

INDIAN STATISTICAL INSTITUTE

MTech(CS) I year 2020-2021

Subject: Computing Laboratory

Lab Test 1 (18 January, 2021)

Total: $3 \times 20 = 60$ marks Duration: 3 hours

SUBMISSION INSTRUCTIONS

1. Please make sure that your programs adhere strictly to the specified input and output format.
2. Please adhere to the file naming conventions discussed in class.

IMPORTANT: Insert a single alpha-numeric string of your choice, 6-8 characters long, in the name given above as shown in the examples below. Think of this string as something like a security password, except that you are not required to remember the string.

Examples: `cs20XX-labtest1-abcdef-prog1.py`, `mnopqr-cs20XX-labtest1-prog2.py`, `cs20XX-labtest1-prog2-uvwxyz.py`.

3. Please upload your programs to `/user1/perm/pdslab/2020/labtest1/cs20XX/` on the ISI server (192.168.64.35), as advised in class.

NOTE: Unless otherwise specified, all programs should take the required input from stdin, and print the desired output to stdout.

Q1. Lottery JackPot. A group of n friends F_1, F_2, \dots, F_n decide to try their luck at a lottery. Each person F_i buys a number X_i of lottery tickets. Each lottery ticket has a digit (0-9) printed on it. The rule for winning the jackpot is as follows. Each person is asked to announce the *largest multiple of 3* that can be formed by selecting and arranging the digits on his lottery tickets. The person who has the highest such multiple wins the jackpot. Note that a person's tickets may not have distinct digits on them.

Input Format

For a group of n friends, the input will consist of $n + 1$ lines. The first line will contain just the number n . The remaining n lines will contain X_1, X_2, \dots, X_n digits respectively.

Output Format

If F_j wins, your program should print j . If it is a tie then print all the indices in increasing order. If there is no winner print `None`. Note that counting starts from 1, not 0.

Sample Input 0

```
2
9 1 8
6 0 7 8 1
```

Sample Output 0

2

Explanation: F_1 buys 3 lottery tickets, numbered 9, 1 and 8, while F_2 buys 5 lottery tickets, numbered 6, 0, 7, 8, 1. The greatest multiple of 3 that F_1 and F_2 can form are 981 and 8760 respectively. Thus, F_2 wins.

Sample Input 1

4
1 2 3
9
3 1 2
3 6

Sample Output 1

1 3

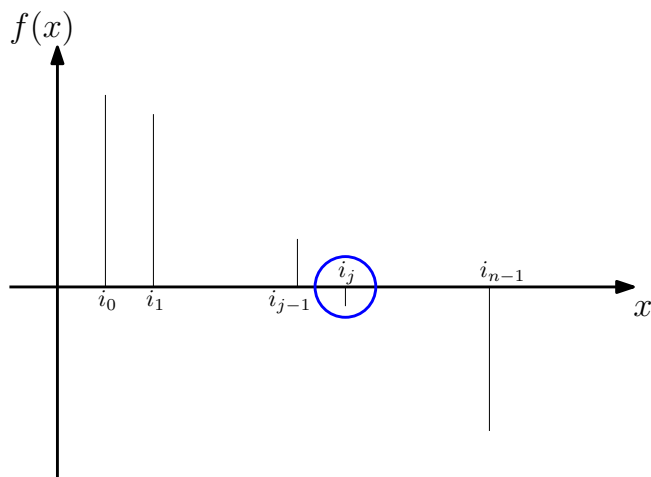
Sample Input 2

3
5 5
1 1
7

Sample Output 2

None

- Q2. Recall that a function f is said to be strictly decreasing if $f(x) < f(y)$ whenever $x > y$. Consider a strictly decreasing function $f : \mathbb{N} \rightarrow \mathbb{Z}$ (i.e., f is defined on the natural numbers, and takes integer values). Suppose that f has been evaluated at n points, $0 < i_0 < i_1 < i_2 < \dots < i_{n-1}$, and the values of $f(i_k)$ have been stored in a list (say L) for $k = 0, 1, 2, \dots, n - 1$. Write a program that takes the list L as input, and computes the smallest j for which $f(i_j) < 0$, as shown in the figure below. You will get full credit only if your algorithm runs in $\Theta(\log n)$ time and $\Theta(1)$ extra space.



Input Format

The input will consist of a single line, containing the values $f(i_0), f(i_1), \dots, f(i_{n-1})$.

Output Format

Your program should print a single integer, namely the smallest j for which $f(i_j) < 0$. If no such $j \in \{0, 1, 2, \dots, n - 1\}$ exists, your program should print n .

Sample Input 0

400 11 10 5 4 3 1 0 -20 -100 -200

Sample Output 0

8

Sample Input 1

32 16 8 5 4 3 2 1 0

Sample Output 1

9

- Q3. Let us define a number as **CONJOINED TWIN** if it can be represented as the sum of two *distinct* numbers that are reverse of each other (e.g., 12 and 21 are reverse of each other). Note that, for being reverse to each other they must have same number of significant digits. Hence, 100 is not reverse of 1 (considering 1 as 001). Write a program to show all the **CONJOINED TWIN** numbers that are no more than n in increasing order.

Input Format

The input (to be read from stdin) is the upper bound (inclusive) n .

Output Format

The output (to be printed to stdout) will show all the **CONJOINED TWIN** numbers less than or equal to n . If there is no **CONJOINED TWIN** number within the specified bound n it must print **None**.

Sample Input 0

10

Sample Output 0

None

Sample Input 1

100

Sample Output 1

33 44 55 66 77 88 99

Sample Input 2

325

Sample Output 2

33 44 55 66 77 88 99 110 121 132 143 154 165 176 187 303 323