CCC JUNIOR

Array/List, 2D Array/List

今日课程预览

- Homework from Week 2
- Math-Divisor Questions
- Math-Shift Questions
- Math-Digit Questions
- Math-GCD Questions
- Math-Arithmetic Sequence Questions
- 真题讲解

CCC 2019 J4 Flipper

https://www.cemc.uwaterloo.ca/contests/computing/2019/stage%201/juniorEF

- **Problem Description**

You are trying to pass the time while at the optometrist. You notice there is a grid of four numbers:

1	2
3	4

You see lots of mirrors and lenses at the optometrist, and wonder how flipping the grid horizontally or vertically would change the grid. Specifically, a “horizontal” flip (across the horizontal centre line) would take the original grid of four numbers and result in:

3	4
1	2

A “vertical” flip (across the vertical centre line) would take the original grid of four numbers and result in:

2	1
4	3

Your task is to determine the final orientation of the numbers in the grid after a sequence of horizontal and vertical flips.

Input and Output Specification

- **Input Specification**

  The input consists of four lines, each line having 4 space-separated integers.

- **Output Specification**

  Output either magic if the input is a magic square, or not magic if the input is not a magic square.

Sample Input and Output

Sample Input 1

HV

Output for Sample Input 1

4 3

2 1

Sample Input 2

VVHH

Output for Sample Input 2

1 2

3 4

CCC 2011 J3 Sumac Sequence

https://www.cemc.uwaterloo.ca/contests/computing/2011/stage1/juniorEn.pdf

- **Problem Description**

In a sumac sequence, t1, t2, .., tm, each term is an integer greater than or equal 0. Also, each term, starting with the third, is the difference of the preceding two terms (that is, $t_{n+2} = t_n - t_{n+1}$ for $n \geq 1$). The sequence terminates at tm if $t_{m-1} < t_m$. For example, if we have 120 and 71, then the sumac sequence generated is as follows: 120, 71, 49, 22, 27. This is a sumac sequence of length 5.

- **Input Specification**

  The input will be two positive numbers t1 and t2, with $0 < t2 < t1 < 10000$.

- **Output Specification**

The output will be the length of the sumac sequence given by the starting numbers t1 and t2.

Sample Input and Output

Sample Input
120
71
Output for Sample Input
5

- Note: Please use ArrayList and print the whole list out at last.

CCC 2010 J4 Global Warming

https://www.cemc.uwaterloo.ca/contests/computing/2010/stage1/juniorEn.pdf

- By way of another example, suppose the following average temperatures are observed:

3, 4, 6, 7.

In this case, there is a difference of one up, two up, then one up. We would consider the shortest cycle to be length two in this case: the cycle (+1, +2). Notice that this cycle occurs once, followed by one truncated occurrence of exactly the same cycle.

Your task is to find the shortest such cycle from a given sequence of temperatures.

Input and Output Specification

- Input Specification

The input consists of a number of test cases. Each test case starts with the number n ($1 \leq n \leq 20$), representing the number of temperatures in a sequence, followed by the sequence of n temperatures. You may assume that each temperature input is an integer in the range −1000...1000 inclusive. The numbers are separated by a single space. The last test case is indicated by a zero and should produce no output.

- Output Specification

For each test case, produce the length of the shortest temperature cycle. The cycle always exists, since the whole sequence could be treated as one long cycle.

Sample Input and Output

Sample Input	Output for this test case
7 3 4 6 4 5 7 5	3
3 1 3 5	1
3 1 4 5	2
4 3 4 6 7	2
0	

Math Questions

- How to get each digit from a number?
- How to determine an integer’s divisor?
- How to get common divisors?
- How to shift a number?
- How to reverse a number?
- How to reduce time complexity?

Divisor of n

- n%d == 0
- Always appears as pairs
- a – b = c + d
- a is the largest, cd is the middle ones, b should be the smallest

Example of Divisor

- A perfect number is a positive **integer** that is equal to the sum of its **positive divisors**, excluding the number itself. A **divisor** of an integer x is an integer that can divide x evenly. Given an integer n, return true *if* n *is a perfect number, otherwise return* false.
- **Input:** num = 28 **Output:** true

  Explanation: 28 = 1 + 2 + 4 + 7 + 14 1, 2, 4, 7, and 14 are all divisors of 28.

