

SEARCH ALGORITHM

INTERPOLATION

SEARCH

ALPHA MEWING SIGMA

INTERPOLATION SEARCH

- This is an improvement over binary search for instances, where the values in a sorted array are uniformly distributed.
- Binary Search always goes to the middle element to check. On the other hand, interpolation search may go to different locations according to the value of the key being searched.
- For example, if the value of the key is closer to the last element, interpolation search is likely to start search toward the end side.

FORMULA

- $$pos = lo + \frac{(x - arr[lo]) \cdot (hi - lo)}{arr[hi] - arr[lo]}$$
- $arr[] \implies$ Array where elements need to be searched
- $x \implies$ Element to be searched
- $lo \implies$ Starting index in $arr[]$

TIME COMPLEXITY

- For Average Case :

$O(\log_2(\log_2 n))$

- For Worst Case :

$O(n)$

- Auxiliary Space Complexity :

$O(1)$

EXAMPLE

10	13	15	26	28	30	50	56	58
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- **Step1:** In a loop, calculate the value of "pos" using the probe position formula.
- **Step2:** If it is a match, return the index of the item, and exit.
- **Step3:** If the item is less than arr[pos], calculate the probe position of the left sub-array. Otherwise, calculate the same in the right sub-array.
- **Step4:** Repeat until a match is found or the sub-array reduces to zero.

CODE

```
public static int interpolationSearch(int arr[], int lo,
                                     int hi, int x)
{
    int pos;

    // Since array is sorted, an element
    // present in array must be in range
    // defined by corner
    if (lo <= hi && x >= arr[lo] && x <= arr[hi]) {

        // Probing the position with keeping
        // uniform distribution in mind.
        pos = lo
            + (((hi - lo) / (arr[hi] - arr[lo]))
                * (x - arr[lo]));

        // Condition of target found
        if (arr[pos] == x)
            return pos;

        // If x is larger, x is in right sub array
        if (arr[pos] < x)
            return interpolationSearch(arr, pos + 1, hi,
                                      x);

        // If x is smaller, x is in left sub array
        if (arr[pos] > x)
            return interpolationSearch(arr, lo, pos - 1,
                                      x);
    }
    return -1;
}
```

```
public static void main(String[] args)
{
    // Array of items on which search will
    // be conducted.
    int arr[] = { 10, 12, 13, 16, 18, 19, 20, 21,
                  22, 23, 24, 33, 35, 42, 47 };

    int n = arr.length;

    // Element to be searched
    int x = 18;
    int index = interpolationSearch(arr, 0, n - 1, x);

    // If element was found
    if (index != -1)
        System.out.println("Element found at index "
                           + index);
    else
        System.out.println("Element not found.");
}
```

Element found at index 4

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THANK YOU !



ANY QUESTIONS????

