Birla Institute of Technology and Science-Pilani, Hyderabad Campus
First Semester 2020-2021
Lab Sheet-12
CS G526: Advanced Algorithms and Complexity
Date: 20/01/21

General Instructions: Argue logically. Write it in a manner that explains your logic very clearly. Do not miss steps in between.

Problem-1: [20 pts] A local company named Abibas wants to sell socks. They make identical socks which can be worn in either foot (left or right). They made single socks of different sizes, now they are trying to pair the socks of similar or socks with a little different sizes so that customer would not notice. Now the problem is if they paired a sock with another with a significant difference (i.e. there is if a different in size of socks in a pair is greater than a than a specified threshold) Customer would notice and they could get into serious trouble. Given that the pair of socks with difference less than the threshold can only sold and others are to be discarded. find out the maximum no. of good pairs that can be sold.

input:

The first line contains two space-separated integers N and D where N is total number of socks and D is the threshold. The next N lines contain one integer each, the ith line giving the value of L[i].

output:

should be a single line containing no. of good pairs (strictly nothing else)

Example Input:

5 2

1

3

3

9

4

Output:

2

Explanation: The 5 socks have sizes 1, 3, 3, 9 and 4 respectively. The maximum allowed difference in the lengths of two socks forming a pair is at most 2. It is clear that the 4th sock (length 9) cannot be used with any other sock. The remaining 4 socks can can be paired as (1st and 3rd) and (2nd and 5th) to form 2 pairs of usable socks.

Problem-2: [40 pts] Suppose you are given a collection of integer intervals. Two intervals $[a, b]$ and $[c, d]$ are overlapping if there is an integer e such that $a \leq e \leq b$ and $c \leq e \leq d$. Otherwise, intervals are non-overlapping. What is the minimum number of intervals you need to remove so that rest of all are non-overlapping? For example, the collection $\{(1, 2), (2, 3), (1, 3)\}$ has overlapping intervals. Removing $(1, 3)$ makes all the intervals non overlapping.

Problem-3: [40 pts] Suppose you are given a set of words L along with two words "W1" and "W2". Your goal is to start from "W1" and arrive at "W2" through a series of transformation where at each transformation you can change only one letter of the word and the changed word must be in the set L. Find the length of shortest transformation sequence. For example, suppose L = {"hot", "cat", "hut", "hat"} and W1 = "hit" and W2 = "hat". The length of shortest transformation is 2. "hit" $\rightarrow$ "hat".