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Binary Search

Searching

Binary Searching

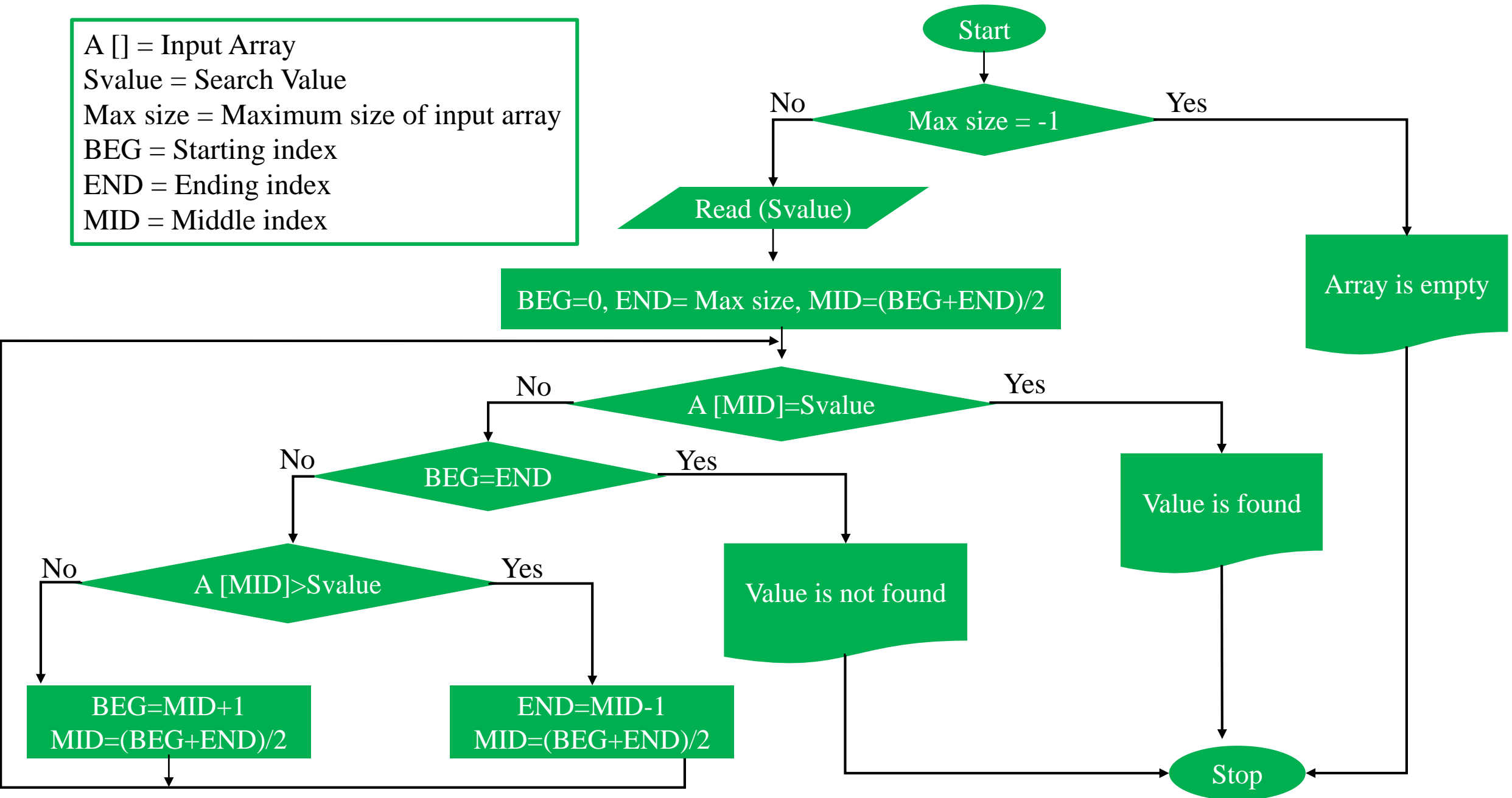
- ❑ Binary search is the search technique that works efficiently on sorted lists. Hence, to search an element into some list using the binary search technique, we must ensure that the list is sorted.

Binary search follows the divide and conquer approach in which the list is divided into two halves, and the item is compared with the middle element of the list. If the match is found then, the location of the middle element is returned. Otherwise, we search into either of the halves depending upon the result produced through the match.

Binary Searching

- ❑ Search a sorted array by repeatedly dividing the search interval in half. Begin with an interval covering the whole array. If the value of the search key is less than the item in the middle of the interval, narrow the interval to the lower half. Otherwise, narrow it to the upper half. Repeatedly check until the value is found or the interval is empty.
- ❑ **NOTE:** Binary search can be implemented on sorted array elements. If the list elements are not arranged in a sorted manner, we have first to sort them.

A [] = Input Array
 Svalue = Search Value
 Max size = Maximum size of input array
 BEG = Starting index
 END = Ending index
 MID = Middle index



$$\text{BEG} = \text{B}, \text{END} = \text{E}, \text{MID} = \text{M} = (\text{B} + \text{E}) / 2$$

Search = 24

3	6	9	13	16	24	39	55	72	93
0	1	2	3	4	5	6	7	8	9

24 > 16,
Take 2nd half

3	6	9	13	16	24	39	55	72	93
B = 0	1	2	3	M = 4	5	6	7	8	E = 9

24 < 55,
Take 1st half

3	6	9	13	16	24	39	55	72	93
0	1	2	3	4	B = 5	6	M = 7	8	E = 9

Found 24,
Return 5

3	6	9	13	16	24	39	55	72	93
0	1	2	3	4	B = 5	E = 6	7	8	9
					M = 5				

Binary Searching Complexity

- ❑ **Best Case Complexity** - In Binary search, best case occurs when the element to search is found in first comparison, i.e., when the first middle element itself is the element to be searched. The best-case time complexity of Binary search is $O(1)$.
- ❑ **Average Case Complexity** - The average case time complexity of Binary search is $O(\log n)$.
- ❑ **Worst Case Complexity** - In Binary search, the worst case occurs, when we have to keep reducing the search space till it has only one element. The worst-case time complexity of Binary search is $O(\log n)$.

Real Life Examples

- Dictionary
- Height of Students
- Library
- Page Number
- University

Thank You

Any Question ?