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 25th 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 a our first example of sorting algorithm. Consider a sequence of numbers $a_1, a_2, \ldots, a_n$. 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.