Programming Practice

2018-10-11

Week 6

Homework Problems

1. Prime Number
2. Ranking
3. Smallest Triangle
4. Binary Search

Problem. **1**

Prime Number

Description

Write a program that gets two integers N and M $(1 \leq N \leq M \leq 5000)$, and prints prime numbers greater than or equal to N and less than or equal to M in ascending order, with single spaces in between.

A prime number is a natural number greater than 1 that cannot be formed by multiplying two smaller natural numbers such as 5, 11, 19, 23.

Input

The first line contains two integers N, M $(1 \leq N \leq M \leq 5000)$.

Output

Print prime numbers included in the closest interval $[N, M]$ in ascending order.

Sample

[input]

```
20 50
```

[output]

```
23 29 31 37 41 43 47
```

Problem. **2**

Ranking

Description

Write a program that gets a number of integers as input, and prints the rank of each integer (The highest gets 1st).

The first line of the input will state the number of integers that will be given : N $(1 \leq N \leq 1000)$.

The second line contains N integers, all of which are within the range of `int`.

The rank of the integer A is defined as **(the number of integers which is higher than A) + 1**.

Input

First line contains a single integer N $(1 \leq N \leq 1000)$.

The second line contains N integers.

Output

Print the rank of each integer, with single spaces in between.

Sample

```
[input]
5
20 17 10 12 12

[output]
1 2 5 3 3
```

Problem. **3**

Smallest Triangle

Description

Given a number of points on a coordinate plane, find a set of points which makes the smallest triangle and print the area of that triangle.

N $(3 \leq N \leq 250)$ points will be given. Each point is given by specifying the x and y coordinates. The x, y coordinate values of all points are integers of range [-10000, 10000].

Print the smallest area of the triangle.

Input

First line contains a single integer N $(3 \leq N \leq 250)$.

Following N lines contain two integers x, y of range [-10000, 10000].

Output

Print the smallest area of the triangle ($error \leq 10^{-6}$).

Sample

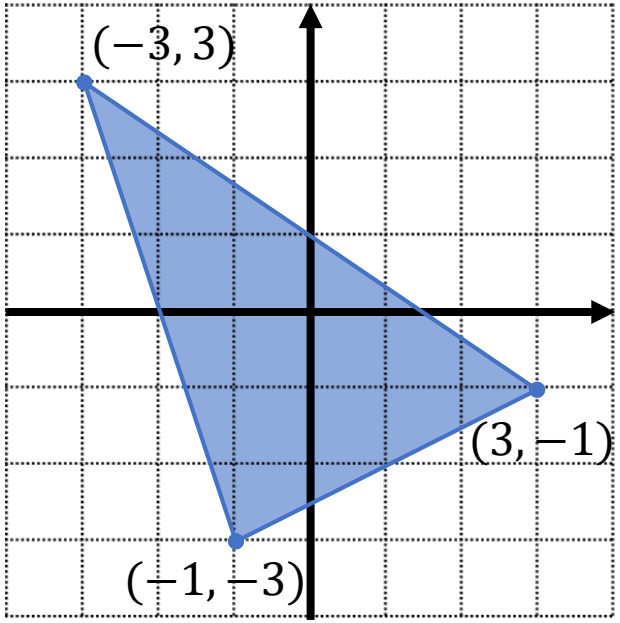
[input]	[input]
3	5
0 0	0 2
0 1	3 4
1 1	1 5
	2 1
	-1 4
[output]	[output]
0.500000	1.500000

Problem. **3**

Smallest Triangle (cont.)

- The area of triangle in coordinate plane is

$$S = \frac{1}{2}|(x_1y_2 + x_2y_3 + x_3y_1) - (x_2y_1 + x_3y_2 + x_1y_3)|$$

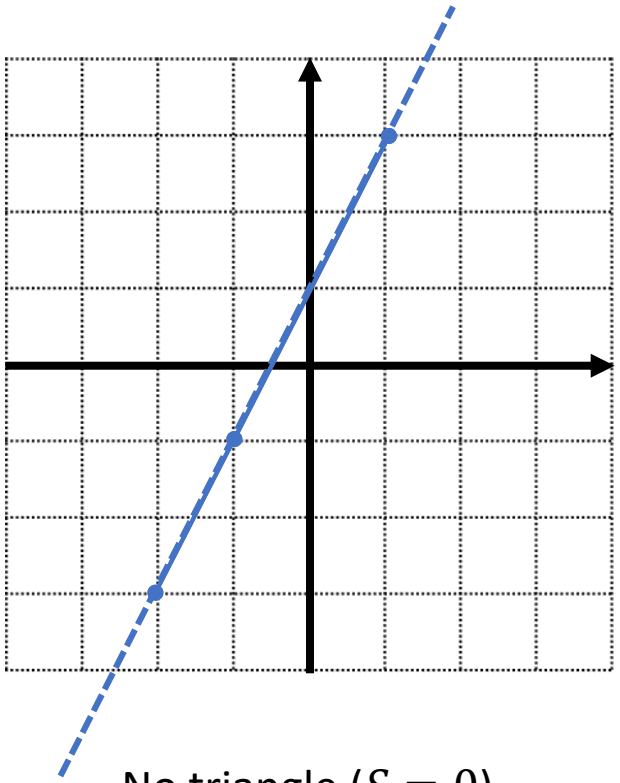


$$S = \frac{1}{2}|(x_1y_2 + x_2y_3 + x_3y_1) - (x_2y_1 + x_3y_2 + x_1y_3)|$$
$$= \frac{1}{2}|(9 + 9 + 1) - (3 - 3 - 9)| = \frac{1}{2} \times 28 = 14$$

