Reg. No.									

MANIPAL UNIVERSITY

FIRST SEMESTER ME VLSI DESIGN DEGREE EXAMINATION – NOVEMBER 2015

SUBJECT: EDA 609 – DATA STRUCTURE

Saturday, November 28, 2015

Time: 10:00 – 13:00 Hrs. Max. Marks: 100

1. Develop the formal specification of the singly-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)

2A. Define minimal data types in C programming language for representing an undirected graph data structure in the form of an adjacency matrix.

2B. Develop syntactically and semantically correct C function implementing the depth-first traversal over the graph with the representation chosen in (2A) above.

(3+7 = 10 marks)

3. Given the following data set with respect to the heap data structure construction:
A = [90, 33, 50, 35, 30, 40, 45, 22, 60, 20, 80, 21,25, 46]
Show the incremental state of the heap as *heapify()* is called in the following order:

3A. *heapify*(A, 4)

3B. *heapify*(A, 5)

3C. *heapify*(A, 2)

3D. *heapify(A, 3)*

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

4A. For the following graph in Figure-A, below, produce a breadth-first traversal.

4B. For the graph in Figure-B, below, produce a depth-first traversal.
Assume that the vertices are picked up in the increasing order of their labels.

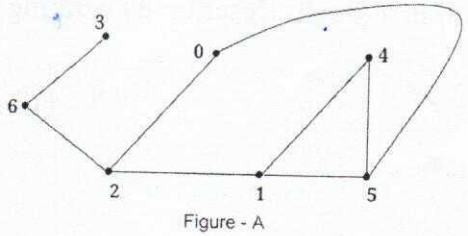


Figure - A

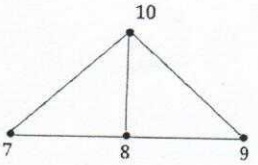


Figure - B

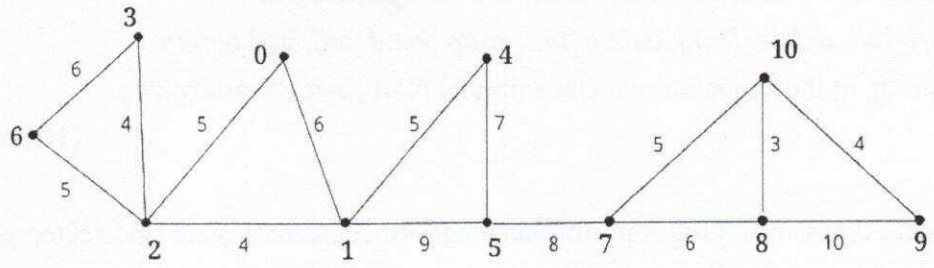
Show the incremental contents of the queue as newer vertices are discovered in the traversal.

(5+5 = 10 marks)

5. Provide a formal specification of the Queue data structure. Give formal definitions for the following operations assuming usual meanings:
new, enque, dequeue, empty and *full*
The last two operations are inspectors of queue's current state.
Provide appropriate interface definitions. Use minimal mathematical machinery.

(10 marks)

6. Use Kruskal's algorithms for finding the minimum-weight spanning tree in the following graph. Show the intermediate steps involved in reaching the result.



(10 marks)

7. For the graph in question 6 above, list the following:

7A. Three cycles

7B. Two paths

7C. A depth first traversal rooted at vertex 7

7D. A breadth first traversal rooted at 3

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

8. 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)

9. Show how QuickSort algorithm works on the following array. Show the intermediate steps involved. A = [70, 33, 40, 25, 20, 40, 75, 22, 63, 18]

(10 marks)

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

(10 marks)