an integer array and to have 3 rows and 3 columns. **(3 marks)**
  - ii) How many elements does the array table contain, write a statement that print the total number of elements. **(5 marks)**
  - iii) Use a for repetition statement to initialize each element of table to the sum of its subscripts. Assume the integer variable x and y are defined as control variables. **(6 marks)**
  - iv) Print the values of each element of array table. Assume the array was initialized with the following definition. (6 marks)  
In table  $[site] [site] = \{\{1,8\}, \{2,4,6\}, \{5\}$

- b) Explain the following data structure concepts:
- i) Dynamic data structures
  - ii) Dynamic memory allocation
  - iii) Function dequence
- c) State the difference between stacks and linked dist. **(2 marks)**

### QUESTION 2

- a) State and explain two primary functions used to manipulate a stack. **(4 marks)**
- b) For each of the following situations, state the most appropriate ADT to implement. **(7 marks)**
- i) The customers as a keychiken's counter who take numbers to make their turn.
  - ii) Integers that need to be sorted.
  - iii) Arranging plates in the cafeteria.
  - iv) People who are put on hold when they call Kenya Airways to make reservations.
  - v) Computer with only one single processor where only one user at a time may be serviced.
  - vi) Whenever a function call is made, the called function must know how to return to its caller, so the return address is pushed to a receiver.
  - vii) Compilers in the process of evaluating expressions and generating machine language code.
- c) Write an algorithm that implement a linear list insertion algorithm. **(9 marks)**

### QUESTION 3

- a) Differentiate between bubble and selection sort algorithms. **(4 marks)**
- b) The basic operation of the insertion sort is the insertion of a single element into a sequence of sorted element so that the resulting is still sorted. The process is illustrated below for an array of five integers. The original array is shown in (i)

i)

235	45	182	205	390
-----	----	-----	-----	-----

ii)

45	235	182	205	390
----	-----	-----	-----	-----

iii)

45	182	235	205	390
----	-----	-----	-----	-----

iv)

45	182	205	235	390
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Write a method that accepts as a parameter an array of intergers and users this algorithm to sort the elements in the array. **(9 marks)**

- c) Explain any **THREE** factors that affects the running time of an algorithm. **(3 marks)**

- d) i) What is gashing. (2 marks)  
ii) List any **TWO** objectives of gashing. (2 marks)

#### QUESTION 4

- a) Explain any **THREE** advantages of implementing a list over an array data structure. (6 marks)  
b) Provide the inorder, preorder and postorder traversal of the binary search tree. (9 marks)

- c) Explain what is a self referential structure. (2 marks)  
d) Explain the components of the following referential structure. (3 marks)

```
struct node {  
    int data;  
    struct node * nextprt;  
};
```

#### QUESTION 5

Write a statement or a set of statements to accomplish each of the following. Assume that all the manipulations occur in main (therefore no address of pointer variables are needed and assume the following definitions.

```
struct gradeNode {
    char LastName [20];
    struct gradewode *nextptr;
    typedes struct gradeNode GradeNode;
    typedes GradeNode *GradeNode ptr;
```

**Required:**

- a) Create a pointer to the start of the list called strasttr. The list is empty. **(5 marks)**
- b) Create a new node of type GradeNode that is pointed to by Pointer Newptor of typeGrade Node ptr. Assign the string “Jones” to member LastName and the value 91.5 to member grade (use stcpy) provide any declaration and statements. **(6 marks)**
- c) Assume that the list pointed to by start for currently Od 2 nodes one containing “Johens” and one containing “switch”. The nodes are in alphabetical order provide the statements necessary to insert in order nodes containing the following data for lastname and grade.

“Adams” 85.0

“Thompson” 75.3

“Pritchard” 66.5

Use pointers previous ptr, current ptr points to be before each insertion. Assume that new ptr always points to the new nodes, and that the new node has already been assigned the data. **(7 marks)**

- d) Write a while loop that prints the data in each node of the list. Use pointer current ptr to move along the list. **(4 marks)**