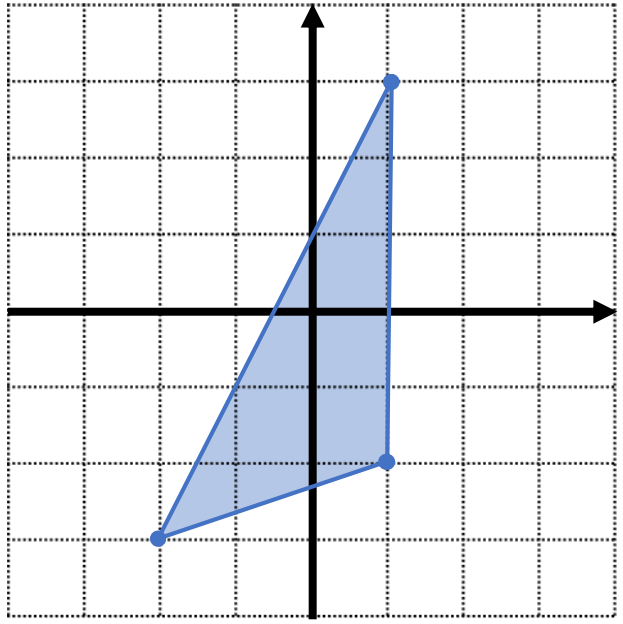
Problem. **3**

Smallest Triangle (cont.)

- Triangle consists of three points which are not on the same line.



No triangle ($S = 0$)



Triangle ($S \neq 0$)

Problem. **4**

Binary Search

Description

Write a program that gets a number of integers as input, and find the index of the target integer.

The first line of the input will state the number of integers that will be given : N $(1 \leq N \leq 5000)$.

The second line contains N integers in ascending order without duplicates, all of which are within the range of `int`.

Print the 1-base index of integer X, or -1.

Input

First line contains a single integer N $(1 \leq N \leq 5000)$.

The second line contains N integers in ascending order without duplicates.

Last one is the single integer X.

Output

Print the 1-base index of integer X, or -1 if there is no X in second line inputs.

Sample

```
[input]
5
-3 -2 1 2 3
2

[output]
4
```

```
[input]
5
-3 -2 1 2 3
0

[output]
-1
```

Problem. **4**

Binary Search (cont.)

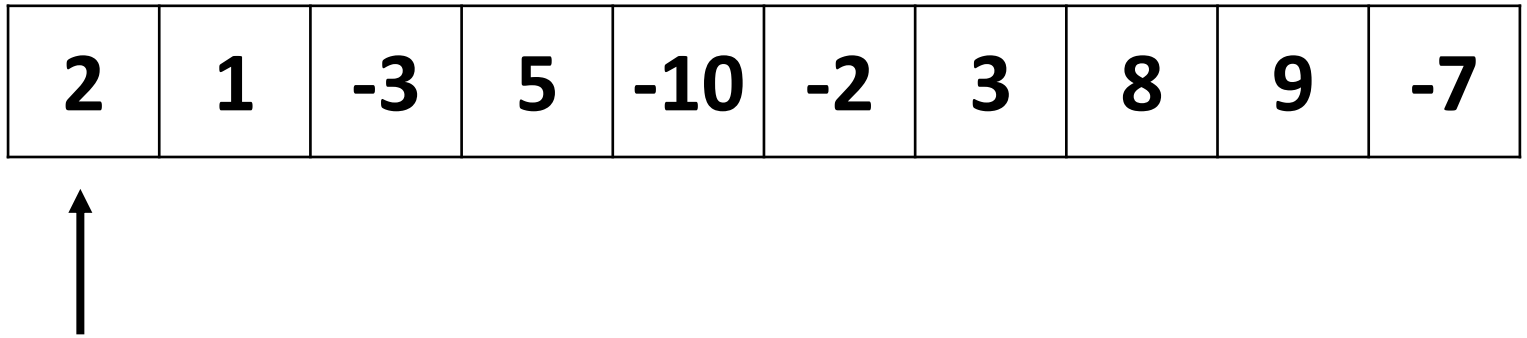
- Where is the number 3?

2	1	-3	5	-10	-2	3	8	9	-7

Problem. **4**

Binary Search (cont.)

