



South African Computer Olympiad Training DAY 1



Overview

Problem	Pooh sticks	Buck Rogers	Cars	Swap
Program name	pooh.exe	buck.exe	cars.exe	swap.exe
Source name	pooh.pas	buck.pas	cars.pas	swap.pas
	pooh.jav	buck.jav	cars.jav	swap.jav
	pooh.cpp	buck.cpp	cars.cpp	swap.cpp
Input file	pooh.in	buck.in	cars.in	swap.in
Output files(10)	pooh.out	buck.out	cars.out	swap.out
Time limit	5 seconds	5 seconds	5 seconds	5 seconds
Num. of tests	10	10	10	10
Points per test	10	10	10	10
Total points	100	100	100	100

The maximum total score for Day1 is 300 points.



Computer Olympiad Training

Day 1



Pooh Sticks

ACM Student Chapter College of Charleston

Winnie the Pooh enjoys spending lazy afternoons playing Pooh Sticks with his friends. The game is very simple. Each player finds a stick. Then, they all line up and look over the side of a bridge. All at once, they drop their sticks into the stream below and rush to the opposite side of the bridge. The stick that appears first from under the bridge is the winner.

To hype up this game a little more, Tigger suggested they keep a running win average every afternoon so they could see who's doing best. He then continued talking about Pooh Stick Internationals and such, but that isn't important. The first step is to calculate a win average for each player.

Owl and Rabbit developed a plan. The winner of each game should receive four points. Second place should receive three points. Third place should receive two points. Everyone else gets one point. Then, when the day is over, they divide everyone's score by the number of games played. The highest win average should be the player with the best sticks.

You are to read in a series of games. The first line contains a single integer N ($1 \leq N \leq 1000$) indicating the number of games played. Each game will be on a line by itself. There are no blank lines between games. Each game will list seven names in the order that the sticks appeared (there are no ties). The names will be: Pooh, Piglet, Rabbit, Owl, Tigger, Roo, and Eeyore.

You will then calculate the win average for each of the seven players and output each name, from the highest win average to the lowest, followed by that player's win average (rounded to two decimal places). A single space character should separate the player's name and win average. Players with the same averages may be listed in any order.

Sample Input

Input: pooh.in

```
4
Pooh Piglet Rabbit Owl Tigger Roo Eeyore
Roo Owl Eeyore Tigger Piglet Pooh Rabbit
Pooh Piglet Eeyore Tigger Rabbit Owl Roo
Pooh Eeyore Piglet Rabbit Owl Roo Tigger
```

Sample Output

Output: pooh.out

```
Pooh 3.25
Piglet 2.25
Eeyore 2.0
Roo 1.75
Owl 1.5
Rabbit 1.25
Tigger 1.0
```

Constraints

The number of games played, $1 \leq N \leq 1000$

Time

Maximum time per test case 5 seconds

Scoring

There will be 10 test cases, each of which will be weighted equally.



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Bucking the Asteroids

Graham Poulter

Help Buck Rogers navigate his way to a secret base hidden in the midst of a dangerous asteroid field. Your ship will start at $X = 0$, $Y = 0$ and must find a route through the asteroids to reach its destination.

For the purposes of Buck Roger's mission, the ship has no significant size, the universe is two-dimensional, and asteroids stay still, have their centres on integer coordinates, are perfectly circular, and have integer radii.

The entire "universe" lies within $0 \leq X, Y \leq 10,000$. Going outside the universe to get around the asteroids is not allowed.

Buck's ship uses a unique jump-drive system which takes him instantly to another point at any displacement from his present position. The only problem is that there must not be any obstacles between the current position and the destination of the jump.

Your first jump will therefore be relative to the coordinates (0,0), the second jump relative to your position after the first one, and so on. In a correct solution, the displacements of all the jumps added together will equal the coordinates of the destination, and the line segments they form will not intersect an asteroid at any point. Your path does not have to be optimal to be correct.

