



MERU UNIVERSITY COLLEGE OF SCIENCE & TECHNOLOGY

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University Examinations 2011/2012

SECOND YEAR, SECOND SEMESTER EXAMINATION FOR DEGREE OF BACHELOR
OF SCIENCE IN INFORMATION TECHNOLOGY/ SECOND YEAR, SECOND SEMESTER
FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER TECHNOLOGY AND
SECOND YEAR, FIRST SEMESTER FOR THE DEGREE OF BACHELOR OF BUSINESS
INFORMATION TECHNOLOGY

ICS 2105: DATA STRUCTURES AND ALGORITHMS

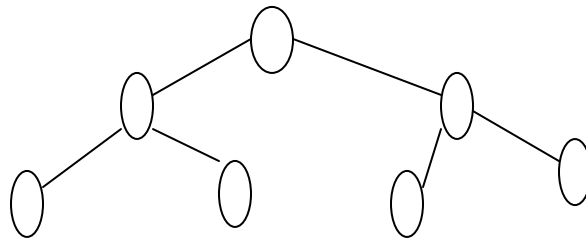
DATE: DECEMBER 2011

TIME: 2 HOURS

INSTRUCTIONS: Answer Question *one* and any other *two* questions.

QUESTION ONE – (30 MARKS)

- a) Define the following terms: (8 marks)
- i) Abstract data type
 - ii) Data object
 - iii) Algorithm complexity
 - iv) Abstraction
- b) Briefly describe the following data structures: (4 marks)
- i) Huffman tree
 - ii) Weighted graph
- c) Consider the binary tree below



Insert the values 5,23,7,2,10,16,13 in the tree using:

- i) Pre-order traversal (4 marks)
- ii) Post-order traversal (4 marks)
- d) Briefly describe two areas of application of the stack ADT (4 marks)
- e) A queue can be implemented as either an array or a linked list. In the linked list implementation, it is not necessary to check whether the queue is full, whereas this is essential in the array implementation. Briefly explain why this is the case. (4 marks)
- f) Distinguish between directed graph and undirected graph (2 marks)
- g) With respect to a tree data structure, define the following terms (4 marks)
 - i) Complete tree
 - ii) Order of a tree

QUESTION TWO (20 MARKS)

- a) Briefly describe the two basic operations on a queue ADT (4 marks)
- b) Consider the numbers 23, 5, 91, 17, 12, 78, 13, 4, 7, 18. Describe the bubble sort procedure by sorting the numbers, showing the resulting list in each step. (10 marks)
- c) Consider two algorithms one having a complexity of order $O(\log(n))$ and the other having an complexity of order $O(n^2)$. Which of the two algorithms is more efficient and why? (4 marks)
- d) State the two types of algorithm complexity. (2 marks)

QUESTION THREE (20 MARKS)

- a) Define a linked list ADT (2 marks)
- b) Give two differences between a linked list and an array (4 marks)
- c) With the help of a relevant illustration, describe the steps you would take to delete the last node from a linked list. (4 marks)
- d) What is a hash function, and how is it used in sorting data? (4 marks)
- e) Briefly describe the two basic operations a queue ADT (4 marks)
- f) State two applications of a tree data structure (2 marks)

QUESTION FOUR (20 MARKS)

- a) Recursion is a very powerful technique for implementing algorithms, as an alternative to iterative operation (loops).
 - i) What is recursion? (2 marks)

- ii) State the three conditions that a problem must meet for it to be solvable by recursion. (3 marks)
- iii) Using the binary search as an example, describe the recursive and stopping cases of a recursive procedure. (4 marks)
- b) Briefly outline the algorithm for an insertion sort implementation. (7 marks)
- c) You wish to implement a patient scheduling system for a hospital. State the data structure you would use and explain why. (4 marks)