

## Data Structures & Algorithms II– IS 2110

Second Year - Group Assignment

3 students per group

(Groups are given in a separate sheet)

**Deadline : 14<sup>th</sup> January 2020**

i) The file ***HashInt.txt*** (in a separate file) contains 100,000 integers all randomly chosen between 1 and 1,000,000 (there might be some repetitions). This is considered as an array of integers where the  $i^{\text{th}}$  row of the file gives you the  $i^{\text{th}}$  entry of the array. Given below are 9 "target sums", in increasing order: 231552, 234756, 596873, 648219, 726312, 981237, 988331, 1277361, 1283379. **You are required to implement the hash table-based algorithm and determine, for each of the 9 target sums  $x$ , whether or not  $x$  can be formed as the sum of two entries in the given array.**

Your answer should be in the form of a 9-bit string, with a 1 indicating "yes" for the corresponding target sum and 0 indicating "no". For example, if you discover that all of the target sums except for the 5<sup>th</sup> and the 7<sup>th</sup> one (i.e., except for 726312 and 988331) can be formed from pairs from the input file, then your answer should be "111101011" (without the quotes). The answer should be in the same order as the target sums listed above (i.e., in increasing order of the target).

ii) Individuals unfamiliar with a foreign language will often translate a sentence from one language to another using a dictionary and word-for-word substitution. While this does not produce the most elegant translation, it is usually adequate for short sentences, such as "Where is the train station?" Write a program that will read from two files. The first file contains a series of word-for-word pairs for a pair of languages. The second file contains text written in the first language. Examine each word in the text, and output the corresponding value of the dictionary entry. When an English sentence is given better process it only for the key words. If there are words not in the dictionary they can be printed in the output surrounded by square brackets.

### Sample 1:

Original sentence : Where is the train station?

Processed sentence : Where train station

French sentence: Où suite gare

### Sample 2:

Original sentence : Did it rain heavily yesterday

Processed sentence : rain heavily yesterday

French sentence : Pluie [heavily] hier

The word heavily is printed as [heavily] when it is not included in your foreign language text file.

You may prepare two text files one for English and one for the foreign language (may be French, Spanish or any other language that you are comfortable with). The word set would be of a reasonable size. A sample dictionary (*dictionary.xlsx*) is attached herewith and you may extend it with more words if necessary.

iii) Consider that substrings of a given input string are queried in terms of the indexes of the substrings to check whether the substrings are palindromes or not. For example, madam, noon and refer are palindromes.

**Example:** Consider that the input string is “step on no pets” and the substrings are - [0, 14], [8,14], [5,9], [0,3]. It is necessary to find out whether the substrings having the starting and ending indices as above is a palindrome or not.

[0, 14] → Substring “step on no pets” is a palindrome.

[8, 14] → Substring “no pets” is not a palindrome.

[5, 9] → Substring “on no” is not a palindrome.

[0, 3] → Substring “step” is a palindrome.

Consider that there are Q such queries to be answered and N be the length of the input string.

## The Task

With respect to the questions given above, the followings should be submitted

- executable programs (using either Java or C++ languages) with the above functionality given under questions (i), (ii) and (iii) however, without any run time errors.
- a report (*not more than 5 pages*) along with test cases clearly illustrating important code segments of each algorithm.

**Deadline: on or before 14<sup>th</sup> January 2020.** The executable program files (with your program code) and the report should be submitted electronically to the LMS in one Zip file. **It is important that you use the group number to name the zip file.** The cover page should contain the index numbers and the email addresses of the group members. State the execution procedure of your executable files if a special procedure has to be followed to execute them. The marks will be allocated for the group as given below:

- Programming solutions (you may use a language of your choice)
- A group report illustrating your approach and algorithms to the questions given above.

## **Plagiarism**

All programming work must be your own. All forms of plagiarism and cheating (for example downloading programs directly from the internet or copying from another student) are regarded seriously and could result in heavy penalties including failure in the assignment.