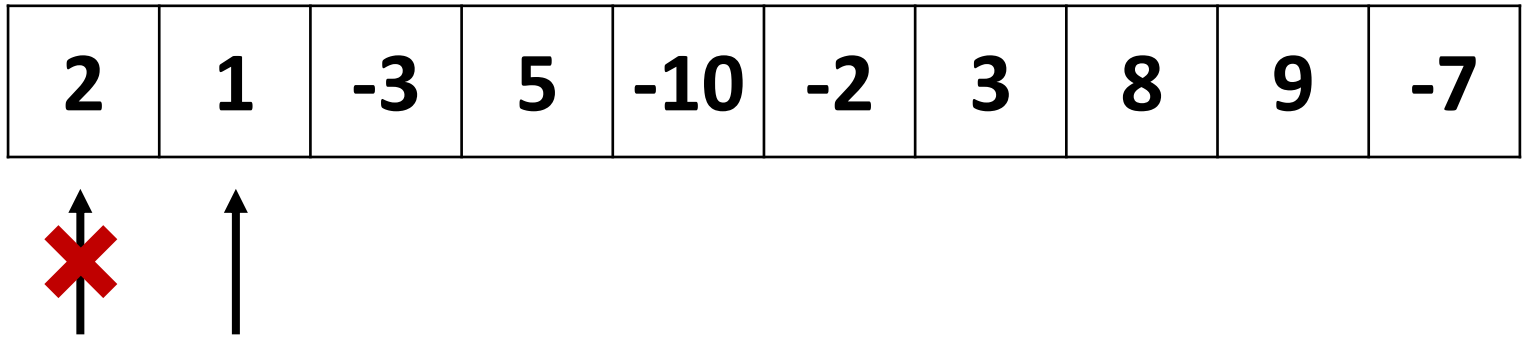
- Where is the number 3?



Problem. **4**

Binary Search (cont.)

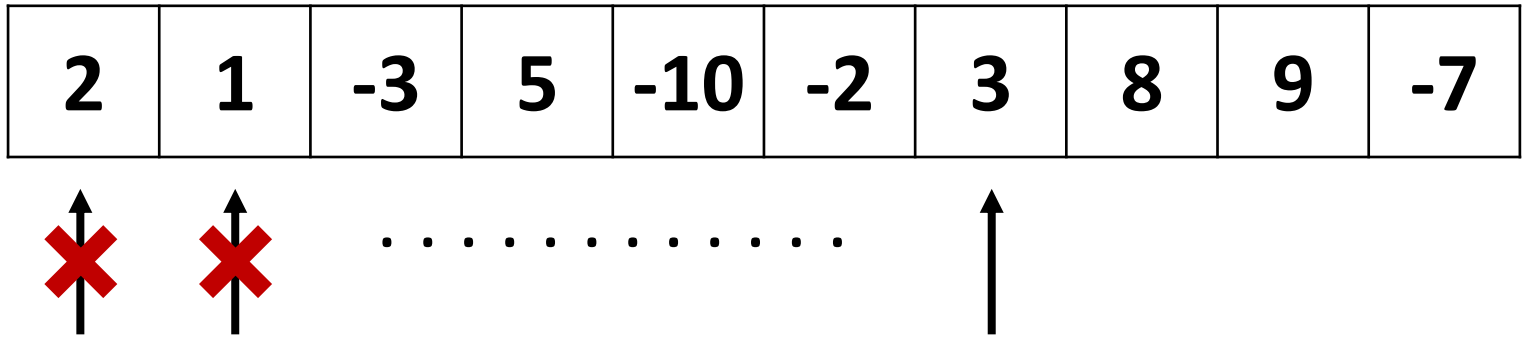
- Where is the number 3?



Problem. **4**

Binary Search (cont.)

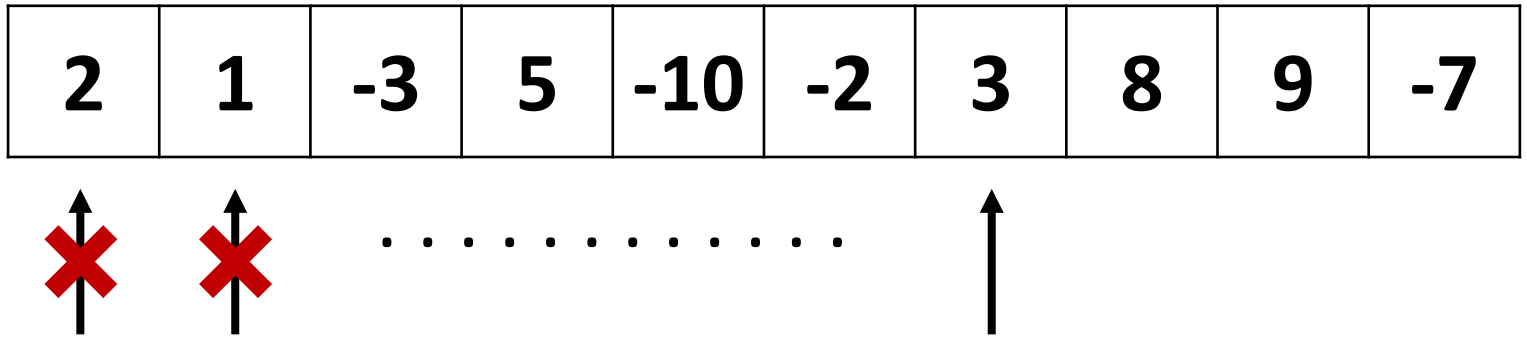
- Where is the number 3?



