The CENTRE for EDUCATION
in MATHEMATICS and COMPUTING

2016 Canadian Computing Competition: Junior Division

Sponsor:

WATERLOO
MATHEMATICS

Canadian Computing Competition
Student Instructions for the Junior Problems

1. You may only compete in one competition. If you wish to write the Senior paper, see the other problem set.

2. Be sure to indicate on your **Student Information Form** that you are competing in the **Junior** competition.

3. You have three (3) hours to complete this competition.

   - if your supervising teacher is grading your solutions, all input is from the keyboard;
   - if you are using the On-line CCC grader, all input is from standard input;
   - all output is to standard output (i.e., to the screen).

   There is no need for prompting. Be sure your output matches the expected output in terms of order, spacing, etc. IT MUST MATCH EXACTLY!

4. Do your own work. Cheating will be dealt with harshly.

5. Do not use any features that the judge (your teacher or the On-line Grader) will not be able to use while evaluating your programs. In particular, take note of the type and version of the compiler used for your programming language on the On-line Grader if you are using the On-line Grader.

6. Books and written materials are allowed. Any machine-readable materials (like other programs which you have written) are *not* allowed. However, you are allowed to use "standard" libraries for your programming languages; for example, the STL for C++, java.util.*, java.io.*, etc. for Java, and so on.

7. Applications other than editors, compilers, debuggers or other standard programming tools are **not** allowed. Any use of other applications will lead to disqualification.

8. If your teacher is grading, please use file names that are unique to each problem: use `j1.pas` or `j1.c` or `j1.java` (or some other appropriate extension) for Problem J1. If you are using the On-line Grader, follow naming rules described there (and take particular note of file and class names for Java programs).

9. Your program will be run against test cases other than the sample ones. Be sure you test your program on other test cases. Inefficient solutions may lose marks for some problems. Be sure your code is as efficient (in terms of time) as possible. You will have at most 5 seconds of execution time per test case.

10. Check the CCC website at the end of March to see how you did on this contest and to see who the prize winners are. The CCC website is:

    `www.cemc.uwaterloo.ca/ccc`

Problem J1: Tournament Selection

Problem Description
Each player in a tournament plays six games. There are no ties. The tournament director places the players in groups based on the results of games as follows:

- if a player wins 5 or 6 games, they are placed in Group 1;
- if a player wins 3 or 4 games, they are placed in Group 2;
- if a player wins 1 or 2 games, they are placed in Group 3;
- if a player does not win any games, they are eliminated from the tournament.

Write a program to determine which group a player is placed in.

Input Specification
The input consists of six lines, each with one of two possible letters: `W` (to indicate a win) or `L` (to indicate a loss).

Output Specification
The output will be either `1`, `2`, `3` (to indicate which Group the player should be placed in) or `-1` (to indicate the player has been eliminated).

Sample Input 1
```
W
L
W
W
L
W
```

Output for Sample Input 1
```
2
```

Sample Input 2
```
L
L
L
L
L
L
```

Output for Sample Input 2
```
-1
```

Problem J2: Magic Squares

Problem Description
Magic Squares are square arrays of numbers that have the interesting property that the numbers in each column, and in each row, all add up to the same total.

Given a 4×4 square of numbers, determine if it is magic square.

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 1
```
16 3 2 13
5 10 11 8
9 6 7 12
4 15 14 1
```

Output for Sample Input 1
```
magic
```

Explanation for Output for Sample Input 1
Notice that each row adds up to 34, and each column also adds up to 34.

Sample Input 2
```
5 10 1 3
10 4 2 3
1 2 8 5
3 3 5 0
```

Output for Sample Input 2
```
not magic
```

Explanation for Output for Sample Input 2
Notice that the top row adds up to 19, but the rightmost column adds up to 11.

Problem J3: Hidden Palindrome

Problem Description
A *palindrome* is a word which is the same when read forwards as it is when read backwards. For example, `mom` and `anna` are two palindromes.

A word which has just one letter, such as `a`, is also a palindrome.

Given a word, what is the longest palindrome that is contained in the word? That is, what is the longest palindrome that we can obtain, if we are allowed to delete characters from the beginning and/or the end of the string?

Input Specification
The input will consist of one line, containing a sequence of at least 1 and at most 40 lowercase letters.

Output Specification
Output the total number of letters of the longest palindrome contained in the input word.

Sample Input 1
```
banana
```

Output for Sample Input 1
```
5
```

Explanation for Output for Sample Input 1
The palindrome `anana` has 5 letters.

Sample Input 2
```
abracadabra
```

Output for Sample Input 2
```
3
```

Explanation for Output for Sample Input 2
The palindromes `aca` and `ada` have 3 letters, and there are no other palindromes in the input which are longer.