You may use floating point for calculations, but the jump drive may only output integer displacements for each jump.

If the radius of an asteroid is R , then the distance from the centre an asteroid to the destination or the edges of the universe will never be less than $2R$. For any two asteroids, the distance between their centres will never be less than $2R$ of the large asteroid plus R of the small one.

Your program will have a 5-second time limit, and 16Mb memory limit.

Input Format (buck.in)

Line 1 Two integers, X and Y , $100 \leq X, Y \leq 10,000$ representing the coordinates of your destination.

Line 2 One integer, $1 \leq N \leq 200$, being the number of asteroids in the simulation field.

Lines 3...N+2 Three integers each: X , Y and R . $10 \leq X, Y \leq 9,990$ are the integer coordinates of the asteroid, and $5 \leq R \leq 500$ is the integer radius of the asteroid.

Output Format (buck.out)

Line 1 An integer E representing the number of times you have used the jump drive. Any more than 1000 and the evaluator will assume that you got lost.

Lines 2 to E+1 Two integers X and Y on each line, representing the displacement the jump drive produces each time. At least one of the numbers must be non-zero, else you're going nowhere and your ship will nullify itself.

Sample Input

```
110 120
2
60 40 20
80 100 10
```

The destination is therefore at (110,120), and there are two asteroids, one with radius 20 at (60,40), and another with radius 10 at (80,100).

Sample Output

```
5
28 30
7 32
33 25
22 -1
20 34
```

The 5 is the number of jumps made. Each jump is then a displacement vector (X,Y) from the previous position, the first being relative to (0,0), your starting position. Add up all the displacement vectors and they will equal the destination vector of (110,120).

Time

Maximum time per test case 5 seconds

Scoring

There will be 10 test cases, each of which will be weighted equally.



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Cars Through The City

Heinrich Du Toit

Description:

You are given a start point an end point a few locations and roads between them. Calculate how many cars can drive from the start to the end without any road used more than once.

Input: cars.in

line 1: N The number of locations

line 2: R The number of roads

the next R lines: Each line describes a road with 2 integers:
The 2 locations it connects.

location 1 is the starting point.

location N is the ending point.

There can be more than 1 road between 2 locations.

e.g.

4

7

1 2

1 2

2 4

2 3

1 3

3 4

3 4

Output: cars.out

output contains 1 integer: The number of cars

Constraints:

Time limit: t.b.a (1.0 seconds on 1.3GHz Athlon)

($2 \leq N \leq 1000$)

($1 \leq R \leq 100000$)

Score:

A correct answer will score 100%

If your answer is illegal (Too much) you will score 0%

If you didn't get all the paths you will score a partial mark as long as your answer is more than half the optimal answer.



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Swap

Harry Wiggins

Description

Jack and Jill are best friends. They invented the game swap, where one person chooses a word from the dictionary and then jumble the letters around. The aim is to get from one word to the other by choosing two letters and to swap them.

Task

To help Jack and Jill you must write a program that finds the minimum number of swaps needed to accomplish this goal.

Input (swap.in)

The input will consist of 3 lines. The first line will be an integer X where $5 \leq X \leq 1000$ and the following two lines will be two words with X letters of the alphabet in uppercase.

Sample input:

```
5
BANANA
ABANAN
```

Output (swap.out)

The output will start with a single line containing the minimum number of swaps, followed by a list of the swaps used. One per line, in the order they were used to achieve the arrangement. A swap is described by using the index associated with each letter in the word.

In this case :

1	2	3	4	5	6
B	A	N	A	N	A
A	B	A	N	A	N

Sample output:

```
3
1 2
3 4
5 6
```

Time Limit

Maximum time per test case is 5 seconds.

Scoring

There will be 10 test cases.

If your output is X and the answer is Y and if $10 > X - Y > -1$, you get $10 + Y - X$ points.