

first =

search_item = 8

last =

midpoint =

items = [1, 4, 6, 7, 10, 11, 13]


`first = 0`

`search_item = 8`

`last = 6`

`midpoint = (0 + 6) // 2 = 3`

`items = [1, 4, 6, 7, 10, 11, 13]`


`first`


`midpoint`


`last`

`first = 0`

`search_item = 8`


`last = 6`

`midpoint = 3`

`items[3] = 7` is not 8

`items[3] = 7` is less than 8

`items = [1, 4, 6, 7, 10, 11, 13]`


`first`


`midpoint`


`last`

`first = 4`

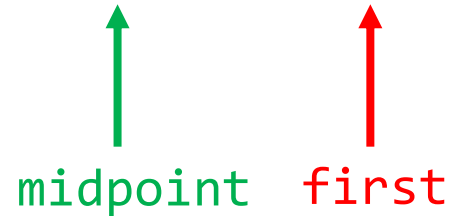
`search_item = 8`

`last = 6`

`midpoint = 3`

Set `first = midpoint + 1`

`items = [1, 4, 6, 7, 10, 11, 13]`


`midpoint` `first`


`last`

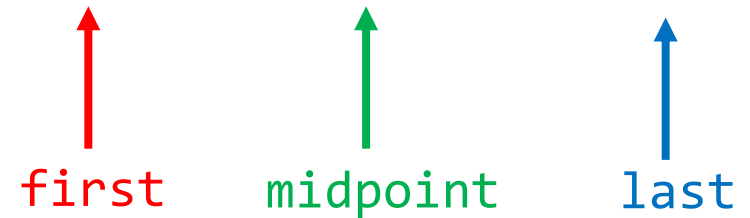
first = 4

last = 6

midpoint = (4 + 6) // 2 = 5

search_item = 8

items = [1, 4, 6, 7, 10, 11, 13]



A diagram showing three colored arrows pointing upwards to elements in the array [1, 4, 6, 7, 10, 11, 13]. A red arrow points to the element 10, a green arrow points to the element 11, and a blue arrow points to the element 13. Below each arrow is its corresponding label: 'first' in red, 'midpoint' in green, and 'last' in blue.

first midpoint last

first = 4

search_item = 8

last = 6

midpoint = 5

items[5] = 11 is not 8

items[5] = 11 is greater than 8

items = [1, 4, 6, 7, 10, 11, 13]

↑
first

↑
midpoint

↑
last

`first = 4`

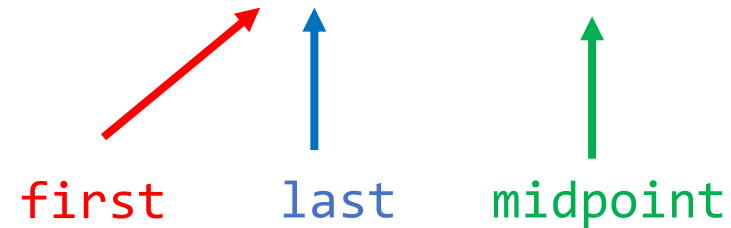
`search_item = 8`

`last = 4`

`midpoint = 5`

Set `last = midpoint - 1`

`items = [1, 4, 6, 7, 10, 11, 13]`



A diagram illustrating the state of a binary search. Three colored arrows point from labels below to elements in the array `items = [1, 4, 6, 7, 10, 11, 13]`. A red arrow labeled `first` points to the element 7. A blue arrow labeled `last` points to the element 10. A green arrow labeled `midpoint` points to the element 11.