CCC 1997 Problem B Nasty Number

https://cemc.uwaterloo.ca/contests/computing/1997/stage1/1997CCCStage1Contest.pdf

- **Problem Description**

We will call a positive integer "Nasty" if it has at least two pairs of positive integer factors such that the difference of one pair equals the sum of the other pair.

For example, 6 is nasty since $6 = 1 \times 6 = 2 \times 3$, and $6 - 1 = 2 + 3$, and 24 is also nasty since $12 - 2 = 6 + 4$.

Write a program which accepts as input a list of positive integers and determine if each one is nasty or not.

Input and Output Specification

- **Input Specification**

The input file is a list of positive integers, one per line. The first number in the list is the number of integers to be tested, and is at most 20. The integers to be tested are all less than 32001.

- **Output Specification**

The output file should contain one line for each test value. Each line is to contain the test value and whether it is nasty or not.

Sample Input and Output

Sample Input 1

4
6
24
30420
10078

Output for Sample Input 1

6 is nasty
24 is nasty
30420 is nasty
10078 is not nasty

CCC 2017 J2 Shift Sum

https://cemc.uwaterloo.ca/contests/computing/2017/stage%201/juniorEF.pdf

- **Problem Description**

Suppose we have a number like 12. Let's define shifting a number to mean adding a zero at the end. For example, if we shift that number once, we get the number 120. If we shift the number again we get the number 1200. We can shift the number as many times as we want.

In this problem you will be calculating a shifty sum, which is the sum of a number and the numbers we get by shifting. Specifically, you will be given the starting number N and a non-negative integer k. You must add together N and all the numbers you get by shifting a total of k times.

For example, the shifty sum when N is 12 and k is 1 is: 12 + 120 = 132. As another example, the shifty sum when N is 12 and k is 3 is 12 + 120 + 1200 + 12000 = 13332.

Input and Output Specification

- **Input Specification**

  The first line of input contains the number N ($1 \leq N \leq 10000$). The second line of input contains k, the number of times to shift N ($0 \leq k \leq 5$).

- **Output Specification**

  Output the integer which is the shifty sum of N by k.

- **Sample Input**

  12

  3

- **Output for Sample Input**

  13332

CCC 2002 J4 Fraction Action

https://cemc.uwaterloo.ca/contests/computing/2002/stage1/2002CCCStage1Contest.pdf

- **Problem Description**

Many advanced calculators have a fraction feature that will simplify fractions for you.

You are to write a program that will accept for input a non-negative integer as a numerator and a positive integer as a denominator, and output the fraction in simplest form. That is, the fraction cannot be reduced any further, and the numerator will be less than the denominator. You can assume that all input numerators and denominators will produce valid fractions.

Keyboard input and screen output are expected.

Sample Input and Output

Numerator
28
Denominator
7

4

Numerator
13
Denominator
5

2 3/5

Numerator
0
Denominator
7

0

Numerator
55
Denominator
10

5 1/2

Binary Number Conversion

- How do you convert a decimal number into a binary number?

CCC 1996 Pattern Generator

https://cemc.uwaterloo.ca/contests/computing/1996/stage1/c-prob.html

- Write a program that repeatedly reads two numbers *n* and *k* and prints all bit patterns of length *n* with *k* ones in descending order (when the bit patterns are considered as binary numbers). You may assume that 30 >= *n* > 0, 8 > *k* >= 0, and *n* >= *k*. The first number in the input gives the number of pairs *n* and *k*. The numbers *n* and *k* are separated by a single space. Leading zeroes in a bit pattern should be included. See the example below.

Sample Input
3
2 1
2 0
4 2

Sample Output
The bit patterns are
10
01
The bit patterns are
00

The bit patterns are
1100
1010
1001
0110
0101
0011