NWERC 2021 presentation of practice solutions

November 20, 2021

A: Aurora Borealis

Problem Author: Nils Gustafsson

Problem

Given n pairs of (time, location), find the smallest length of a cloud that, moving at a speed of at most 1 m/s, can cover all the locations at the corresponding times.

A: Aurora Borealis

Problem Author: Nils Gustafsson

Problem

Given n pairs of (time, location), find the smallest length of a cloud that, moving at a speed of at most 1 m/s, can cover all the locations at the corresponding times.

Solution

- Sort the input by time.

A: Aurora Borealis

Problem Author: Nils Gustafsson

Problem

Given n pairs of (time, location), find the smallest length of a cloud that, moving at a speed of at most 1 m/s, can cover all the locations at the corresponding times.

Solution

- Sort the input by time.
- Idea: you can check for a given length ℓ of the cloud if it can cover all the points:

A: Aurora Borealis

Problem Author: Nils Gustafsson

Problem

Given n pairs of (time, location), find the smallest length of a cloud that, moving at a speed of at most 1 m/s, can cover all the locations at the corresponding times.

Solution

- Sort the input by time.
- Idea: you can check for a given length ℓ of the cloud if it can cover all the points:
  - Keep track of the interval of all possible left ends of the cloud at the current time

A: Aurora Borealis

Problem Author: Nils Gustafsson

Problem

Given n pairs of (time, location), find the smallest length of a cloud that, moving at a speed of at most 1 m/s, can cover all the locations at the corresponding times.

Solution

- Sort the input by time.
- Idea: you can check for a given length ℓ of the cloud if it can cover all the points:
  - Keep track of the interval of all possible left ends of the cloud at the current time
  - In each second this interval extends one unit to the left and to the right

A: Aurora Borealis

Problem Author: Nils Gustafsson

Problem

Given n pairs of (time, location), find the smallest length of a cloud that, moving at a speed of at most 1 m/s, can cover all the locations at the corresponding times.

Solution

- Sort the input by time.
- Idea: you can check for a given length ℓ of the cloud if it can cover all the points:
  - Keep track of the interval of all possible left ends of the cloud at the current time
  - In each second this interval extends one unit to the left and to the right
  - If you need to cover a position x at the current time, you remove all impossible left ends of the cloud

A: Aurora Borealis

Problem Author: Nils Gustafsson

Problem

Given n pairs of (time, location), find the smallest length of a cloud that, moving at a speed of at most 1 m/s, can cover all the locations at the corresponding times.

Solution

- Sort the input by time.
- Idea: you can check for a given length ℓ of the cloud if it can cover all the points:
  - Keep track of the interval of all possible left ends of the cloud at the current time
  - In each second this interval extends one unit to the left and to the right
  - If you need to cover a position x at the current time, you remove all impossible left ends of the cloud
  - If no point is left, the cloud is too short

A: Aurora Borealis

Problem Author: Nils Gustafsson

Problem

Given n pairs of (time, location), find the smallest length of a cloud that, moving at a speed of at most 1 m/s, can cover all the locations at the corresponding times.

Solution

- Sort the input by time.
- Idea: you can check for a given length ℓ of the cloud if it can cover all the points:
  - Keep track of the interval of all possible left ends of the cloud at the current time
  - In each second this interval extends one unit to the left and to the right
  - If you need to cover a position x at the current time, you remove all impossible left ends of the cloud
  - If no point is left, the cloud is too short
- Binary search over the length of the cloud. Complexity: $\mathcal{O}(n \log n)$.

A: Aurora Borealis

Problem Author: Nils Gustafsson

Problem

Given n pairs of (time, location), find the smallest length of a cloud that, moving at a speed of at most 1 m/s, can cover all the locations at the corresponding times.

Solution

- Sort the input by time.
- Idea: you can check for a given length ℓ of the cloud if it can cover all the points:
  - Keep track of the interval of all possible left ends of the cloud at the current time
  - In each second this interval extends one unit to the left and to the right
  - If you need to cover a position x at the current time, you remove all impossible left ends of the cloud
  - If no point is left, the cloud is too short
- Binary search over the length of the cloud. Complexity: $\mathcal{O}(n \log n)$.
- Challenge: solve this problem without binary search.

A: Aurora Borealis

Problem Author: Nils Gustafsson

Problem

Given n pairs of (time, location), find the smallest length of a cloud that, moving at a speed of at most 1 m/s, can cover all the locations at the corresponding times.

