COMP 2230 - Data Structure, Algorithm Analysis, and Program Design
Laboratory No. 2
Total: 60 points

Due date and time for submission: Midnight of Sunday, September 29, 2019
Method of submission: Moodle.tru.ca

In this lab, you should use arrays and linked list.

Problem 1: [10 Marks] Given a generic array with 'n' items (not only integers). Give a solution for checking whether there are any duplicate elements in the array or not? You just need to return a boolean (true or false). **State the complexity of your solution. Can you come up with another solution that has O(n logn) complexity? Explain.**

Problem 2: [10 Marks] Now consider the same problem as problem 1, but this time you only have positive integer numbers ranging from 0 to (n-1) in the array. **Can you find a duplicate in O(n) complexity? Implement the solution.**

Problem 3: [10 Marks] Given an array A[0 … n-1], where each element of the array represent a vote in the election. Assume that each vote is given as an integer representing the ID of the chosen candidate. Can you determine who wins the election? **What is the complexity of your solution?**
Hint: it is similar to finding the element that is repeated the maximum number of times.

[Practice problems on Linked List]

Problem 4: [10 Marks] Write a method that inserts a node in a sorted linked list.

HINTS: *Traverse the list and find a position for the element and insert it.*

Problem 5: [10 Marks] Write a method that will reverse a singly linked list.

Problem 6: [10 Marks] Assume N people have decided to elect a leader by arranging themselves in a circle and eliminating every M^{th} person around the circle, closing ranks as each person drops out. Find which person will be the last one remaining (with rank 1).

HINT: Assume the input is a circular linked list with N nodes and each node has a number (range 1 to N) associated with it. The head node has number 1 as data.