

Problem Domain

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

input: array of values
input: a value
output: array index

Visual

[1, 2, 3, 4, 5, 6], (5)
↑ ↑ ↑
start mid end

[1, 2, 3, 4, 5, 6]
 ↑ ↑
 start end, mid

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

Big O

time: $O(\log N)$

space: $O(1)$

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
```