THE OPEN UNIVERSITY OF SRI LANKA
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

FINAL EXAMINATION 2007
DIPLOMA IN TECHNOLOGY – COMPUTER ENGINEERING

115

ECX4235 – DATA STRUCTURES AND ALGORITHMS

DATE: APRIL 25, 2008 **TIME: 1330-1630 HRS**

PART A (40 Marks)

Answer all questions.

1. (20 Marks) You are asked write pseudo codes to apply double hashing for collision resolution to a given hash table where the collisions are handled using chaining.

   Size of the hash table is 600. Hashing is done based on the value of **K**. Hashing function used in the original hash table is ***K mod 599***. Initial hash function for the double hashed table is also same as the original one. In addition to that, double hashed table uses ***1+ (K mod 598)*** as the successive hash function.

   It is given that the sum of the items in the hash table and in the chains, of the original hash table, is less than the size of the hash table.

   Suggested steps to be followed,
   - You need to check whether any chains are available in a particular slot of the original table
   - If so, each item in the link list must be rehash using the second hash function to find an offset. (Link list is modelled as a dynamic structure)
   - Then the hash table is accessed using that offset, until an empty slot is found.

   *(**Double hashing** uses two hash functions, where initial probe is using the first hash function, in this case it is K mod 599, if it is already occupied, successive probe positions are calculated using the second hash function, in this case it is 1+ (K mod 598). A successive probe position is an offset to the initial probe. Finding an empty slot is continued with the offset calculated using the successive hash function until an empty slot is found.)*

2.

a) (4 Marks) Briefly explain polymorphism in relation to the object oriented modelling.

Mr Podililame is a married person. He is the Managing Director of the Advance Pharmaceuticals Company which is a subsidiary of Advanced Group of Companies. He is a member of the board of directors of the advanced group of companies. He always walks to the company from his home. His 19 year old daughter Nimali is a student at All Advanced Institute. Mrs Podinilame teaches Unified Softaware Development process at All Advanced Institute. She also works as a visiting consultant at Advance Software Development Company. She has a guitar and plays it often. Mr Podinilame is also working as visiting lecturer at All Advanced Institute. Nimali has a sport car, red in colour. She always uses her car to travel to the campus.

b) (12 Marks) Identify objects, their classes, states and behaviours as suggested by the given text.

c) (4 Marks) Show an example for sub class from the above text.

PART B (60 Marks)

Answer any three questions. All questions carry equal marks.

3.

a) (4 Marks) Distinguish a tree data structure from graph data structure.

b) (8 Marks) Consider three simple sorting algorithms for arrays: Bubble Sort, Selection Sort and Insertion Sort. Assume you start with array [8, 9, 12, 6, 7]. After three iterations of the outer loop, you have the array [6, 7, 8, 12, 9]. Which of the above algorithm/s are you running?

c) (8 Marks) Write pseudo codes to display all the keys in tree T in post order.

4.

a) (4 Marks) Why do you use O-notation in algorithm analysis?

b) (6 Marks) List four different classes of O-notation and name an algorithm for each one.

c) (10 marks) Given a sorted array S of n elements and an integer X, write an algorithm to determine whether there exist two integers whose sum is exactly X. Try to make it in O(n log n) time. If there are many such indices, the algorithm can return any one of them.

5.

a) (4 Marks) Distinguish the priority queue from the queue. Suggest one possible application of priority queue.

b) (6 Marks) There are two classes of sorting algorithms as O (n^2) and O (n log n). Briefly explain under which situation you might choose sorting algorithms from each class.
(Hint: you might focus your answer on time complexity and space complexity)

c) (10 Marks) Write an iterative function to count number of zeros in an array of binary digits of size n.

6.

a) (7 Marks) Write pseudo codes for Selection sort.

b) (3 Marks) What is the worst case performance of Selection sort? Why does it need to run for only n-1 elements, rather than running for all n elements?

c) (6 Marks)What are the advantages and disadvantages of a balanced binary tree over an unbalanced binary tree?

d) (4 Marks) Briefly describe the advantages of dynamic representation of data structures.

7.

a) (8 Marks) Write pseudo codes to sort a dynamic doubly linked list using bubble sort.

b) (7 Marks) Suggest how a dynamic doubly linked list could be used as a queue. Write pseudo codes to insert and remove routines of the queue (New items are entered at *left end* and items are removed at the *right end*).

c) (5 Marks) List three *good programming practices* and briefly explain the importance of one good programming practice in order to increase the productivity.