1. Introduction to the judge environment

2. Prefix sum/precomputation technique

Sample Problem: Even Pairs

Input:

- ightharpoonup first line: a positive integer n
- \blacktriangleright second line: a sequence $x_0, \ldots, x_{n-1} \in \{0, 1\}$

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- ightharpoonup first line: a positive integer n
- second line: a sequence $x_0, \ldots, x_{n-1} \in \{0, 1\}$

Output: a single line containing the number of pairs $0 \le i \le j < n$ such that

$$x_i + \cdots + x_j$$

is even.

- (1) for all pairs $i \leq j$, compute the sum $x_i + \cdots + x_j$
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A few points, but also a **TIMELIMIT** error on harder test sets!

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- ▶ this type of analysis is **very important** in this course.

Observation:

$$x_i + \dots + x_j = \sum_{a=0}^{j} x_a - \sum_{b=0}^{i-1} x_b$$

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- (3) O = # of S_i that are odd

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Running time: $\Theta(n)$

Even Pairs - Conclusion

Technique: Partial sums/Precomputing

- ▶ Precomputing partial sums allows computing the sum of the elements in an interval in constant time.
- More generally, precomputing certain values can speed up the running time of an algorithm.

Judge Feedback

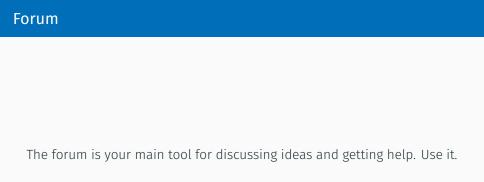
Besides **CORRECT**, **TIMELIMIT**, and **WRONG-ANSWER**, the judge can give the following feedback:

ASSERTION-FAILURE SIGABRT: memory screw-up or assertion failure

SEGMENTATION-FAULT SIGSEGV: memory screw-up (e.g. out-of-bounds)

RUN-ERROR nonzero exit status

FORBIDDEN bad syscall or other safety



Of course, you will only learn if you first try to solve the problems **on** your own.

1. Apply spoiler warnings

Example

SPOILER<<<

Set this text to have a white foreground. It will then be invisible unless marked. The <<< ... >>> exploit a bug in the email plugin to also remove the text in plain-text email.



- 1. Apply spoiler warnings
- 2. Describe the problem, not your guesses or summaries

Example

```
Bad When I compile, it tells me it cannot find it.
```

```
Good When I run g++ -o foo foo.cpp, I get
bash: $'g++\302\240-o': command not found
```

- 1. Apply spoiler warnings
- 2. Describe the problem, not your guesses or summaries
- 3. Code: describe what fails and what you expect instead

Example

Bad The code below doesn't work. Help?

Good I am trying to solve Problem 1. I tried strategy **something**. My code is below. For some reason, when running it on the provided test case it emits **no solution** instead of **1**. What am I doing wrong?

- 1. Apply spoiler warnings
- 2. Describe the problem, not your guesses or summaries
- 3. Code: describe what fails and what you expect instead
- 4. Code: post minimal examples

Example

Bad When I call .foo() on a vector, it segfaults. Bug!

Good I am trying to **something**. The code is below. I get a segfault in the line that calls **.foo()**, but if I remove that line the program continues. What am I doing wrong?

- 1. Apply spoiler warnings
- 2. Describe the problem, not your guesses or summaries
- 3. Code: describe what fails and what you expect instead
- 4. Code: post minimal examples
- 5. Don't rush to claim that you have found a bug

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- ▶ Objected Oriented Programming in C++

STL (Standard Template Library) is part of the C++ standard library. It is important that you know:

- ► how to do I/O using <iostream>,
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IMPORTANT! Read the 'Introduction to C++' document and familiarise yourselves with the concepts within.

The most important things to remember:

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- ▶ Next Monday at 17:00, we have the first Problem of The Week!