University of Swaziland

Faculty of Science
Department of Computer Science

Final Examination, 2005

Title of Paper:	Data Structures
Course Number:	CS342
Time Allowed:	Three (3) hours
Instruction:	Answer all questions
Special Requirement:	none

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

1. [16]
Define a (computer) algorithm. Describe all the necessary features an algorithm must have.

2. [20]
Describe the course's algorithmic language that you have been using in the course, by defining, explaining and giving examples.

3. [10]
Define recursion and iteration. Discuss the differences between the two approaches: when, for example, is it better to use one rather than the other?

4. [10]
Define a linked list. Draw a diagram for the following ordered list of numbers:
4.2, 23.2, 0.19, 100

When is a doubly linked list used?

5. [16]
Define fully a Binary Search Tree (BST).
Derive an algorithm for post-order BST transversal.

6. [5]
Which is the better model for a computer operating system, and why, between a tree and a graph?

7. [26]
Consider the following algorithm:
procedure Y (x isoftype in Num)
        if NOT (x ≥ 3)
        then
                print (x)
                Y (x + 1)
endprocedure

a) Although this routine uses the constructs introduced in the course, it falls short of the ideal. In what ways should it be improved?

b) Explain whether this routine recursive or iterative.

c) Provide a tabulation of its execution for an initial input parameter of unity.

8.[35]

A subset of a mythical natural language is selected as follows:
+ there are nouns, verbs, subjects and objects.
+ the full subset drawn from this language is:
nouns: indlu, indvodza
verbs: na, hlala
subject: i
object: wu, yi
Examples of sentences in this language are:
indvodza ina indlu.
indvodza iyina indlu.
indlu ihlala.

a) From this description, draw railroad diagrams to show the structure of this subset.

b) Further investigation of this mythical language shows there are words which can be added in association with nouns. They are inserted in the sentence either preceding or succeeding a noun. Themselves, they are prefixed by 'y'.
Provide modified railroad diagrams to show this new knowledge.

c) What information has not been shown by the railroad diagrams, and why?

d) You are tasked to produce a syntax analyser for this language. Choose three computer languages and argue the advantages and disadvantages of each, finally choosing one of them and giving supporting justification for your choice.

End of examination paper.