CPT Intermediate Lesson 11 - Practice Problems

December 19, 2017

Once you have completed a problem, raise your hand and one of the execs will come around to check it.

Problem 1

You may have heard that no two snowflakes are alike. Your task is to write a program to determine whether this is really true. Your program will read information about a collection of snowflakes, and search for a pair that may be identical.

Each snowflake has six arms. For each snowflake, your program will be provided with a measurement of the length of each of the six arms. Any pair of snowflakes which have the same lengths of corresponding arms should be flagged by your program as possibly identical.

Input Specification

The first line of input will contain a single integer n, $0 < n \leq 100000$, the number of snowflakes to follow. This will be followed by n lines, each describing a snowflake. Each snowflake will be described by a line containing six integers (each integer is at least 0 and less than 10000000), the lengths of the arms of the snowflake. The lengths of the arms will be given in order around the snowflake (either clockwise or counterclockwise), but they may begin with any of the six arms. For example, the same snowflake could be described as 1 2 3 4 5 6 or 4 3 2 1 6 5.

Output Specification

If all of the snowflakes are distinct, your program should print the message: No two snowflakes are alike. If there is a pair of possibly identical snowflakes, your program should print the message: Twin snowflakes found.

Sample Input

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

Sample Output

Twin snowflakes found.

Problem 2 (CCC 2005)

In the rush to buy last-minute holiday presents, online customers frequently become targets of credit card fraud. As a result, many web browsers use a protection based on "RSA Numbers." A number is an RSA number if it has exactly four divisors. In other words, there are exactly four numbers that divide into it evenly. For example, 10 is an RSA number because it has exactly four divisors (1, 2, 5, 10). 12 is not an RSA number because it has too many divisors (1, 2, 3, 4, 6, 12). 11 is not an RSA number either. There is only one RSA number in the range 10...12. Write a program that inputs a range of numbers and then counts how many numbers from that range are RSA numbers. You may assume that the numbers in the range are less than 1000.

Input Specification
The first two lines are the lower and upper limits of the range.

Output Specification
Output how many numbers in the specified (inclusive) range meet RSA specifications.

Sample Input 1
10
12

Sample Output 1
1

Sample Input 2
11
15

Sample Output 2
2

Problem 3 (CCC 2007)

A winter truck driver is planning to drive from Whitehorse to Tuktoyaktuk, a route that includes the Dempster Highway and a stretch on the ice road that begins in Inuvik. The driver will cover a distance of 7000 km (a very rough estimate, but please suspend your disbelief), stopping each night at a motel. The driver has been provided with a list of locations of eligible motels, with the respective distance of each motel, measured in km, from the starting point in Whitehorse. Some of the motel locations are: 0, 990, 1010, 1970, 2030, 2940, 3060, 3930, 4060, 4970, 5030, 5990, 6010, 7000 but more motel locations may be added just before the trip begins.

Determine if it is possible to complete the journey if:

1. The trucking company insists that the driver travels a minimum distance of A km per day,
2. The law sets a maximum distance of B km per day, and
3. Each night, the driver must stay at an eligible motel (from the above list or the additional locations described below).

The driver is interested in different options when making the trip, and you are to write the program to calculate how many different options there are. For example, if no new motel locations are added, A = 1 and B = 500, then it is impossible to make the trip, i.e., the number of options is 0. If A = 970 and B = 1030 then there is one way to make the trip, but if A = 970 and B = 1040 then there are four ways to make the trip. There are two ways to make the trip if A = 970, B = 1030, and we add one stop at 4960.

Input Specification

The first two lines of the input are the minimum distance A and the maximum distance B ($1 \leq A \leq B \leq 7000$), both of which are integers. The third line of the input is an integer N ($0 \leq N \leq 20$), followed by N lines, each giving the location m of an additional eligible motel ($0 < m < 7000$). You should note that no two motels are located at the same distance from Whitehorse.

Output Specification

Output the number of different ways the driver can choose the motels to make the trip, under the given constraints.

Sample Input	**Sample Output**
1 500 0	0
970 1030 0	0

970 1040 0	4
970 1030 1 4960	2