

# Data Structures and Algorithms (EE 220): Homework 3

Submit to Ms. Spanner before 10am on Feb 25  
Email your programs to PA before the class on 25<sup>th</sup> Feb

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Note: Please provide proof of correctness for the algorithms that you propose. Also provide the complexity of the proposed algorithm.

**Problem 1: (5 pts)** Give an efficient algorithm to implement Queue data structure (First In First Out) using two Stacks (Last In First Out).

**Problem 2: (5 pts)** This is our first example of sorting algorithm. Consider a sequence of numbers  $a_1, a_2, \dots, a_n$ . The sequence given is nice in a sense that for every  $1 \leq i \leq n$  elements  $a_i$  satisfies the following property.  $a_i$  is either less than or equal to  $a_j$  for every  $1 \leq j \leq i$  or  $a_i$  is greater than or equal to  $a_j$  for every  $1 \leq j \leq i$ . Propose an efficient algorithm to sort the sequence in the ascending order.

**Problem 3: (5 pts)** *Palindrome* is a word that reads the same from both the sides, e.g. a word “madam”. Now, you have given a word in the dynamic linked list (not array). Propose an efficient algorithm to determine whether it is a palindrome or not.

**Problem 4: (10 pts)** Consider a linked list that stores polynomials. Such a linked list will store a structure with two attributes, namely, coefficient and the degree of each term in the polynomial. For example,  $x^3+6x+5$  will be stored as (3,1),(1,6) and (0,5) in the three elements of the list. Give an efficient algorithm for multiplication of two polynomials stored in the lists.

**Programming Assignment (15 pts)** Implement your algorithm using C or Java. The implementation should provide you experience in implementing and traversing linked list, which is one of the most widely used data structures.