Problem. **4**

Binary Search (cont.)

- Where is the number 3?



Problem. **4**

Binary Search (cont.)

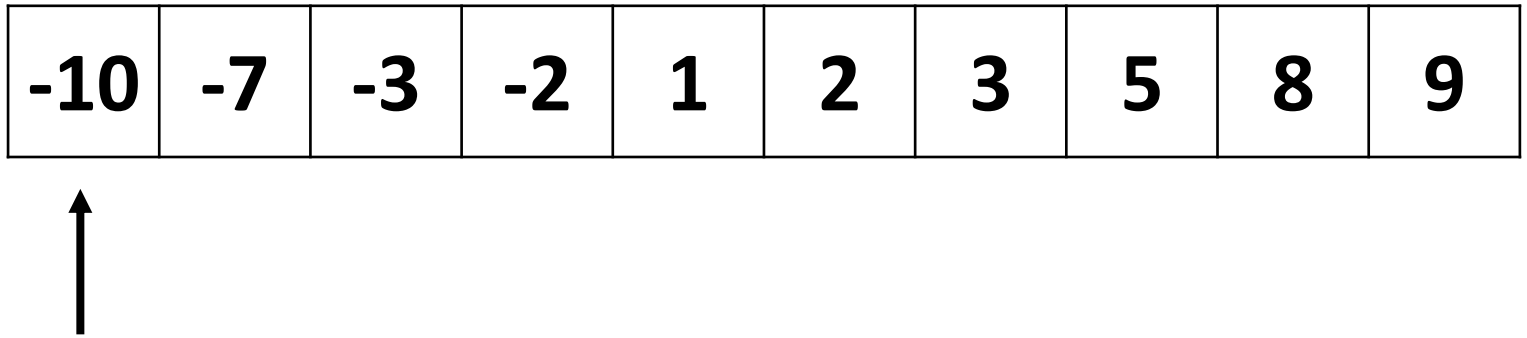
- Where is the number 3 in the sorted array?

-10	-7	-3	-2	1	2	3	5	8	9

Problem. **4**

Binary Search (cont.)

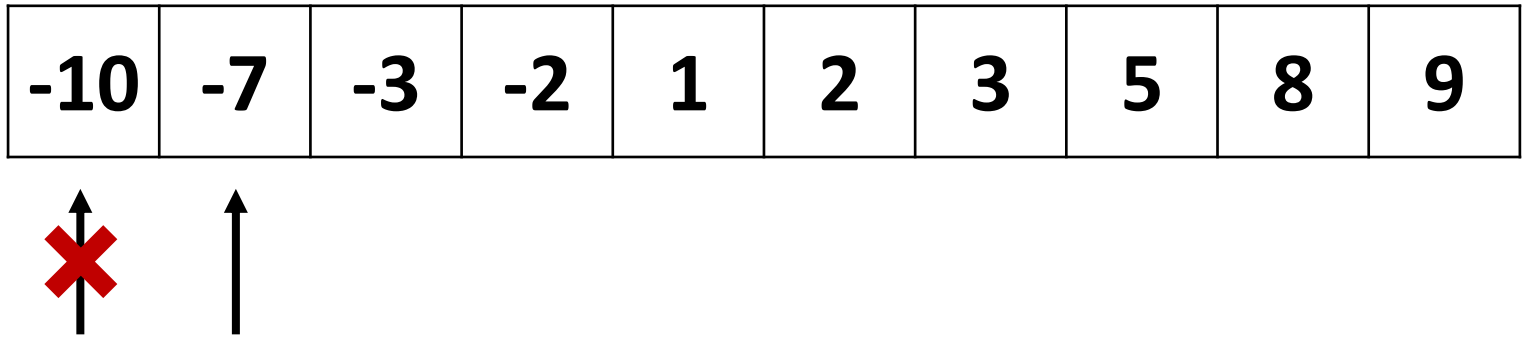
- Where is the number 3 in the sorted array?



Problem. **4**

Binary Search (cont.)

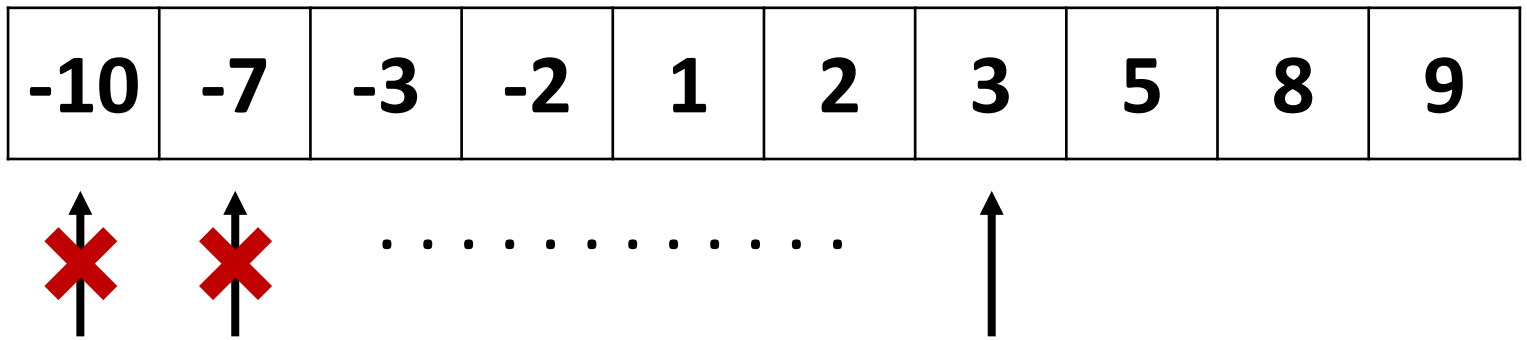
- Where is the number 3 in the sorted array?



