THE OPEN UNIVERSITY OF SRI LANKA
DIPLOMA IN TECHNOLOGY - LEVEL 4
ECX4235 – DATA STRUCTURES AND ALGORITHMS
FINAL EXAMINATION 2006

DURATION: THREE HOURS

105

Date : 17th March 2007 Time : 1330 - 1630 Hrs

Answer **five** questions including all the questions in Section A and selecting three from the Section B.

Section A

The questions in this section are compulsory (55 marks). Answer all the questions after reading the scenario given below.

Scenario:

The Dispatch Centre of OUSL

The Dispatch Centre at the OUSL is the main centre that distributes all course materials to various recipients. So it needs to keep an inventory of all course material that are received and distributed. The regional centres, the library and the academic departments are the major recipients of this centre. Course material consists of one or more components such as printed materials, audio/ video materials and CDs.

Printed material itself can be a combination of different textbooks (e.g. Unit 1, Unit 2 etc). The Dispatch Centre receives textbooks from the OUSL Press as well as from outside publishers. The Dispatch Centre also keeps a list of publishers with whom they regularly place orders. Publisher's contact details as well as the history of transaction details are kept there. Each textbook printed by the OUSL can be identified by a unique serial number and it also has a course code, a title, and a printed date. The textbooks received from outside publishers have their transaction details. Each transaction detail includes the title of the textbook, author, ISBN, number of copies bought, unit price, and the total amount spent. At the same time, in the inventory, it has to indicate for which course these textbooks (from outside publishers) are.

For other components of a course material such as for audio/ video materials and CDs you are free to apply a similar procedure. Your task is to design software for its inventory.

1.

a) If the Dispatch Centre may also receive audio/ video materials and CDs from the departments and divisions of OUSL as well as from outside dealers what details of such components should be included in the inventory.
b) Propose a suitable data structure for course materials for your software.
c) Define data structures for other information that has to be used for the software.
d) Using the data structures defined show how you would organize the details of the course materials as a Linked List.
e) Present an algorithm to insert new course materials and to remove a selected course material from the Linked List given in question 1.d.

(35 marks)

2. Assume that you have to use Object Oriented design for the software. For that identify objects, their classes and give states and behaviours according to the scenario.

(20 marks)

Section B

*Answer **three** questions from this section. Each question carries 15 marks.*

3.
   a) Briefly explain how you organize data in a Stack.
   b) According to the scenario in Section A and the data structures defined in question 1. implement a Stack in any programming language for course materials.

4.
   a) According to the scenario in Section A and the data structures defined in question 1 organize details of the course materials in a Queue structure using pointers.
   b) Show a simple way of deleting an item from the queue.

5.
   a) Describe the organization of data in a Binary Tree. Give an example.
   b) When is it useful to have a Binary Tree?
   c) Using the same example in question 5.a briefly explain pre-order traversal of a Binary Tree.

6.
   a) Describe the following Object Oriented concepts briefly
      i) Encapsulation
      ii) Inheritance
      iii) Polymorphism
   b) Implement two classes that you have identified in question 2. Use a suitable programming language for its implementation.

7.
   a) Briefly describe three sorting algorithms giving examples.
   b) Using one of the sorting algorithms you described above, draw a flowchart of an algorithm to sort numbers of an array in ascending order. In your algorithm you are not allowed to use any additional array except the one which stored the original values.