Programming Question - 6

Warning: The hard deadline has passed. You can attempt it, but **you will not get credit for it**. You are welcome to try it as a learning exercise.

Question 1

Download the text file here. (Right click and save link as).

The goal of this problem is to implement a variant of the 2-SUM algorithm (covered in the Week 5 lecture on hash table applications)

The file contains 500,000 positive integers (there might be some repetitions!).This is your array of integers, with the i^{th} row of the file specifying the i^{th} entry of the array.

Your task is to compute the number of target values t in the interval [2500,4000] (inclusive) such that there are *distinct* numbers x, y in the input file that satisfy $x + y = t$. (NOTE: ensuring distinctness requires a one-line addition to the algorithm from lecture.)

Write your numeric answer (an integer between 0 and 1501) in the space provided.

As an optional exercise, you might try implementing your own hash table for this question.

Question 2

Download the text file here.

The goal of this problem is to implement the "Median Maintenance" algorithm (covered in the Week 5 lecture on heap applications). The text file contains a list of the integers from 1 to 10000 in unsorted order; you should treat this as a stream of numbers, arriving one by one. Letting x_i denote the ith number of the file, the kth median m_k is defined as the median of the numbers $x_1, \ldots, x_k$. (So, if k is odd, then m_k is $((k+1)/2)$th smallest number among $x_1, \ldots, x_k$; if k is even, then m_k is the $(k/2)$th smallest number among $x_1, \ldots, x_k$.)

In the box below you should type the sum of these 10000 medians, modulo 10000 (i.e., only the last 4 digits). That is, you should compute $(m_1 + m_2 + m_3 + \cdots + m_{10000}) \bmod 10000$.

As an optional exercise, you might compare the performance achieved by heap-based and search-tree-based implementations of the algorithm.

In accordance with the Honor Code, I certify that my answers here are my own work.

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