Lëtzebuerger Informatiksolympiad 2022

Qualification round

Task Descriptions

INSTRUCTIONS

- The allowed programming languages are Python 3, Java and C/C++.
- All the programs must be realized in the form of a console application. For instructions how to realize a console application in the allowed programming languages, please refer to the remarks on the site *www.infosolympiad.lu* under the heading *Les questionnaires.*
- Under the input of the program is meant either the direct entry of data from the keyboard or the redirection from a text file in console mode. Under output of the program is meant either the direct display of data to the screen or the redirection to a text file in console mode.
- The formats of the input and output data shown in the execution examples must absolutely be respected.
- For testing, submitting and evaluating a program, the source file with a file extension "PY", "java" or "c/cpp") must be uploaded to the automated online judge CMS (Contest Management System), accessible via the homepage *www.infosolympiad.lu* or directly via the URL *http://158.64.46.20*. Please use your personal login (username & password) to access your account on the CMS. The filename of the single source file should be the same than the task name. Please refer to the CMS for technical details on how to test and submit a program.
- Please refer to the CMS for technical details like time limits and memory limits as well as compilation commands.
- You have the right to ask questions via the CMS, but the answers will not teach you how to use a programming language nor tell you how to solve the tasks by using a specific algorithm. The questions should be in relation with the CMS or should treat clarification issues concerning the task descriptions.

Task 1 — divisors — 25 points

Description

In high school, an advantage of scoring class papers out of 60 points is, that this number can be subdivided into many sub-scores. Indeed, the number 60 has 10 different sub-scores, 1 and 60 excluded, namely 2, 3, 4, 5, 6, 10, 12, 15, 20 and 30. In this task we want you to generalize and find the number that has the largest number of divisors, this in a given interval.

Task

Write a program to calculate the integer number ***N*** that has the largest number of divisors in a given integer interval [***A***; ***B***], bounds included. If several values for ***N*** exist, only the smallest value is considered.

Constraint

$1 \leq A < B \leq 2^{15} - 1$

Input and output of the program

Input data

The input consists of 2 integer numbers ***A*** and ***B***, separated by a space.

Output data

The output consists of the calculated number ***N***.

Execution examples

Input	Output
1 60	60

Input	Output
1 100	60

Input	Output
10 50	48

Input	Output
50 10000	7560

Input	Output
8 10	8

Task 2 — mole — 25 points

Description

A mole (*Deutsch: ein Maulwurf, Français: une taupe*) has dug a long tunnel, partitioned in ***S*** segments numerated from 0 to ***S*** - 1. Imagine the mole is situated in segment number ***M,*** an underground enemy is located in segment number ***E*** and the only exit from the tunnel exists in segment number ***X***. The question is, if the mole can escape the enemy safely. But attention, the enemy and the mole are moving with the same speed (the mole towards the exit and the enemy towards the mole), so the mole should be at the exit first to escape safely.

Task

Write a program to determine if the mule can escape safely from a given tunnel.

Example 1

If ***S*** = 8, ***M*** = 5, ***E*** = 2 and ***X*** = 7 the situation can be illustrated as follows.

0	1	2	3	4	5	6	7
							Exit

The mole can escape safely.

Example 2

If ***S*** = 8, ***M*** = 6, ***E*** = 4 and ***X*** = 3, the situation can be illustrated as follows.

0	1	2	3	4	5	6	7
			Exit				

Unfortunately, the mole cannot reach the exit safely. No chance.

Example 3

If ***S*** = 8, ***M*** = 7, ***E*** = 0 and ***X*** = 4, the situation can be illustrated as follows.

0	1	2	3	4	5	6	7
				Exit			

The mole can escape safely because he reaches the exit first.

Example 4

If ***S*** = 8, ***M*** = 1, ***E*** = 5 and ***X*** = 3, the situation can be illustrated as follows.

0	1	2	3	4	5	6	7
			Exit				

Unfortunately, the mole cannot reach the exit safely. No chance.

Constraints

$3 \leq S \leq 100$

$M, E, X \in \mathbb{N}$ and $M, E, X \in [0; S-1]$, $M \neq E \neq X$.

Input and output of the program.

Input data

The input consists of 4 lines: the first line represents ***S***, the second line represents ***M***, the third line represents ***E*** and the fourth line represents ***X***.

Output data

The output consists of the text “Safe escape” if the mule can escape safely or of the text “No chance” if not.

Execution example (corresponding to example 1)

Input	Output
8 5 2 7	Safe escape

Task 3 autokey 25 points

Description

You finally succeeded at transcribing an ancient manuscript into a modern-day alphabet, but most of the texts you find are complete gibberish. A college barges in and hands you a tablet that explains that the letters are ciphered the following way: 1. The first letter is kept. 2. You take the next letter and add to it the last encrypted letter and repeat until end. This addition refers to the tabula recta (cf. remark). You decide to write a program to decipher and cipher words using this method.

Example

Here a more detailed explanation:

1. CODE → C---
2. O+C gives Q → CQ--
3. D+Q gives T → CQT-
4. T+E gives X → CQTX

Task

Write a program that ciphers or deciphers a word using the described method.

Constraint

The words are given in UPPERCASE without accents and do not contain empty spaces.

Input and output of the program

Input data

The input consists of an arbitrary number of queries where each query has 2 lines:

1. The first line is a lowercase letter: ***d*** for decoding, ***e*** for encoding and ***f*** to signify the end of the query.
2. The second line contains the word to de-/cypher. There is no second line if the first line is ***f***.

Output data

The output consists of one line for each given query.

Execution examples

Input	Output
e CODE f	CQTX

Input	Output
d CQTX e LIO f	CODE LTH

Distribution of points

Subtask	Points	Description
1	10	Only encodings are asked
2	15	No additional constraints

Remark - tabula recta

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
B	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A
C	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B
D	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C
E	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D
F	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E
G	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F
H	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G
I	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H
J	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I
K	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J
L	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K
M	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L
N	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M
O	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N
P	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Q	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
R	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
S	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
T	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
U	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
V	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
W	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
X	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Y	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
Z	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y

Task 4 news 25 points

Description

In some countries radio stations need to encrypt their news before reading them.

Reading the encrypted words right can take a while and delay the whole news programme. In this question, you must figure out how much time it needs to read such a news programme.

You are given a table that tells you, as a function of the number of vowels (‘a’, ‘e’, ‘i’, ‘o’, ‘u’, ‘y’) and the number of consonants in the word, how long it will take to pronounce a certain word correctly. You will be given the list of words to be read and as a result you must output the total duration of the news programme.

Input and output of the program

Input data

The first line contains two integers 0 <= ***L*** <= 30, 0 <= ***n*** <= 100000. ***L*** is the (larger of the) maximum number of vowels/consonants in any word, and ***n*** is the number of words.

This is followed by ***L*** + 1 lines, each with ***L*** + 1 integers. Entry ***j*** in row ***i*** contains an integer 0 <= $p_{i,j}$ 100, which tells you how many seconds it takes to pronounce a word with ***i*** vowels and ***j*** consonants; here, 0 <= ***i***, *j* <= ***L***.

This is followed by ***n*** lines, each containing a string of length at most 2***L***, consisting only of lowercase letters. This string is the word, and it will contain at most ***L*** vowels and at most ***L*** consonants.

Output data

The output consists of the total duration of the news programme in seconds.

Execution examples

Input	Output
4 4 1 2 8 25 50 1 1 1 3 8 7 6 4 8 10 6 5 5 4 4 15 12 10 10 10 cthulu amoeba czsz	71

Input	Output
1 2 0 5 1 10 a b	6