first =

last =

midpoint =

search_item = 8

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

first = 0

last = 6

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

search_item = 8

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

first

midpoint

last

first = 0

last = 6

midpoint = 3

search_item = 8

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

last = 6

midpoint = 3

search_item = 8

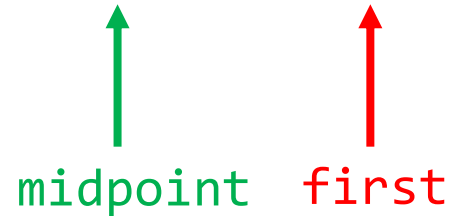Set first = midpoint + 1

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

midpoint   first   last
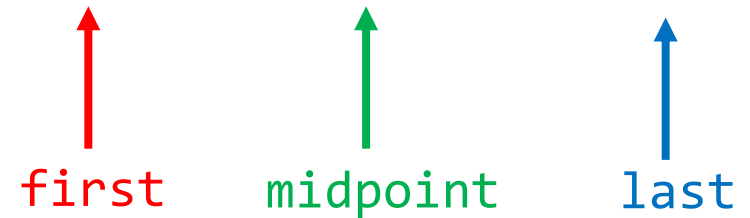
first = 4

last = 6

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

search_item = 8

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

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

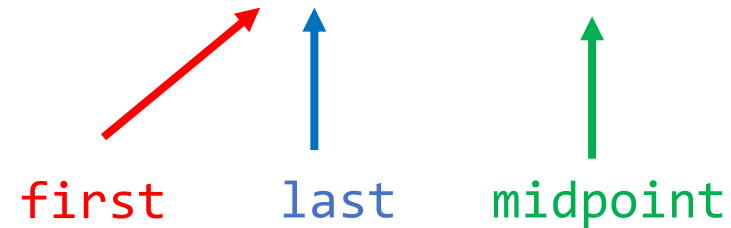items = [1, 4, 6, 7, 10, 11, 13]

first   midpoint   last

first = 4

last = 4

midpoint = 5

search_item = 8

Set last = midpoint - 1

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

first   last   midpoint

first = 4

last = 4

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

search_item = 8

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

first   midpoint   last
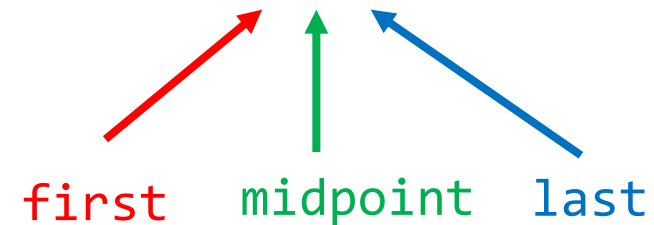
first = 4

last = 4

midpoint = 4

search_item = 8

items[4] = 10 is not 8
items[4] = 10 is greater than 8

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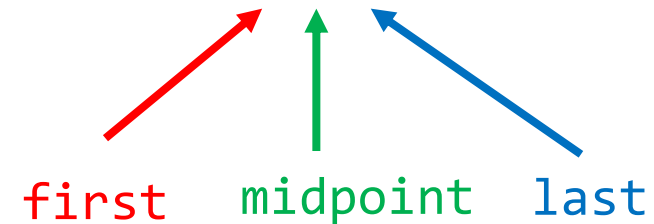
first   midpoint   last

first = 4

last = 3

midpoint = 4

search_item = 8

Set last = midpoint - 1

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

last   first

first = 4   search_item = 8

last = 3

first > last - STOP

ITEM NOT FOUND

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

$[1,4,6,7,10,11,13]$

$[1,4,6]$

$[10,11,13]$

$[1]$ $[6]$

$[10]$ $[13]$
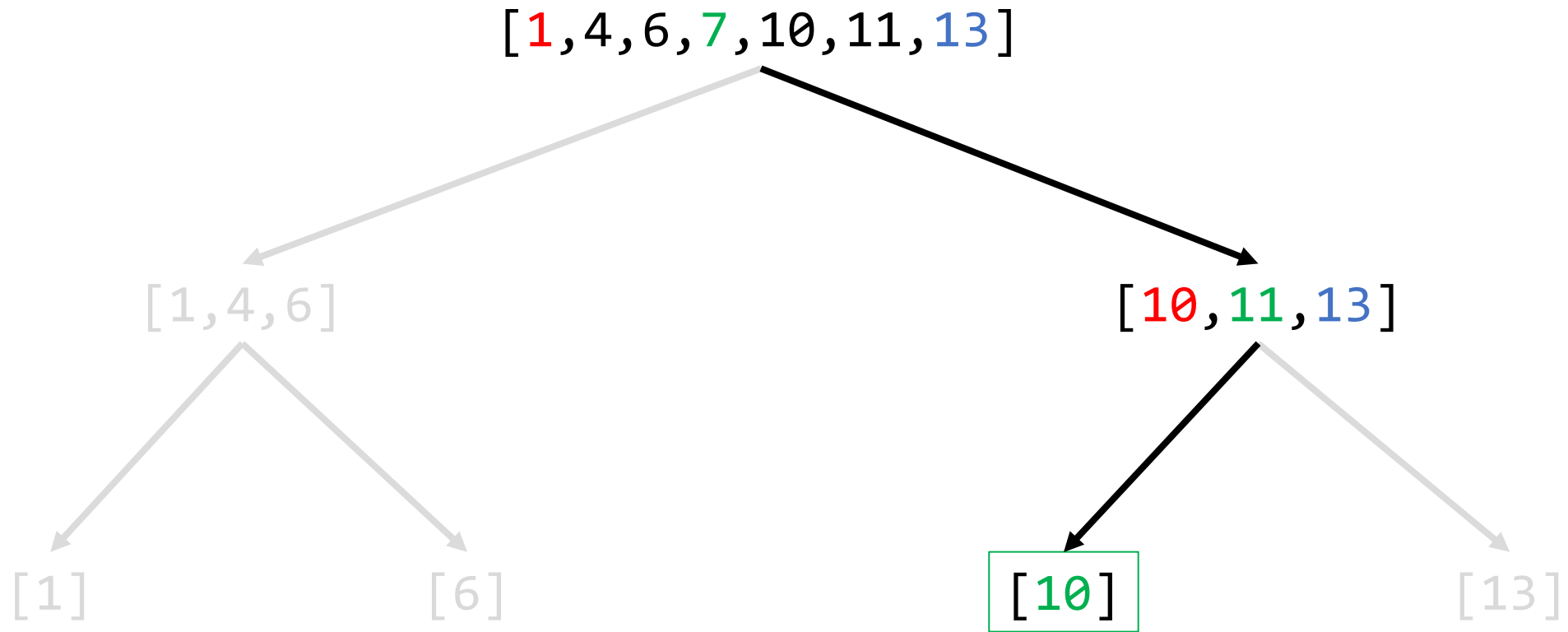
Tracing the number of midpoints checked.

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

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