Indian Statistical Institute
M.Tech.(CS) — First Year
Programming Test 2021
Date: 23.11.2021 Duration: 10:00–12:30

INSTRUCTIONS

1. **Please make sure that your programs adhere strictly to the specified input and output format.**
2. **Naming convention for your programs: `cs21xx-skilltest-progy.c`, where xx denotes your roll number and y (= 1, 2, 3) denotes the question number.**
3. **In order to pass, you have to score at least 40 out of 60 in this test.**
4. **If the submissions from multiple students match significantly, all the matching submissions will be barred from evaluation.**

1. For a sequence of n (> 1) natural numbers $S =< a_1, a_2, \ldots, a_n >$, define

$$p(S) = \sum_{i=1}^{n} a_i$$

and

$$q(S) = \sum_{i=1}^{n-1} (a_i - a_{i+1}).$$

We say S is an $\mathcal{A}$-sequence if the following holds:

(a) $a_1 \geq a_2 \geq a_3 \geq \cdots \geq a_n$

(b) $p(S)$ and $q(S)$ are relatively prime.

Given a sequence S of natural numbers as user input, write a program to verify whether the given sequence is an $\mathcal{A}$-sequence or not.

[20 marks]

Input Format

The input (to be read from stdin) will start with the number of elements in the sequence followed by the sequence. The sequence may be read as an array of integers.

Output Format

The output (to be printed to stdout) will show whether the input sequence is $\mathcal{A}$-sequence or not.

Sample Input 0

3 7 5 3

Sample Output 0

A-sequence

Sample Input 1

5 50 40 30 20 10

Sample Output 1

NOT A-sequence

Sample Input 2

4 1 2 3 4

Sample Output 2

NOT A-sequence

2. Suppose you are given with a file consisting of English alphabets only. You are asked to add a particular prefix to all the occurrences of a specific string (case-sensitive) in the said file. Write a program that can serve the purpose.

[20 marks]

Input Format

Input will be provided in a file. The name of the file is to be taken as a command-line argument. The file will contain characters from the English alphabet.

Output Format

Output will be generated in the same input file.

Command-line Arguments

```
./prog <input_filename> <string> <prefix>
```

Sample Input 1

```
Input from command-line:
./prog input.txt set data

Content of input.txt before execution of the program:
This was a set of items.
```

Sample Output 1

```
Contents of input.txt after execution of the program:
This was a dataset of items.
```

Sample Input 2

```
Input from command-line:
./prog input.txt SO SO

Content of input.txt before execution of the program:
There was an SOS message
```

Sample Output 2

```
There was an SOSOS message
```

Sample Input 3

```
Input from command-line:
./prog input.txt hi bye

Content of input.txt before execution of the program:
Say Hi to me!!!
```

Sample Output 3

```
Contents of input.txt after execution of the program:
Say Hi to me!!!
```

3. Recall that any arbitrary pair of hands (denoting `hour`, `minute`, and `second`) of a clock forms two possible angles within themselves. Write a program that takes an angle (any one of the possible two) between the other pair of hands (`minute` and `hour`) and returns whether there is any valid time satisfying the given angle or not, assuming that the `second` hand of a clock is residing at 12. Consider that an angle between a pair of hands of a clock will always remain within $[0, 2\pi]$.

[20 marks]

Input Format

The input (to be read from stdin) is to be taken as a pair of integers (say m and n) representing the fractional angle between the `minute` and `hour` hands (in radian), i.e. the angle is $\frac{m\pi}{n}$ radian.

Output Format

The output (to be printed to stdout) will show whether the angle is VALID or INVALID.

Sample Input 0

1 1

Sample Output 0

VALID

Sample Input 1

5 2

Sample Output 1

INVALID

Sample Input 2

7 11

Sample Output 2

INVALID