BACHELOR OF COMPUTER SC. ENGG. EXAMINATION, 2009
(2nd Year, 1st Semester)
DATA STRUCTURES AND ALGORITHMS

Time : Three hours   Full Marks : 100

Answer question no. 1 and any *four* from the rest.

1. (a) Show how the following array will be sorted in increasing order using selection sort:
   30 90 60 100 10 20 40 70 50.

   3

   (b) Show how the following expression is evaluated by your algorithm ($ is a sentinel):
   30 3 2 * / 5 4 * + 7 2 * - $

   3

   (c) Draw a hash table of size 11 with open addressing. Use the "modulo 11" hash function to insert the following keys in the given order into your table:
   7, 35, 0, 40, 33, 20, 44.

   3

   (d) Find the max heap created from the following array:
   1 5 12 75 89 72 854.

   3

   (e) What do you mean by a Transitive Closure Matrix? Explain with an example.

   3

   (f) Show how the following polynomial can be efficiently represented:
   $3x^{99} - 10x^{10} + 13x^2 - 20$

   2

   (g) How can you represent a generalized tree using a binary tree? Explain with an example.

   3

2. Explain the Mergesort algorithm. Why does it run faster than Bubble Sort in most of the cases? Show how the mergesort algorithm will sort the following array in increasing order:
   100 90 80 70 60 50 40 30 20.
   Analyse the time complexity of the mergesort algorithm.

   7+5+8=20

3. What are the problems of Binary Search Tree? Explain the improvement of performance by the use of Height Balanced Tree.
   Explain how a height-balanced tree can be formed by inserting the following elements in the given order:
   1, 2, 3, 4, 5, 6, 8, 9, 10, 7, 11.
   Show how the root element can be deleted from the above tree

   8+6+6=20

4. Define the ADT Queue. Implement the queue data structure in C, using an array and two integer variables *front* and *number_of_elements* with usual meanings.

   20

5.

Start vertex
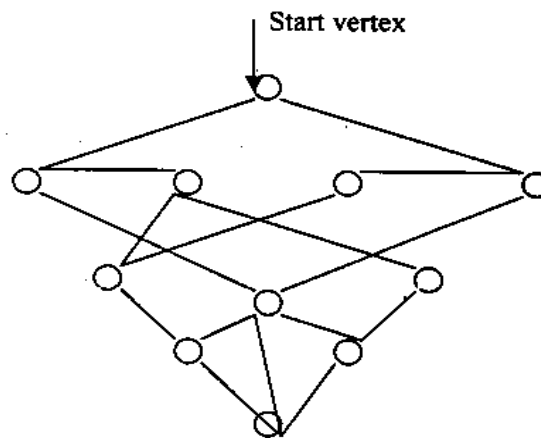
What is a Graph? How is it represented as a data structure?
Write an algorithm for Breadth First Search of a Graph. Show how the algorithm works on the graph shown above. Name the vertices according to your choice.

3+8+9=20

6. What is B-Tree? Show how the 26 capital letters of the English alphabet will be inserted in order from A to Z in a B-Tree of order 4.
What are the applications of B-Tree? How can a B-Tree be maintained in a Hard Disk File?

3+8+3+6=20

7. What do you mean by Space Complexity and Time Complexity of an algorithm? Explain. How can you compute the space complexity of an algorithm? What are the rules of finding out the time complexity of the different program structures?

What do you mean by Hashing? What are the time complexities of insertion, deletion and search in a hash table? Explain how you can delete an element from a hash table. Explain how coalesced chaining works.

10+10=20

8. A rat has entered in a checkerboard maze through one corner. Develop an algorithm by which the rat can exit the maze though the opposite corner. Clearly explain the representation of the maze and any specific data structure you have used for the algorithm.

20