Data Structures, Lab Exam

Group B (3-6 slot)

April 20, 2013

1 Problem 1 (Marks 100)

You are given a circuit board with MxN holes to place electrical components. There are K electrical components placed on the board, each of which has 2 terminals - the -ve terminal and +ve terminal.

The terminals of the i'th component are known to be placed at the holes: (xi+, yi+), (xi-, yi-). You have a 9v battery with its +ve terminal soldered to hole (0,0) and -ve terminal soldered to hole at (0,N-1).

A connection is made by soldering (an insulated) wire straight from one terminal to another (you are not allowed to use empty holes to make any junctions).

Your task is to optimally connect the +ve terminal of the battery with all K +ve terminals of the components; and the -ve terminal of the battery and all K -ve terminals of the components (forming junctions at any of the terminals is allowed), in order to minimize the total cost of the wiring. The cost of a wire is its squared length.

Since answer can be large, output it modulo 1000000007.

1.1 Input Format

First line contains the number of test cases T
First line of each test case contains three integers: M N K
It is followed by K lines, the ith line contains 4 integers: xi+ yi+ xi- yi- (the locations of terminals of the ith components)

1.2 Output Format

For each test case, print one line containing the minimal wiring cost of the circuit.

1.3 Sample Input

```
1
4 7 3
1 2 2 1
2 2 2 4
2 5 3 3
```

1.4 Sample Output

```
30
```

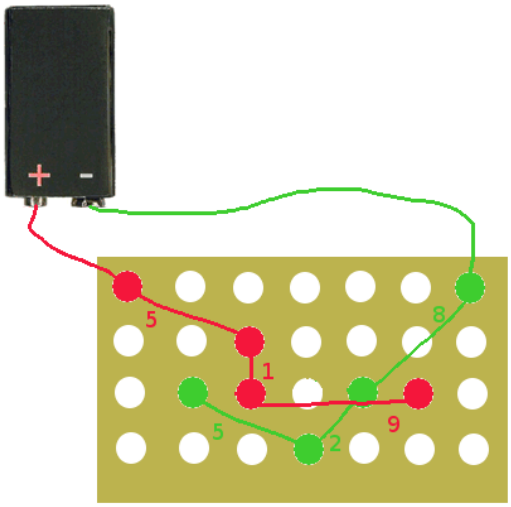

Figure 1: Explanation The above connections give a minimal cost wiring: (5+1+9) + (8+2+5) = 30

2 Problem 2 (Marks 100)

You are to find all the two-word compound words in a dictionary.
A two-word compound word is a word in the dictionary that is the concatenation of exactly two other words in the dictionary.

2.1 Input Format

Standard input consists of a number of lowercase words, one per line, in alphabetical order. There will be no more than 120,000 words.

2.2 Output Format

Your output should contain all the compound words, one per line, in alphabetical order.

2.3 Sample Input

a
alien
born
less
lien
never
nevertheless
new
newborn
the
zebra

2.4 Sample Output

alien
newborn

2.5 Constraints

3 Problem 3 (Marks 100)

Given a BST and 2 nodes present in the BST, find the lowest common ancestor of the two nodes.

3.1 Input Format

First line contains N, the number of nodes in the BST.
Next N lines contain 1 integer each. The numbers are in the order in which they were inserted into the BST.
The last line contains 2 integers P and Q.

3.2 Output Format

One integer which is the LCA of P and Q.

3.3 Sample Input

9
6
2
0
4
3
5
8
7
9
2 9

3.4 Sample Output

6