Problem. **4**

Binary Search (cont.)

- Where is the number 3 in the sorted array?



Problem. **4**

Binary Search (cont.)

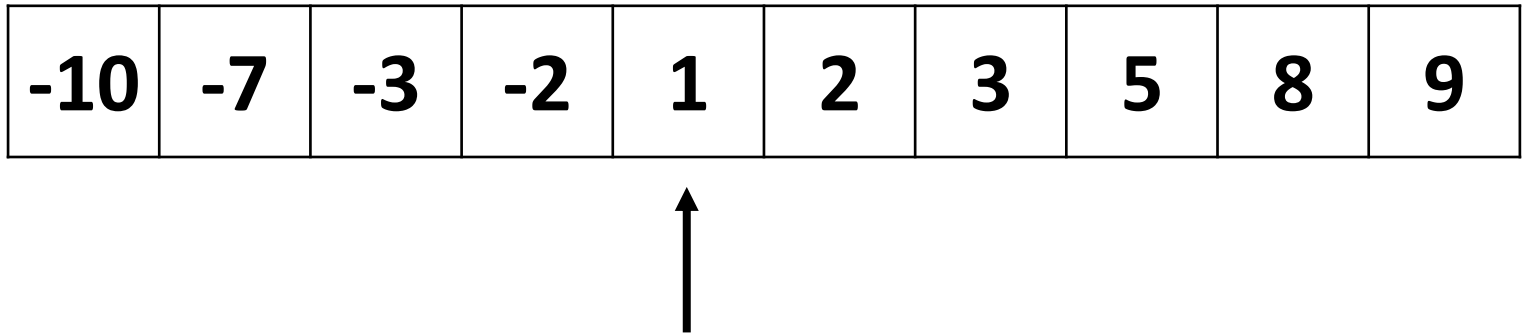
- Where is the number 3 in the sorted array?

-10	-7	-3	-2	1	2	3	5	8	9

Problem. **4**

Binary Search (cont.)

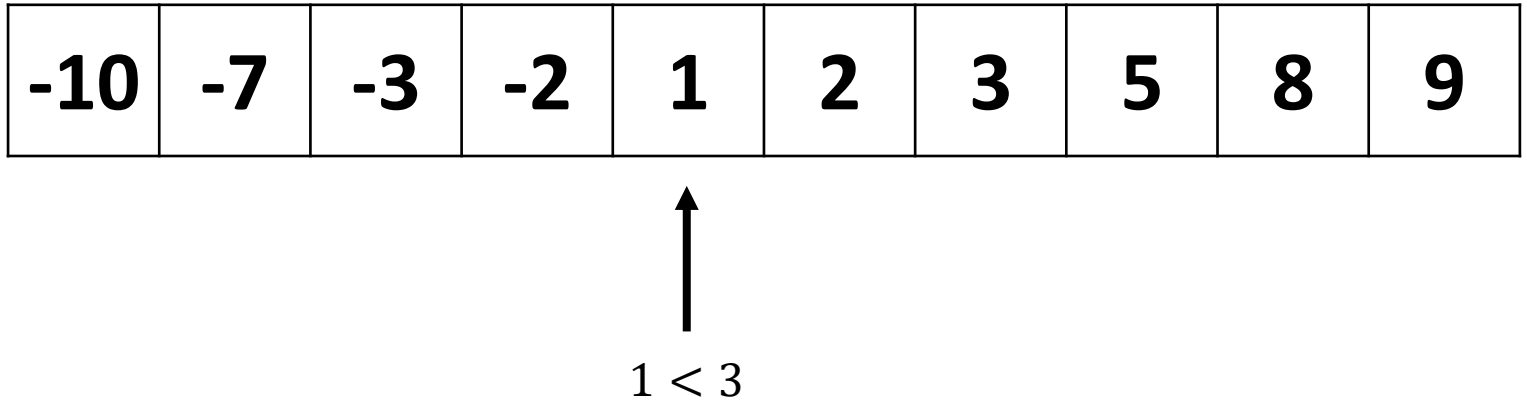
- Where is the number 3 in the sorted array?



Problem. **4**

Binary Search (cont.)

