



MERU UNIVERSITY COLLEGE OF SCIENCE & TECHNOLOGY

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University Examinations 2010/2011

FIRST YEAR SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR SCIENCE COMPUTER
SCIENCE/SCIENCE MATHEMATICS & COMPUTER SCIENCE/SECOND YEAR, SECOND SEMESTER
BACHELOR OF SCIENCE INFORMATION TECHNOLOGY/SECOND YEAR, FIRST SEMESTER BACHELOR OF
BUSINESS INFORMATION TECHNOLOGY

ICS 2105: DATA STRUCTURES AND ALGORITHMS

DATE: DECEMBER 2010

TIME: 2 HOURS

INSTRUCTIONS: *Answer Questions One and any other Two Questions*

QUESTION ONE – (30 MARKS)

- (a) List two basic ways of representing linear structures in memory. (2 Marks)
- (b) List three most common types of graph representation. (3 Marks)
- (c) Differentiate between functional, and data abstraction. (2 Marks)
- (d) Suppose that STACK is allocated $N=6$ memory cells and initially STACK is empty, or in other words $TOP: = 0$. Find the output of the following module. Show the logic. (4 Marks)
 - 1. Set $AAA: =3$ and $BBB: = 8$
 - 2. Call PUSH (STACK, AAA)
 - 3. Call PUSH (STACK, $BBB +2$)
 - 4. Call PUSH(STACK, 11)
 - 5. Call PUSH(STACK, $AAA+BBB$)
 - 6. REPEAT WHILE $TOP \leq 0$
 - Call pop (STACK, ITEM)
 - Display/Print (ITEM)
 - [End of Loop]
 - Return
- (e) Given a 30×10 matrix, DATA, such that $Base (DATA) = 200$ and that there are 8 words per memory cell.

(i) Explain how matrices of the same category as DATA are represented in the computer's memory. (2 Marks)

(ii) Assuming a programming language that uses:

(a) Row-major order

(b) Column-major order

Compute the address of DATA [15,5] (6 Marks)

(f) Information held about a student at the admissions office comprises the record.

STUDREGNO	REC NO	NAME	FACULTY	DEPARTMENT	SEX
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Give a STRUCTURE type Definition that could be used to declare a variable STUDINFO, of type STUDREC, which holds the information of individual student

(3 Marks)

(g) Give a recursive function that accepts the base, p and power, q, entered from the keyboard as its input and computes and displays p raised to $q(P^q)$. (6 Marks)

(h) What do you understand of the term hash function? (2 Marks)

QUESTION TWO – (20 MARKS)

(a) Using the following weights, construct a Huffman tree {9,4,7,2,5,14} (8 Marks)

(b) Perform an heap sort on the list 35, 15, 77, 60, 22, 41. (8 Marks)

(c) Define the following terms: (4 Marks)

(i) Data structure

(ii) Simple data type

QUESTION THREE – (20 MARKS)

(a) (i) Define a stack ADT. (2 Marks)

(ii) Compare the sequential search with binary search (2 Marks)

(b) Show how the following items; 40 50 30 can be implemented in stack ADT as an array. (2 Marks)

(c) Consider the algorithm below that finds mean of a set n numbers stored in an array:

(i) Initialize the index variable, sum to 0

(ii) Initialize the index variable, i, to 1

(iii) When $i < n$ do the following

(iv) (a) Increment i by 1

(b) Add $x(i)$ to sum

(v) Calculate and return mean as sum/n

Using the 'big oh' notation, show that $T(n) = O(n)$ (5 Marks)

(d) Write pseudo code for a binary search tree. Assume the array is already sorted.

(5 Marks)

(e) What do you understand from the following terms

(4 Marks)

- Structured data type
- Pointer data type

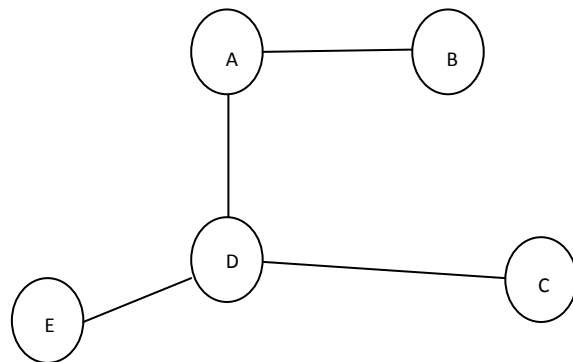
QUESTION FOUR – (20 MARKS)

(a) Write a code (any language preferably C) to implement the POP and PUSH functions of STACK ADT

(6 Marks)

(b) Write down the adjacency matrix for the graph below.

(6 Marks)



(c) Define a binary tree and outline Two of its properties.

(3 Marks)

(d) Write a program to enter in five dates, store this information in an array of structures.

(5 Marks)