Solution

- Sort the input by time.
- Idea: you can check for a given length ℓ of the cloud if it can cover all the points:
  - Keep track of the interval of all possible left ends of the cloud at the current time
  - In each second this interval extends one unit to the left and to the right
  - If you need to cover a position x at the current time, you remove all impossible left ends of the cloud
  - If no point is left, the cloud is too short
- Binary search over the length of the cloud. Complexity: $\mathcal{O}(n \log n)$.
- Challenge: solve this problem without binary search.

Statistics: 152 submissions, 43 accepted, 49 unknown

B: Basalt Breakdown

Problem Author: Paul Wild

Problem

Given the area of a regular hexagon, find its perimeter.

B: Basalt Breakdown

Problem Author: Paul Wild

Problem

Given the area of a regular hexagon, find its perimeter.

Solution

- Let a be the side length of the hexagon.

B: Basalt Breakdown

Problem Author: Paul Wild

Problem

Given the area of a regular hexagon, find its perimeter.

Solution

- Let a be the side length of the hexagon.
- The perimeter is $p = 6a$.

B: Basalt Breakdown

Problem Author: Paul Wild

Problem

Given the area of a regular hexagon, find its perimeter.

Solution

- Let a be the side length of the hexagon.
- The perimeter is $p = 6a$.
- The hexagon is made up of six equilateral triangles, so the area is $A = 6 \cdot \frac{\sqrt{3}}{4} a^2$.

B: Basalt Breakdown

Problem Author: Paul Wild

Problem

Given the area of a regular hexagon, find its perimeter.

Solution

- Let a be the side length of the hexagon.
- The perimeter is $p = 6a$.
- The hexagon is made up of six equilateral triangles, so the area is $A = 6 \cdot \frac{\sqrt{3}}{4} a^2$.
- Combine the equations and solve for the perimeter:

$$p = 6 \cdot \sqrt{\frac{4A}{6\sqrt{3}}}$$

B: Basalt Breakdown

Problem Author: Paul Wild

Problem

Given the area of a regular hexagon, find its perimeter.

Solution

- Let a be the side length of the hexagon.
- The perimeter is $p = 6a$.
- The hexagon is made up of six equilateral triangles, so the area is $A = 6 \cdot \frac{\sqrt{3}}{4} a^2$.
- Combine the equations and solve for the perimeter:

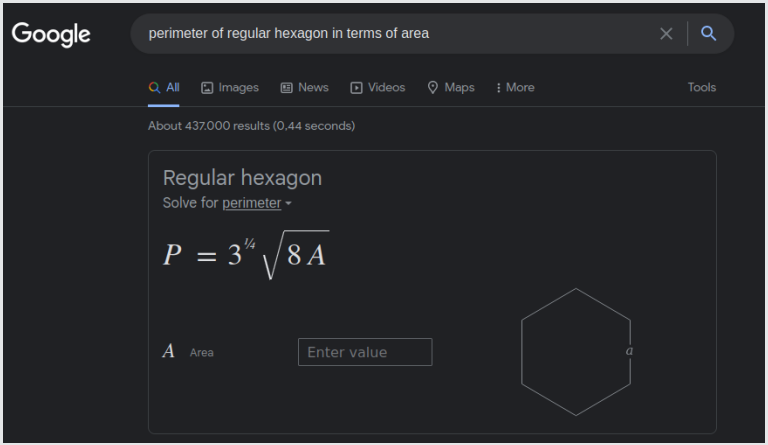
$$p = 6 \cdot \sqrt{\frac{4A}{6\sqrt{3}}}$$

Statistics: 141 submissions, 100 accepted, 9 unknown

B: Basalt Breakdown

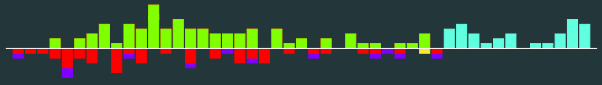
Problem Author: Paul Wild

Alternative Solution



C: Counterfeit Coin

Problem Author: The NWERC 2021 Jury

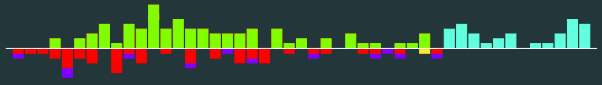


Problem

Given $n-1$ coins of the same weight and one of a different weight, find the coin of different weight by weighing at most $\lceil \frac{n}{2} \rceil$ times.

