1. Introduction to the judge enviroment

2. Prefix sum/precomputation trick

Sample Problem: Even Pairs

Input:

- first line: a positive integer n
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- 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 $0 \leq i \leq j < n$ such that

$$x_i + \cdots + x_j$$

is even.

First approach

(1) for all pairs $i \leq j$, compute the sum $x_i + \cdots + x_j$

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- running time is $\Theta(n^3)$
- this type of analysis is very important in this course.

Second approach

Observation: if we know the parity of the sum

$$x_i + \cdots + x_j$$

then based on the parity of x_{j+1} we also know the parity of

$$x_i + \cdots x_j + x_{j+1}$$

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Running time: $\Theta(n^2)$

Third approach

Observation:

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

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Fourth approach

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(1) calculate partial sums $S_i = \sum_{a=0}^{i} x_a$ in one iteration

(2) $E =$ # of S_i that are even

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

Fourth approach

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Running time: $\Theta(n)$

Even pairs - conclusion

Tricks/techniques: 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 Results

Besides correct, timelimit, and wrong-answer, the judge can give the following results.

assertion-failure	SIGABRT: memory screwup or assertion failure
segmentation-fault	SIGSEGV: memory screwup
run-error	nonzero exit status
forbidden	bad syscall or other safety

Forum

The forum is your main tool for discussing ideas and getting help. Use it.

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

Forum: How To Ask Questions

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.

>>>

Forum: How To Ask Questions

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
```

Forum: How To Ask Questions

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 testcase it emits `no solution` instead of `1`. What am I doing wrong?

Forum: How To Ask Questions

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?

Forum: How To Ask Questions

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

Further reading: How To Ask Questions The Smart Way

C++

Learning C++ is beyond the scope of this course.

- True beginners should probably read a book
  - Andrew Koenig and Barbara E. Moo: Accelerated C++, Addison-Wesley, 2000
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- Useful in any case: C++ FAQ Lite

C++

STL is part of the C++ standard library. It is important that you know

- how and when to use the classes `std::vector`, `std::priority_queue`, `std::set` and `std::map`,
- how to do I/O using `<iostream>`, and
- how to use the `sort` function from the `<algorithm>` header file.

That's it.

The most important things to remember:

- You can find all that you need at our website:
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- Next Monday at 17:00, we have the first problem of the week.