CS 140: Algorithms(Fall 2016)
Homework 2
Dute time:October 24,2016

Please hand in C/C++ code to **algorithms_fall2016@outlook.com** with subject: **CS140HW2_StudentID_Name** before **24:00, October 24th.** (do check the subject before you send your email).
Please hand in handwriting in class.

1. $[20 points]$ 3 Sum problem. You are given an $N(N \leq 6000)$ integer number array and a integer number k, your task is find out 3 numbers in the array, which sum of them is clostest to k. Output the clostest sum.(what you need to do is to finish **EX1 3Sum**, hand in code!)

2. $[20 points]$ You are given three sequences A, B and C. The length of the three sequences is m, n and m+n respectively. In other words, the length of C is the sum of the length of A and B. Design an algorithm to check if A and B can be merged into C such that the order of all the letters in A and B is preserved. Example 1: A=aabb, B=cba, C=acabbab, then your algorithm should return true. Example 2: A=aabb, B=cba, C=aaabbbc, then your algorithm should return false.(what you need to do is to finish **EX2_MergeCheck**, hand in code!)

3. $[20 points]$ (CLRS) Stooge Sort. Professors Howard, Fine, and Howard have proposed the following elegant sorting algorithm:

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STOOGE_SORT(A, i, j)
  if A[i] > A[j]
     then exchange A[i]  A[j]
  if i+1 >= j
    then return
  k = floor((j-i+1)/3)
  STOOGE–SORT(A, i, j-k)
  STOOGE–SORT(A, i + k, j)
  STOOGE–SORT(A, i, j-k)
```

   a. Argue that, if n = length[A], then STOOGE-SORT(A, 1, length[A]) correctly sorts the input array A[1..n].
   b. Give a recurrence for the worst-case running time of STOOGE-SORT and a tight asymptotic bound on the worst-case running time.
   c. Compare the worst-case running time of STOOGE-SORT with that of insertion-sort,mergesort, heapsort, and quicksort. Is it better, worse, or about the same as compared to these known algorithms?(handwriting!)

4. $[20 points]$ Suppose that you are given a sorted sequence of distinct integers A1,A2, , An. Give an O(lg n) algorithm to determine whether there exists an i index such that Ai = i. For example, in -7, -1, 1, 4, 7 A4 = 4. In 2, 3, 4, 5, 6, 7, there is no such i. Please write pseudo-code and analysis it's complexity.(handwriting!)

5. $[20 points]$ You are given two sorted lists of size m and n. Give an O(lg m + lg n) time algorithm for computing the k-th smallest element in the union of the two lists. Please write down your algorithm and analysis it's complexity.(handwriting!)