C: Counterfeit Coin

Problem Author: The NWERC 2021 Jury



Problem

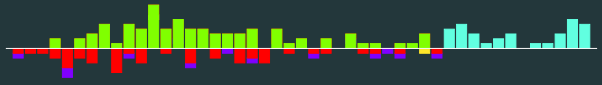
Given $n-1$ coins of the same weight and one of a different weight, find the coin of different weight by weighing at most $\lceil \frac{n}{2} \rceil$ times.

Solution

- Compare the first and second coin, then the third and fourth, and so on, until you find a pair that does not have equal weight. We call this pair (a, b).

C: Counterfeit Coin

Problem Author: The NWERC 2021 Jury



Problem

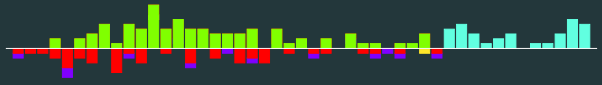
Given $n-1$ coins of the same weight and one of a different weight, find the coin of different weight by weighing at most $\lceil \frac{n}{2} \rceil$ times.

Solution

- Compare the first and second coin, then the third and fourth, and so on, until you find a pair that does not have equal weight. We call this pair (a, b).
- This takes at most $\lfloor \frac{n-1}{2} \rfloor$ queries, as you never need to query the last pair.

C: Counterfeit Coin

Problem Author: The NWERC 2021 Jury



Problem

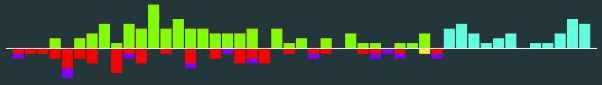
Given $n-1$ coins of the same weight and one of a different weight, find the coin of different weight by weighing at most $\lceil \frac{n}{2} \rceil$ times.

Solution

- Compare the first and second coin, then the third and fourth, and so on, until you find a pair that does not have equal weight. We call this pair (a, b).
- This takes at most $\lfloor \frac{n-1}{2} \rfloor$ queries, as you never need to query the last pair.
- Compare one of the coins in the pair (say a) to any other coin. If they have different weight, then a is the odd one out. If they have equal weight, then b is the odd one out.

C: Counterfeit Coin

Problem Author: The NWERC 2021 Jury



Problem

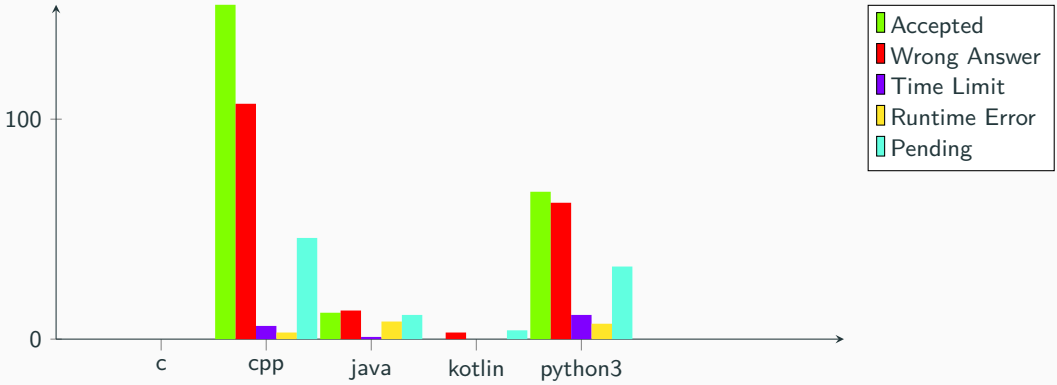
Given $n-1$ coins of the same weight and one of a different weight, find the coin of different weight by weighing at most $\lceil \frac{n}{2} \rceil$ times.

Solution

- Compare the first and second coin, then the third and fourth, and so on, until you find a pair that does not have equal weight. We call this pair (a, b).
- This takes at most $\lfloor \frac{n-1}{2} \rfloor$ queries, as you never need to query the last pair.
- Compare one of the coins in the pair (say a) to any other coin. If they have different weight, then a is the odd one out. If they have equal weight, then b is the odd one out.