Sample Input 3
```
abba
```

Output for Sample Input 3
```
4
```

Problem J4: Arrival Time

Problem Description
Fiona commutes to work each day. If there is no rush-hour traffic, her commute time is 2 hours. However, there is often rush-hour traffic. Specifically, rush-hour traffic occurs from 07:00 (7am) until 10:00 (10am) in the morning and 15:00 (3pm) until 19:00 (7pm) in the afternoon. During rush-hour traffic, her speed is reduced by half.

She leaves either on the hour (at XX:00), 20 minutes past the hour (at XX:20), or 40 minutes past the hour (at XX:40).

Given Fiona's departure time, at what time does she arrive at work?

Input Specification
The input will be one line, which contains an expression of the form `HH:MM`, where `HH` is one of the 24 starting hours (00, 01, . . ., 23) and `MM` is one of the three possible departure minute times (00, 20, 40).

Output Specification
Output the time of Fiona's arrival, in the form `HH:MM`.

Sample Input 1
```
05:00
```

Output for Sample Input 1
```
07:00
```

Explanation for Output for Sample Input 1
Fiona does not encounter any rush-hour traffic, and leaving at 5am, she arrives at exactly 7am.

Sample Input 2
```
07:00
```

Output for Sample Input 2
```
10:30
```

Explanation for Output for Sample Input 2
Fiona drives for 3 hours in rush-hour traffic, but only travels as far as she normally would after driving for 1.5 hours. During the final 30 minutes (0.5 hours) she is driving in non-rush-hour traffic.

Sample Input 3
```
23:20
```

Output for Sample Input 3

```
01:20
```

Explanation for Output for Sample Input 3

Fiona leaves at 11:20pm, and with non-rush-hour traffic, it takes two hours to travel, so she arrives at 1:20am the next day.

Problem J5: Tandem Bicycle

Problem Description
Since time immemorial, the citizens of Dmojistan and Pegland have been at war. Now, they have finally signed a truce. They have decided to participate in a tandem bicycle ride to celebrate the truce. There are N citizens from each country. They must be assigned to pairs so that each pair contains one person from Dmojistan and one person from Pegland.

Each citizen has a cycling speed. In a pair, the fastest person will always operate the tandem bicycle while the slower person simply enjoys the ride. In other words, if the members of a pair have speeds a and b, then the *bike speed* of the pair is $\max(a, b)$. The *total speed* is the sum of the N individual *bike speeds*.

For this problem, in each test case, you will be asked to answer one of two questions:

- Question 1: what is the minimum total speed, out of all possible assignments into pairs?
- Question 2: what is the maximum total speed, out of all possible assignments into pairs?

Input Specification
The first line will contain the type of question you are to solve, which is either 1 or 2.

The second line contains N ($1 \leq N \leq 100$).

The third line contains N space-separated integers: the speeds of the citizens of Dmojistan.

The fourth line contains N space-separated integers: the speeds of the citizens of Pegland.

Each person's speed will be an integer between 1 and $1\ 000\ 000$.

For 8 of the 15 available marks, questions of type 1 will be asked. For 7 of the 15 available marks, questions of type 2 will be asked.

Output Specification
Output the maximum or minimum total speed that answers the question asked.

Sample Input 1
```
1
3
5 1 4
6 2 4
```

Output for Sample Input 1
```
12
```

Explanation for Output for Sample Input 1
There is a unique optimal solution:

- Pair the citizen from Dmojistan with speed 5 and the citizen from Pegland with speed 6.
- Pair the citizen from Dmojistan with speed 1 and the citizen from Pegland with speed 2.
- Pair the citizen from Dmojistan with speed 4 and the citizen from Pegland with speed 4.

Sample Input 2

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

Output for Sample Input 2

```
15
```

Explanation for Output for Sample Input 2
There are multiple possible optimal solutions. Here is one optimal solution:

- Pair the citizen from Dmojistan with speed 5 and the citizen from Pegland with speed 2.
- Pair the citizen from Dmojistan with speed 1 and the citizen from Pegland with speed 6.
- Pair the citizen from Dmojistan with speed 4 and the citizen from Pegland with speed 4.

Sample Input 3

```
2
5
202 177 189 589 102
17 78 1 496 540
```

Output for Sample Input 3

```
2016
```

Explanation for Output for Sample Input 3
There are multiple possible optimal solutions. Here is one optimal solution:

- Pair the citizen from Dmojistan with speed 202 and the citizen from Pegland with speed 1.
- Pair the citizen from Dmojistan with speed 177 and the citizen from Pegland with speed 540.
- Pair the citizen from Dmojistan with speed 189 and the citizen from Pegland with speed 17.
- Pair the citizen from Dmojistan with speed 589 and the citizen from Pegland with speed 78.
- Pair the citizen from Dmojistan with speed 102 and the citizen from Pegland with speed 496.

This sum yields $202 + 540 + 189 + 589 + 496 = 2016$.