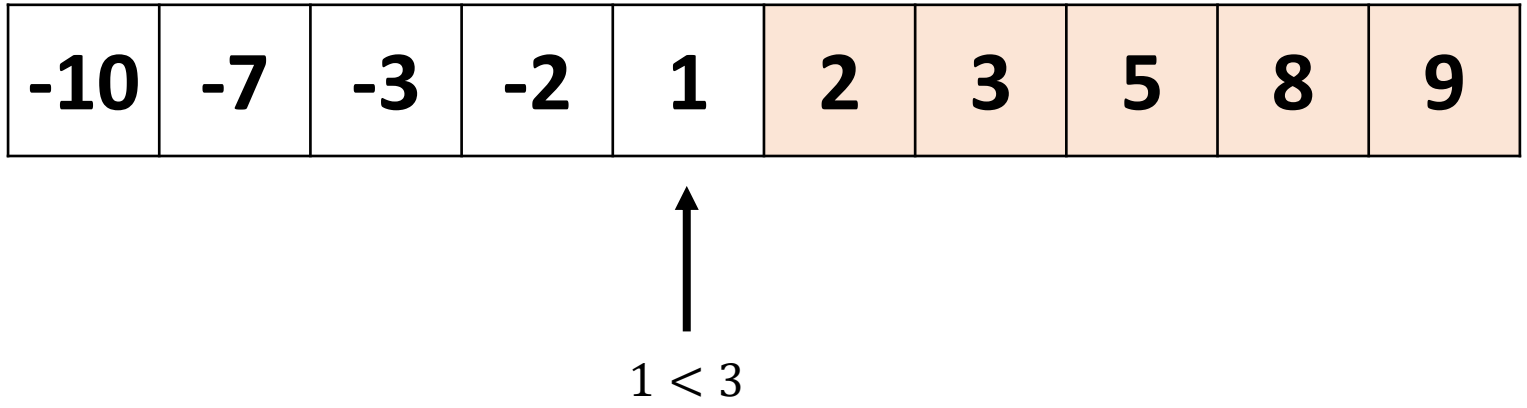
- Where is the number 3 in the sorted array?



Problem. **4**

Binary Search (cont.)

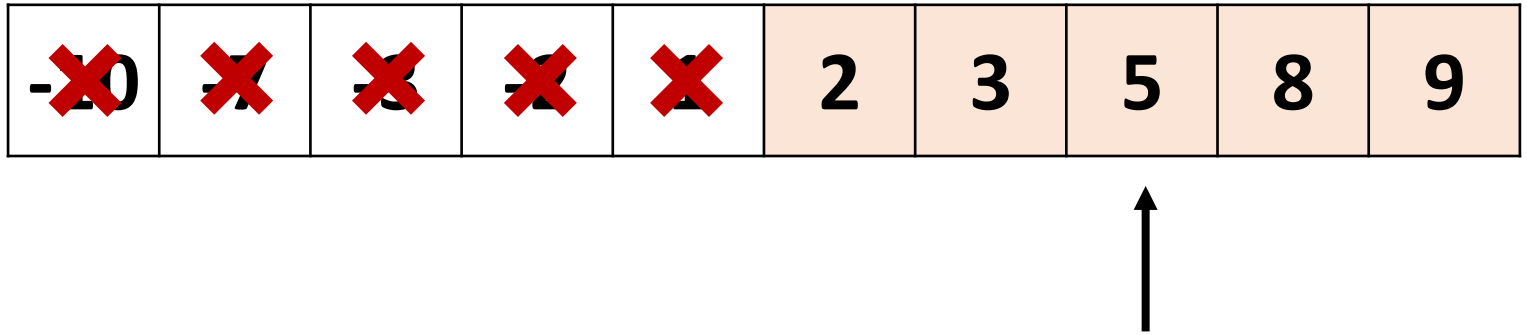
- Where is the number 3 in the sorted array?



Problem. **4**

Binary Search (cont.)

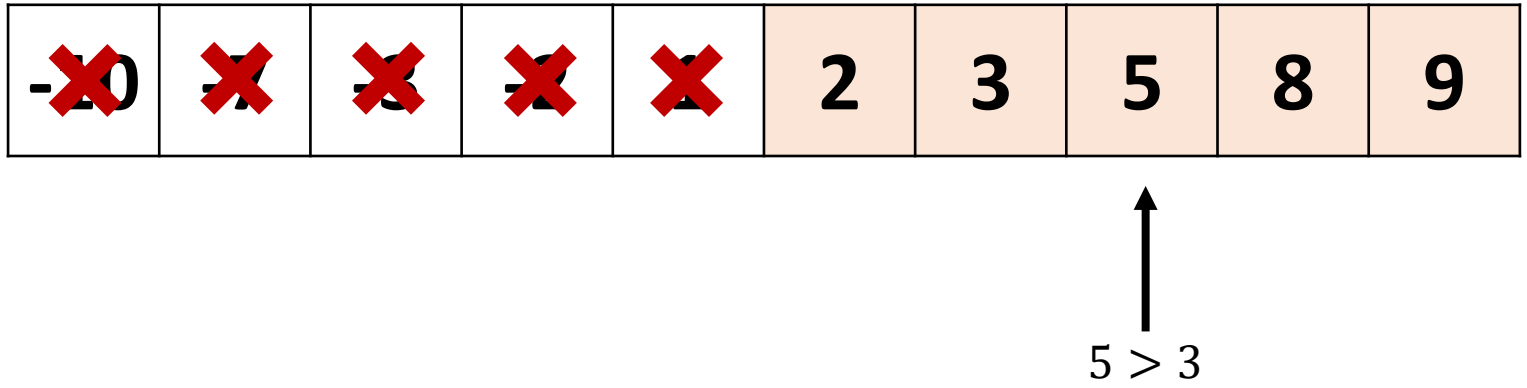
- Where is the number 3 in the sorted array?



