

UNIVERSITY OF SWAZILAND
Faculty of Science
Department of Computer Science
SUPPLEMENTARY EXAMINATION 2008

Title of paper: DATA STRUCTURES

Course number: CS342

Time allowed: Three (3) hours

Instructions: Answer any five (5) of the six (6) questions.

This examination paper should not be opened until permission has been granted by the invigilator.

Question 1

- a) List and describe the operations of the queue ADT. [5]
- b) Give a linked-list based implementation of the queue ADT, including definitions of relevant data types. [15]

Question 2

- a) List and describe the operations of the stack ADT. [5]
- b) Define the meaning of big-O notation and hence show that
 $N(N+1) \in O(N^2)$ [6]
- c) Write an algorithm that finds and returns the greatest value in a given stack of numbers. [6]
- d) Analyse the big-O time complexity of the algorithm given in c). [3]

Question 3

Give an array based implementation of the list ADT, including definitions of relevant data types.

[20]

Question 4

a) Write an algorithm that takes a list of numbers and repeatedly deletes the largest remaining item until the list becomes empty.

[14]

b) Analyse the big-O time complexity of the algorithm given in a), assuming that the given list is array based.

[6]

Question 5

- a) Draw a binary tree of size 10 and depth 4. Label the nodes 1, 2, ..., 10 according to the *postorder* traversal sequence. [6]
- b) What is meant by the term *binary search tree*? [2]
- c) Draw the binary search tree that results from insertion of the following values in sequence: 2, -10, 3, 15, 0, 9. [3]
- d) Write an algorithm that searches for a given key in a given binary search tree. It should return the subtree whose root contains the given key, if found. Otherwise it should return the empty tree. [9]

Question 6

- a) Explain the main ideas behind *adjacency matrix* and an *adjacency list* representation of graphs. [10]
- b) Write the algorithm for depth-first traversal of a given graph commencing at a given vertex. [10]