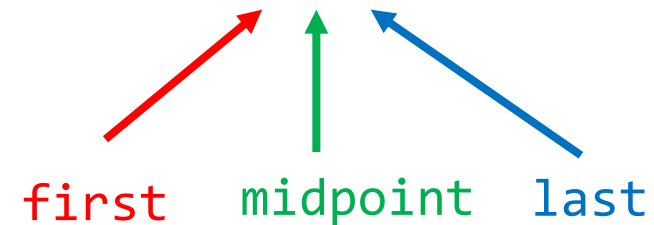
`first = 4`

`search_item = 8`

`last = 4`

`midpoint = (4 + 4) // 2 = 4`

`items = [1, 4, 6, 7, 10, 11, 13]`



`first = 4`

`search_item = 8`

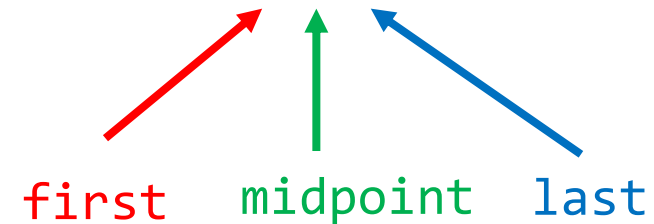
`last = 4`

`midpoint = 4`

`items[4] = 10` is not 8

`items[4] = 10` is greater than 8

`items = [1, 4, 6, 7, 10, 11, 13]`



`first = 4`

`search_item = 8`

`last = 3`

`midpoint = 4`

Set `last = midpoint - 1`

`items = [1, 4, 6, 7, 10, 11, 13]`

↑
`last`

↑
`first`

`first = 4`

`last = 3`

`search_item = 8`

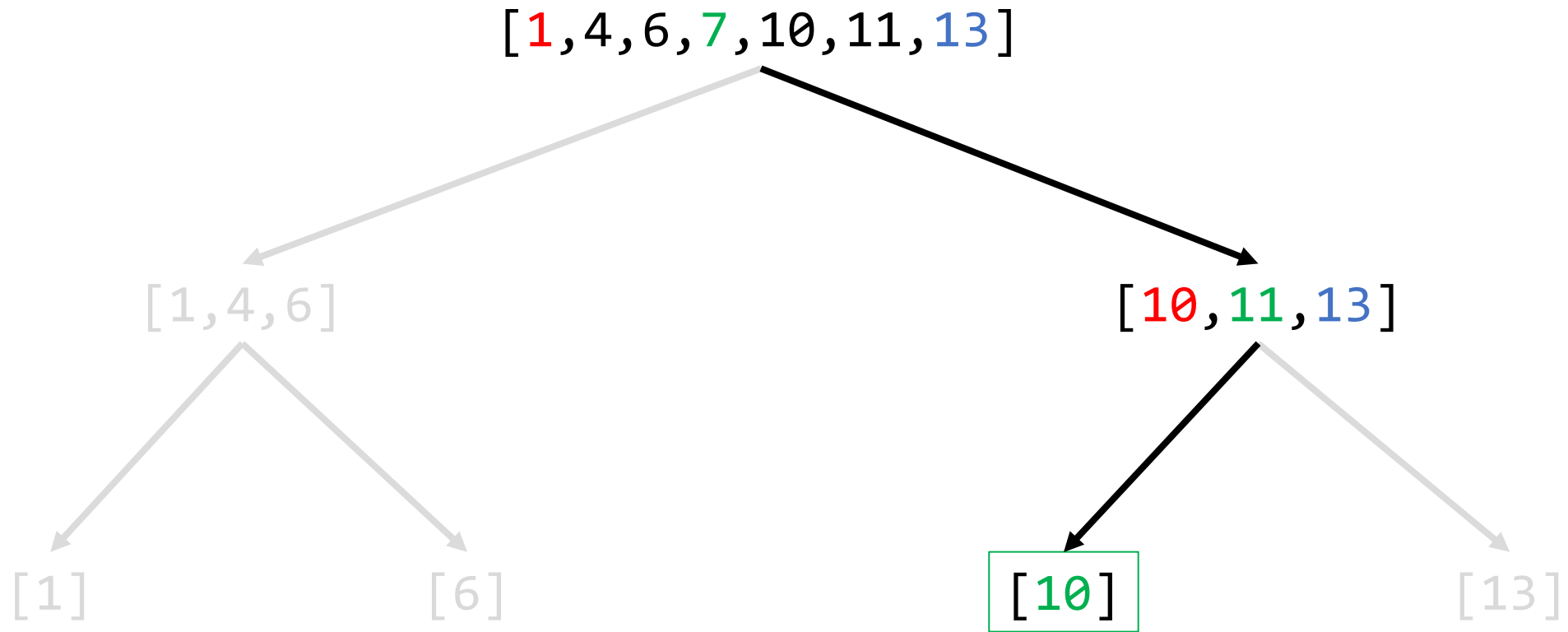
`first > last - STOP`

ITEM NOT FOUND

`items = [1, 4, 6, 7, 10, 11, 13]`

↑
`last`

↑
`first`



Tracing the number of midpoints checked.

Here the number of items is $n = 7$ and the item isn't found.

The number of checks of the midpoint is $\lfloor \log(7) \rfloor + 1 = 3$