Reg. No.										

MANIPAL UNIVERSITY
SCHOOL OF INFORMATION SCEINCES

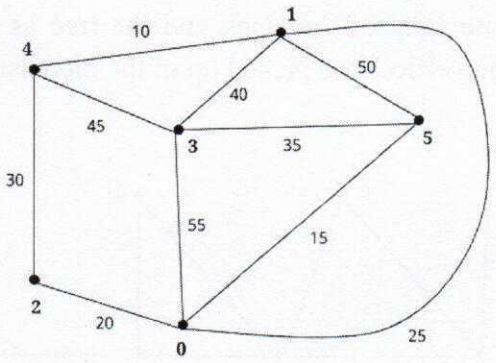
FIRST SEMESTER MASTER OF ENGINEERIG - ME (VLSI DESIGN) DEGREE EXAMINATION – APRIL / MAY 2016

SUBJECT: EDA 609 – DATA STRUCTURES

Wednesday, April 27, 2016

Time: 10.00 – 13.00 Hrs. Max. Marks: 100

1. Use Kruskal's algorithm to find the minimum weight spanning tree in the following graph.



Show the intermediate steps and the evolution of the state as computation proceeds.

(10 marks)

2. Develop the formal specification of the doubly-linked list data structure. Provide the interface definition and formal behavioral definition of the following operations:
   insert_head, insert_tail, delete_head, delete_tail, swap_head_tail, and *length.*
   Assign usual meaning to these operations. Use minimal mathematical machinery.

(10 marks)

3.

a. Define minimal data types in the C programming language for representing a binary search tree data structure. This representation is required to maintain a running count of the number of elements in the tree.

b. Develop syntactically and semantically correct C function that implements the iterative version of an algorithm to insert a new element into the tree defined in (a) above.

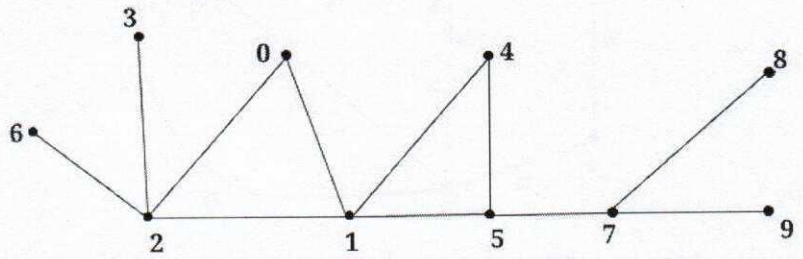
(4 + 6 = 10 marks)

4. Given the following data set with respect to the heap data structure construction,
   A = [74, 17, 33, 18, 63, 8, 23, 5, 43, 3, 13, 4, 23, 27, 21]
   show the incremental state of the heap as *heapify()* is called in the following order:

   a. *heapify*(A, 7)
   b. *heapify*(A, 6)
   c. *heapify*(A, 2)
   d. *heapify(A, 1)*

(3 + 3 + 2 + 2 = 10 marks)

5. For the following graph in Figure-A, below, produce a breadth-first traversal rooted at vertex 4. Show the intermediate state of the stack and the tree as the execution of the technique evolves. Assume that the vertices are picked up in the increasing order of their labels.



(10 marks)

6. Provide a formal specification of the Stack data structure. Give formal definitions for the following operations assuming usual meanings:

   new, push, pop,peek, empty and *full*

The last two operations are inspectors of queue's current state.
Provide appropriate interface definitions. Use minimal mathematical machinery.

(10 marks)

7. Write the Quicksort algorithm and state the key idea behind its design and implementation. Show how Quicksort progresses in the following case.
   A = [74, 17, 33, 18, 63, 8, 23, 5, 43, 3]

(5 + 5 =10 marks)

8. For the graph in question 5 above, list the following:
   a. Two cycles.
   b. Two trails.
   c. A depth first traversal, rooted at vertex 5.
   d. A breadth first traversal rooted at vertex 6.

(1 + 1 + 4 + 4 = 10 marks)

9. Describe an algorithm to determine the strongly connected components of a graph. Express the basic ideas behind its working with a minimal example.

(10 marks)

10. Write an algorithm to compute all-pairs shortest path in a graph. Describe its working with a simple example.

(10 marks)