

# Problem Description

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- Given
  - a sorted vector `vec`
  - a value `val`
- Question
  - Where does `val` appear in `vec`?

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- Example

`vec` =

1	2	3	5	6	8	8
---	---	---	---	---	---	---

`val` =

6

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# Problem Description

- Given
  - a sorted vector `vec`
  - a value `val`
- Question
  - Where does `val`...

How can we find it quickly?

1	2	3	5	6	8	8
---	---	---	---	---	---	---

=  
6

# Binary Search

# Binary Search

- Works iteratively:

1	2	3	5	6	8	8
---	---	---	---	---	---	---

# Binary Search

- Works iteratively:
  - Examine element in the middle

1	2	3	5	6	8	8
---	---	---	---	---	---	---



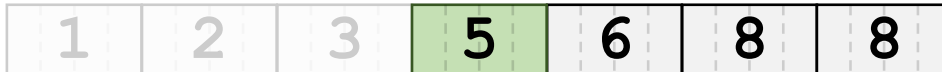
# Binary Search

- Works iteratively:
  - Examine element in the middle
    - It is greater → `val` not to the right



# Binary Search

- Works iteratively:
  - Examine element in the middle
    - It is greater → `val` not to the right
    - It is smaller or equal → `val` not to the left



Back to Initial Example

# Binary Search

- Find 6

It is **greater** → **val not to the right**  
It is **smaller or equal** → **val not to the left**

1	2	3	5	6	8	8
---	---	---	---	---	---	---

# Binary Search

- Find 6

It is greater



val not to the right

It is smaller or equal



val not to the left

smaller  
or equal

1	2	3	5	6	8	8
---	---	---	---	---	---	---

# Binary Search

- Find 6

It is greater

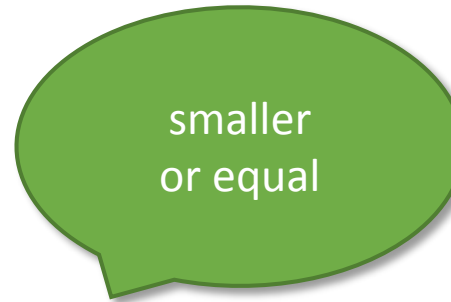


val not to the right

It is smaller or equal



val not to the left



1	2	3	5	6	8	8
---	---	---	---	---	---	---

# Binary Search

- Find 6

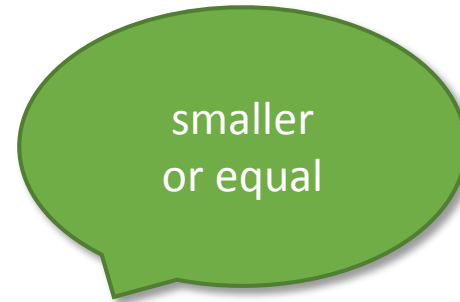
It is **greater** → **val not to the right**  
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1	2	3	5	6	8	8
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# Binary Search

- Find 6

It is greater → val not to the right  
It is smaller or equal → val not to the left



1	2	3	5	6	8	8
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# Binary Search

- Find 6

It is greater → val not to the right  
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# Binary Search

- Find 6

It is **greater** → **val not to the right**  
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# Binary Search

- Find 6

It is **greater** → val **not to the right**  
It is **smaller or equal** → val **not to the left**



1	2	3	5	6	8	8
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# Binary Search

- Find 6

It is **greater** → val **not to the right**  
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# Binary Search

- Find 6

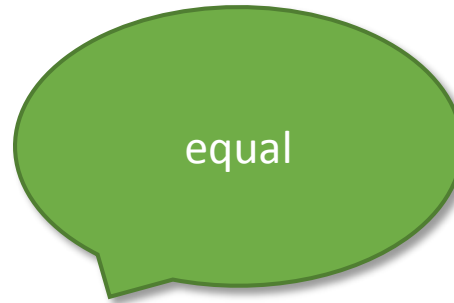
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- Find 6

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1	2	3	5	6	8	8
---	---	---	---	---	---	---

# Binary Search

- Find 6

It is **greater** → `val not to the right`  
It is **smaller or equal** → `val not to the left`

This test is important.

(Otw. wrong result if value doesn't appear at all.)

equal

1	2	3	5	6	8	8
---	---	---	---	---	---	---