**Lab 1-List Data Structures**

**Practical exercises**

*Note*:  You can select and do some options according to your ability only. We would like to note you that the more questions you do the better for you in doing final practical and writing exams.

**Question 1.** Write a program in Java to implement a singly linked list of integer values with the following operations :  
1.   addToHead(x) - add a node with value x  at the head of  a list.  
2.   addToTail(x) - add a node with value x  at the tail of  a list.  
3.   addAfter(p, x) - add a node with value x  after the node p.  
4.   traverse() - traverse from head to tail and dislay info of all nodes in the list.  
5.   deleteFromHead() - delete the head and return its info.  
6.   deleteFromTail() - delete the tail and return its info.  
7.   deleteAter(p) - delete the node after the node  p  and return its info.  
8.   del(x) - delele the first node whose info is equal to x.  
9.   search(x) - search and return the reference to the first node having info x.  
10. count() - count and return number of nodes in the list.  
11. del(i) - delete an i-th node on the list. Besure that such a node exists.  
12. sort() - sort the list by ascending order of info.  
13. del(p) - delete node p if it exists in the list.  
14. toArray() - create and return array containing info of all nodes in the list.  
15. Merge two ordered singly linked lists of integers into one ordered list.  
16. addBefore(p, x) - add a node with value x  before the node p.  
17. Attach a singly linked list to the end of another singly linked list.  
18. max() - find and return the maximum value in the list.   
19. min() - find and return the minimum value in the list.   
20. sum() - return the sum of all values in the list.   
21. avg() - return the average of all values in the list.  
22. sorted() - check and return true if the list is sorted, return false if the list is not sorted.  
23. insert(x) - insert node with value x into sorted list so that the new list is sorted.  
24. Reverse a singly linked list using only one pass through the list.  
25. Check whether two singly linked list have the same contents.

**Question 2.** Write a program in Java to implement a singly linked list of string values with 1 - 10 operations in the above list.  
**Question 3.** Write a program in Java to implement a doubly linked list of integer values with the above operations.  
**Question 4.** Write a program in Java to implement a circular linked list of integer values with the above operations.