Statistics: 239 submissions, 81 accepted, 34 unknown

Language stats



Clarifications

Clarifications

- Clarifications should be written (and will be answered) in English.

Clarifications

Clarifications

- Clarifications should be written (and will be answered) in English.
- Will I get penalty time for submissions that fail on the samples? Yes.

Clarifications

Clarifications

- Clarifications should be written (and will be answered) in English.
- Will I get penalty time for submissions that fail on the samples? Yes.
- Will I get penalty time for submissions that get a compile error? No.

Clarifications

Clarifications

- Clarifications should be written (and will be answered) in English.
- Will I get penalty time for submissions that fail on the samples? Yes.
- Will I get penalty time for submissions that get a compile error? No.
- Where can I see compiler flags? Go to `nwerc.eu/system/`.

Clarifications

Clarifications

- Clarifications should be written (and will be answered) in English.
- Will I get penalty time for submissions that fail on the samples? Yes.
- Will I get penalty time for submissions that get a compile error? No.
- Where can I see compiler flags? Go to `nwerc.eu/system/`.
- If your submission uses too much memory, you will get a `Runtime Error`

Clarifications

Clarifications

- Clarifications should be written (and will be answered) in English.
- Will I get penalty time for submissions that fail on the samples? Yes.
- Will I get penalty time for submissions that get a compile error? No.
- Where can I see compiler flags? Go to `nwerc.eu/system/`.
- If your submission uses too much memory, you will get a `Runtime Error`
- For interactive problems:

Clarifications

Clarifications

- Clarifications should be written (and will be answered) in English.
- Will I get penalty time for submissions that fail on the samples? Yes.
- Will I get penalty time for submissions that get a compile error? No.
- Where can I see compiler flags? Go to `nwerc.eu/system/`.
- If your submission uses too much memory, you will get a `Runtime Error`
- For interactive problems:
  - `Wrong Answer` means your submission printed something wrong;

Clarifications

Clarifications

- Clarifications should be written (and will be answered) in English.
- Will I get penalty time for submissions that fail on the samples? Yes.
- Will I get penalty time for submissions that get a compile error? No.
- Where can I see compiler flags? Go to `nwerc.eu/system/`.
- If your submission uses too much memory, you will get a `Runtime Error`
- For interactive problems:
  - `Wrong Answer` means your submission printed something wrong;
  - `Time Limit Exceeded` means your submission took too much time;

Clarifications

Clarifications

- Clarifications should be written (and will be answered) in English.
- Will I get penalty time for submissions that fail on the samples? Yes.
- Will I get penalty time for submissions that get a compile error? No.
- Where can I see compiler flags? Go to `nwerc.eu/system/`.
- If your submission uses too much memory, you will get a `Runtime Error`
- For interactive problems:
  - `Wrong Answer` means your submission printed something wrong;
  - `Time Limit Exceeded` means your submission took too much time;
  - `Run Time Error` means your submission exited with non-zero status code.

Clarifications

Clarifications

- Clarifications should be written (and will be answered) in English.
- Will I get penalty time for submissions that fail on the samples? Yes.
- Will I get penalty time for submissions that get a compile error? No.
- Where can I see compiler flags? Go to `nwerc.eu/system/`.
- If your submission uses too much memory, you will get a `Runtime Error`
- For interactive problems:
  - `Wrong Answer` means your submission printed something wrong;
  - `Time Limit Exceeded` means your submission took too much time;
  - `Run Time Error` means your submission exited with non-zero status code.
- For Kotlin, make a `fun main` function, use the `.ks` extension, and for e.g. `file.ks` use `FileKs` as the mainclass.

Clarifications

FYI

- We do not provide a PDF for the statements.

Clarifications

FYI

- We do not provide a PDF for the statements.
- We do not provide a single samples zip.

Clarifications

FYI

- We do not provide a PDF for the statements.
- We do not provide a single samples zip.
- Tomorrow, you will not see the number of test cases you passed.

Clarifications

FYI

- We do not provide a PDF for the statements.
- We do not provide a single samples zip.
- Tomorrow, you will not see the number of test cases you passed.
- Tomorrow, you will not see the CPU time your submission used.

Clarifications

FYI

- We do not provide a PDF for the statements.
- We do not provide a single samples zip.
- Tomorrow, you will not see the number of test cases you passed.
- Tomorrow, you will not see the CPU time your submission used.
- You can not hide the IDE widget on the problem web pages.