



# South African Computer Olympiad Training DAY 2



## Overview

Problem	Binary Search	Expensive Mail	Area	Puzzle
Author	Graham	Heinrich	Harry	Francois
Program name	bsrch.exe	mail.exe	area.exe	puzzle.exe
Source name	bsrch.pas	mail.pas	area.pas	puzzle.pas
	bsrch.jav	mail.jav	area.jav	puzzle.jav
	bsrch.cpp	mail.cpp	area.cpp	puzzle.cpp
Input file	bsrch.in	mail.in	area.in	puzzle.in
Output files(10)	bsrch.out	mail.out	area.out	puzzle.out
Time limit	2 seconds	5 seconds	2 seconds	1 seconds
Num. of tests	10	10	10	5
Points per test	10	10	10	20
<b>Total points</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

The maximum total score for Day2 is 300 points.



# Computer Olympiad Training

## Day 2



### A binary search with a difference!

**Graham Poulter**

#### *Description*

You have been recruited to help in the second step of deciphering the codes of an alien invasion force coming to attack Earth. So far, the codes have been turned into a square matrix of 1's and 0's, and a list of hidden code words (also binary) has been provided by a friendly alien visitor.

Your task is, given an input file with the matrix and a list of distinct words, to output for each word the number of times, which it occurs. At a particular position in the matrix, the word could lie in any of the four diagonal directions. Symmetrical words must not be counted twice if they lie in the same position, and in the provided dictionary there will never be two words, which are mirror images of each other.

Your program has a 5-second time limit and a 16Mb memory limit.

#### *Input Format (bsrch.in)*

**Line 1** Two integers,  $W$  and  $D$ .  $8 \leq W \leq 256$  is the height of the matrix (i.e. the number of lines of matrix data), and is also the width of the matrix in bits.  $1 \leq D \leq 60$  is the number of hidden binary "words" listed in the dictionary, whose occurrences must be counted.

**Lines 2 to  $W+1$**  Each line is one row of the matrix, represented as a literal bit-string of  $W$  1's and 0's.

**Lines  $W+2$  to  $W+D+1$**  This is the dictionary. Each line consists of one integer,  $L$ ,  $2 \leq L \leq 32$  representing the number of bits in the word, then a space, and then a bit-string of length  $L$ , such as 1010111 if  $L = 7$ , representing the word. The dictionary is provided sorted in increasing order of word-length, and for each length, in increasing order of binary value. The high bit is written first, and is the first bit to be checked when deciding if a word is present at a position.

#### *Output Format (bsrch.out)*

**Lines 1 to  $D$**  Output the number of occurrences of the word corresponding to the line number. Thus, for the example, the first line will be the number of occurrences of 11, the second the number of occurrences of 011, and so on.

#### *Sample Input*

```
8 5
00000000
00000000
00000000
00010100
00001000
00000100
00000010
00000001
2 11
3 011
3 100
3 111
6 111110
```

#### *Sample Output*

```
5
3
9
3
1
```

#### *Constraints:*

Time Limit: 2 seconds.



# Computer Olympiad Training Day 2



## The most expensive mail

### Heinrich Du Toit

#### *Description:*

The All-star postage service runs between  $N$  cities. But there is only certain route's that the couriers travel between the cities. Each route has a certain cost involved. You are to calculate a table of the costs involved in sending mail between the cities.

#### *Input:* (mail.in)

Line 1: ( $2 \leq N \leq 200$ ) The number of cities  
Line 2: ( $1 \leq R \leq 18000$ ) The number of routes.  
The next  $R$  lines each contain 3 integers describing a route.  
 $A_i$   $B_i$   $C_i$   $A_i$  and  $B_i$  are the numbers of the cities that the route connects and  $C_i$  is the cost of this route.

E.g.:  
3  
3  
1 2 5  
2 3 4  
1 3 10

#### *Output:* (mail.out)

The output is in the form of a table.  
 $N$  lines each containing  $N$  integers. (Space separated)  
Each integer describes the cost of sending mail between the 2 cities. E.g. integer 5 in line 8 will give the cost of sending mail from city 5 to city 8 of the other way.  
If it is impossible to send mail between 2 cities output -1 at the correct location.  
Note that the output will be symmetrical. If your output is not Symmetrical for 2 cities it will be regarded as wrong!  
The middle diagonal, Sending mail from a city to itself will be all 0's.

e.g.:  
0 5 9  
5 0 4  
9 4 0

#### *Score:*

A fully correct table will score 100%  
Your score will be partially calculated as the percentage of the table that is correct.

#### *Constraints:*

Time Limit: 5 seconds.  
( $0 \leq C_i \leq 1000$ )  
No more than 1 route between 2 cities.



# Computer Olympiad Training

## Day 2



### Area

#### Harry Wiggins

##### *Description*

Jack asked Jill to marry him. Jill wants to marry a clever guy, so she threw  $N$  rectangles on a Cartesian plane. All the edges of the rectangles are parallel to one of the  $x$ -axis or  $y$ -axis. If Jack could calculate the area they occupy, he could marry her.

##### *Task*

To help Jack you must write a program that finds the area that the  $N$  rectangles occupy, given the coordinates of the bottom left and top right corner.

##### *Input* (spot.in)

The first line will be  $N$  which is the amount of rectangles where  $2 \leq N \leq 2000$ . The following  $N$  lines will be of the form  $x_1, y_1, x_2, y_2$ . Where  $(x_1, y_1)$  and  $(x_2, y_2)$  is the bottom left and top right coordinate respectively. Note  $0 \leq x_i, y_i \leq 200$ .

##### *Sample input:*

```
4
1 2 3 4
1 1 2 2
0 6 7 8
2 3 5 7
```

##### *Output:* (spot.out)

The output will be a single line containing the area the  $N$  rectangles occupy.

##### *Sample output:*

```
27
```

##### *Constraints:*

Maximum time per test case is 2 seconds.

##### *Scoring*

There will be 10 test cases. If your answer is correct you'll get 10 points, otherwise you get 0 points.