Problem. **4**

Binary Search (cont.)

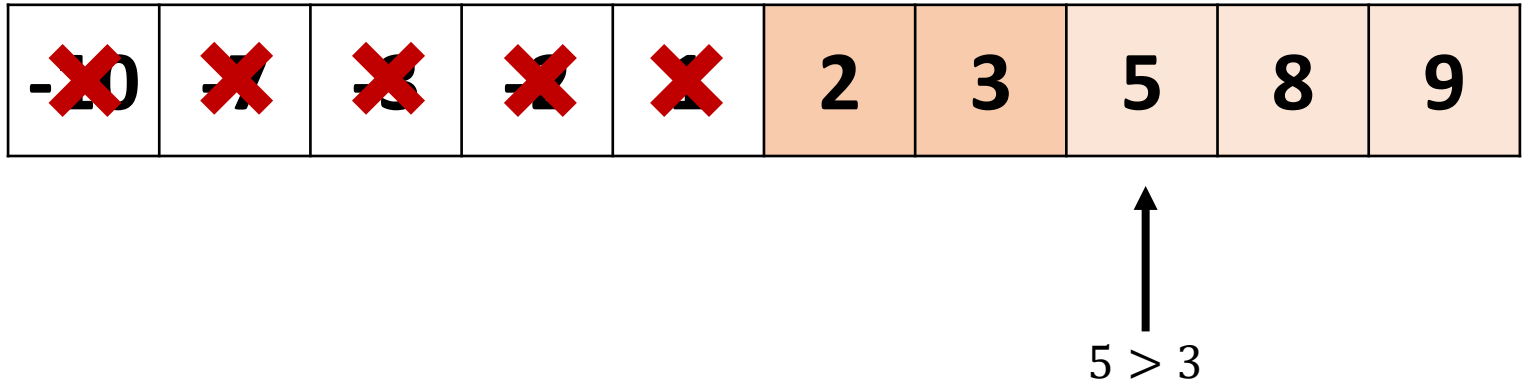
- Where is the number 3 in the sorted array?



Problem. **4**

Binary Search (cont.)

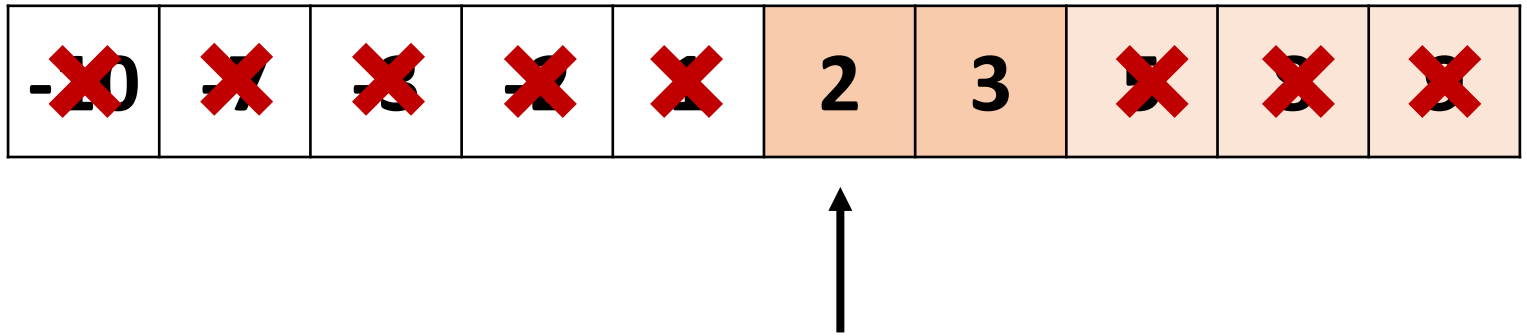
- Where is the number 3 in the sorted array?



Problem. **4**

Binary Search (cont.)

