Data Structures and Algorithms – (COMP SCI 2C03)
Fall, 2021
Assignment 2

Due at 11:59pm on October 24th, 2021

- **No late assignment accepted.**
- Make sure to submit a version of your assignment ahead of time to avoid last minute uploading issues.
- Submit one assignment solution as a PDF file on Avenue.
- If the solution submitted by any student is identical to another student, both students will get a zero mark on the assignment.
- Present your algorithms in Java or Pseudocode (Pseudocode is preferred).
- It is advisable to start your assignment early.

This assignment consists of 4 questions, and is worth 20 marks.

1. Using a recursion tree show that $T(n) = T(n/3) + T(2n/3) + n^2$ is in $O(n^2 \log_2 n)$. Give the recurrence tree and explain your answer. You may omit the floor and ceiling functions for simplicity. [5 marks]
2. Suppose that the initial random shuffle is omitted in Quicksort. Give five arrays (with different forms) consisting of ten elements for which Quicksort uses the worst-case number of compares. [5 marks]
3. Explain how to use a max. priority queue to implement
   (a) a stack, and [3 marks]

(b) a queue. [3 marks]

4. Prove that if a node in a Binary Search Tree (BST) has two children, its successor has no left child and its predecessor has no right child. [4 marks]