

MANIPAL UNIVERSITY

THIRD SEMESTER B.S. (ENGG.) DEGREE EXAMINATION – JUNE 2015

SUBJECT: DATA STRUCTURES (CS 231)

(BRANCH: CE/CS)

Tuesday, June 09, 2015

Time: 10:00 – 13:00 Hrs.

Max. Marks: 100

✍ Answer ANY FIVE Questions.

- 1A. When and how will you express the time complexity of a given algorithm? Explain.
 1B. Write an algorithm to evaluate the prefix expression using stack. Also apply your algorithm to evaluate the prefix expression $+ - 9 2 7 * 8 / 4 12$.

(10+10 = 20 marks)

- 2A. What do you mean by a recursive function? Write a recursive function to calculate the GCD of two numbers.
 2B. Write an algorithm to convert an infix expression to postfix notation and trace that algorithm to convert the following infix expression to postfix expression.

$$A - (B / C + (D \% E * F) / G) * H$$

(8+12 = 20 marks)

- 3A. What is a linear queue? Implement a linear queue with constructor, destructor, insert, deletion and display along with isFull and isEmpty methods. Show the method invocation in main().
 3B. Write a member function to find union of two unsorted singly linked lists with the signature, void list :: getUnion (list l1, list l2) { ...} .Also write appropriate comments.
 3C. Mention any two draw backs of linked lists when compared to the arrays.

(10+8+2 = 20 marks)

- 4A. What do you mean by a doubly linked list? Give the structure of a doubly linked list in C++. Also write an algorithm to delete a node before a given node in a doubly linked list.
 4B. Draw a directed graph for the following adjacency matrix with rows and columns labelled A, B, C, D, and E respectively: [Element of the matrix represents the weight of the edge.

$$\begin{bmatrix} 0 & 4 & 0 & 2 & 0 \\ 0 & 0 & 0 & 7 & 0 \\ 0 & 5 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 3 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix}$$

- 4C. Find the transitive closure of the graph shown in Figure 4C.

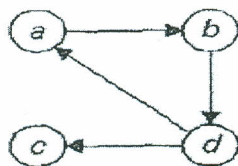


Figure 4C

(10+5+5 = 20 marks)

- 5A. Write a non-recursive member function for pre-order traversal of a binary tree.

- 5B. Create a binary search tree for the following numbers. Also write pre-order, in-order, post-order and level-order traversals for the tree obtained.

45, 39, 56, 12, 34, 78, 32, 10, 89, 54, 67, 81

- 5C. Write an algorithm to perform quick sort which makes use of a function Partition to divide the array into two sub-arrays. Show the steps in Partition function as well.

(7+6+7 = 20 marks)

- 6A. What does the following function do?

```
void mystery(queueType<int>& q)
{
    stackType<int> s;
    while (!q.isEmptyQueue())
    {
        s.push(q.front());
        q.deleteQueue();
    }
    while (!s.isEmptyStack())
    {
        q.addQueue(2 * s.top());
        s.pop();
    }
}
```

- 6B. How do the graph traversal algorithms generally differ from tree traversal algorithms? Define a C++ function breadthFirstTraversal implementing breadth-first traversal of a graph.

- 6C. Give the definition of an AVL tree. Also give one example for both AVL and non-AVL tree. How do you define a node in an AVL tree using C++ construct?

(4+10+6 = 20 marks)

- 7A. Write the C++ function, linkedInsertionSort, to implement the insertion sort with linked list-based lists.

- 7B. Whether the given tree in Figure 7B is minimum-heap tree or a maximum-heap tree? Show the tree structures for removing the smallest element from the heap.

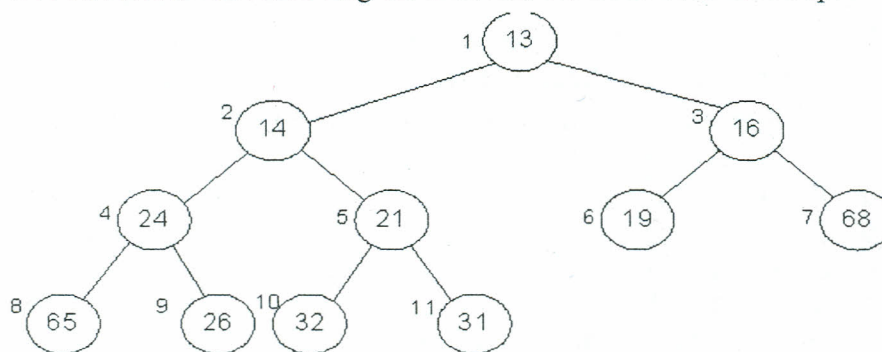


Figure 7B

(10+10 = 20 marks)

8. Write short notes on the following.

8A. Hashing

8B. Priority Queues.

8C. Class template and its illustrative use in implementing stack operations

(8+6+6 = 20 marks)

