

Problem Domain

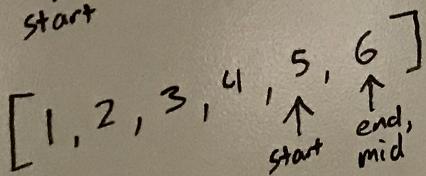
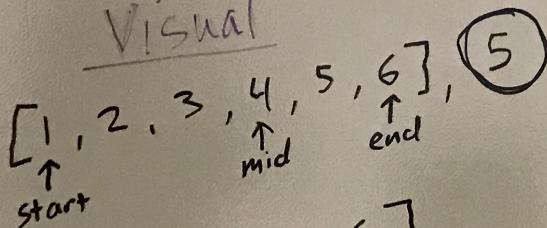
Write a function that accepts a sorted array and a value. Returns the array index of element that matches the value. Returns -1 if not found.

input: array of values

input: a value

output: array index

Visual



Algorithm

Accept sorted array + search value
Define start and end array indexes
While value not found, iteratively find middle index between start + end
determine if value is less than, greater or equal to middle
Adjust start and end appropriately
Return array index, or -1

Code

```
def binary_search(arr, val):  
    index = -1  
    start = 0  
    end = len(arr) - 1  
    found = False  
    while found == False:  
        mid = (start + end) // 2  
        if val == arr[mid]:  
            index = mid  
            found = True  
        else:  
            if val < arr[mid]:  
                end = mid - 1  
            else:  
                start = mid + 1  
    return index
```

Big O

time: $O(\log N)$

space: $O(1)$