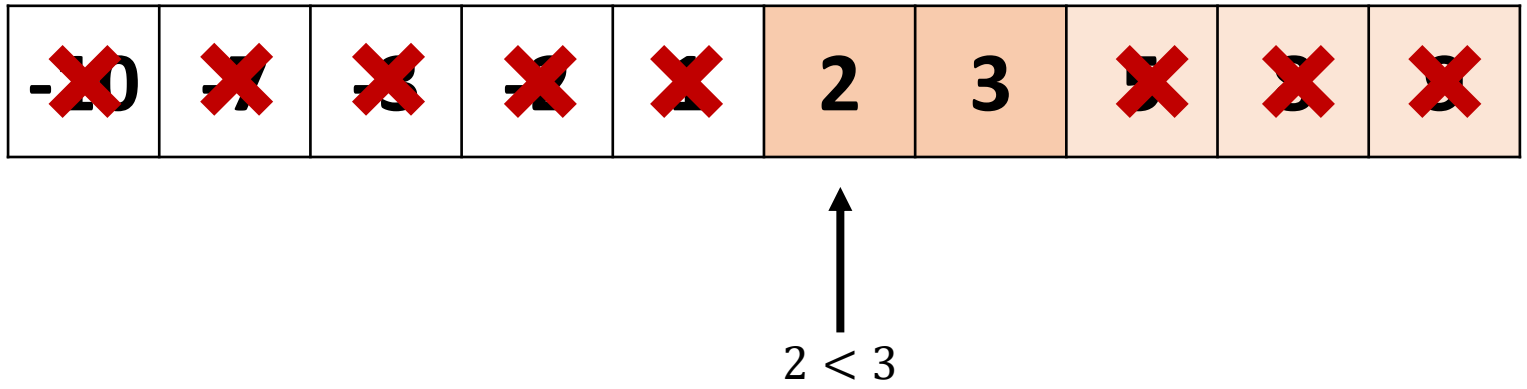
- Where is the number 3 in the sorted array?



Problem. **4**

Binary Search (cont.)

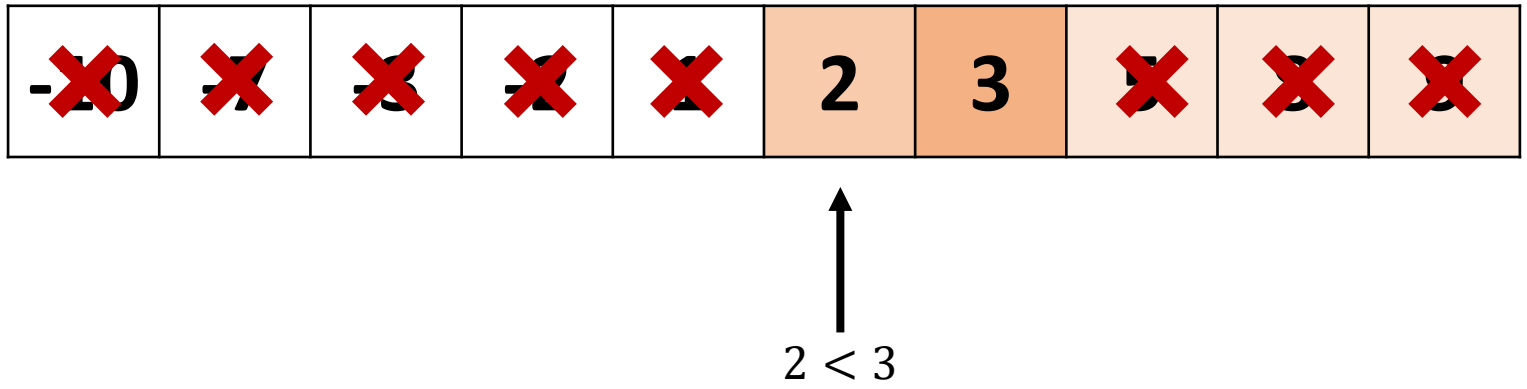
- Where is the number 3 in the sorted array?



Problem. **4**

Binary Search (cont.)

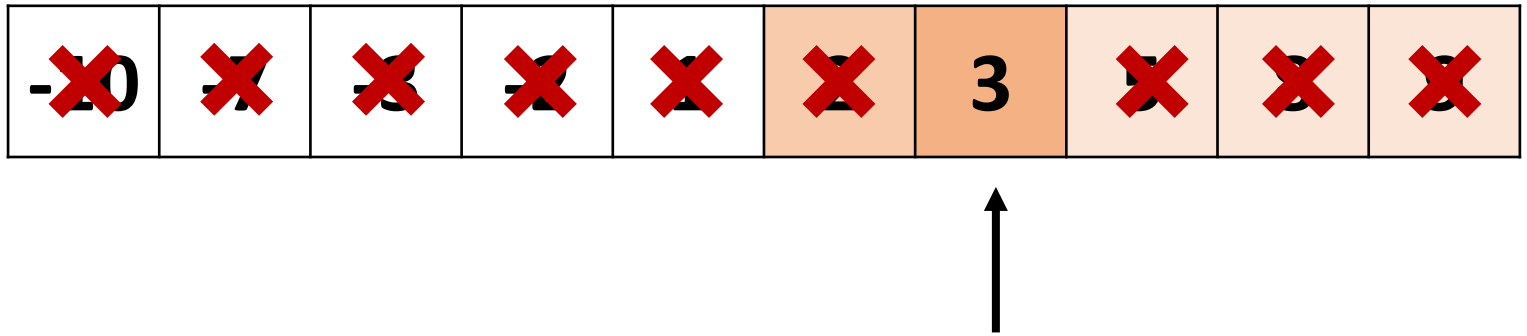
- Where is the number 3 in the sorted array?



Problem. **4**

Binary Search (cont.)

- Where is the number 3 in the sorted array?



Problem. **4**

Binary Search (cont.)

- Where is the number 3 in the sorted array?