14th Feb

14 February 2022 21:21

- Binary Search only works on Sorted Array.

```
     0  1  2  3  4  5  6  7  8  9
arr [10,20,30,40,50,60,70,80,90,100] , k = 25
          r  l
```

```
 0  1  2   3   4
[3, 7, 10, 12, 15], k = 9
    r  l
```

```
while (l <= r) {
   mid = (r + l)/2
   if(arr[mid] == k) {
      return mid;
   }
   else if (arr[mid] > k) {
      r = mid - 1;
   } else {
      l = mid + 1;
   }
}
```

mid = (l+r)/2

arr[m] > k

arr[m] < k

```
 -1  0  1  2  3  4  5  6  7  8  9
arr [10,20,30,40,50,60,70,80,90,100] , k = 5
 r   l
```

$\frac{n}{2}$ m

$\frac{2}{2}$! = 1

$\frac{2}{2}$

1) $\frac{10}{2} = 5$

2) $\frac{5}{2} = 2$

3) $\frac{2}{2} = 1$

n = 10

$\log_2(n) = 3$

Binary Search (Recursion):

k = 100

```
arr [10,20,30,40,50,60,70,80,90,100] ,
     0  1  2  3  4  5  6  7  8  9
```

l	r	m	
9	9	9	1 2 3
8	9	8	1 2 3 4
5	9	7	1 2 3 4
0	9	4	1 2 3 4

9

100 0 9

```
int BSR(arr, k, l, r) {
1   if(l > r) return -1;
2       m = (l+r)/2;
3       if (arr[mid] == k) {
           return mid;
4       } else if(arr[mid] < k) {
           return BSR(arr, k, m+1, r );
        } else {
5          return BSR(arr, k, l, m - 1);
        }
}
```

Ternary Search:-

```
     0  1  2  3  4  5  6  7  8  9
arr [10,20,30,40,50,60,70,80,90,100]
```

while (l < r) {

0 1 2 3 4 5 6 7 8 9

arr [10, 20, 30, 40, 50, 60, 70, 80, 90, 100]

m_1 l r m_2 X

K = 50

$K < arr[m_1]$

$K > arr[m_2]$

$10/3 = 3$

$3/3 = 1$

$10/2 = 5$

$5/2 = 2$

$2/2 = 1$

```
while (l ≤ r) {
  Partition = (r-l)/3
  m1 = l + partition;
  m2 = r - Partition;
  if (arr[m1] == k) {
    return m1;
  } else if (arr[m2] == k) {
    return m2;
  } else if (k < arr[m1]) {
    r = m1 - 1
  } else if (k > arr[m2]) {
    l = m2 + 1
  } else {
    l = m1 + 1;
    r = m2 - 1;
  }
}
```

T.C

$3^2 = 9$

$\sqrt{9} = 3$

$\log_2(n) = \sqrt{n}$

$n = 10$

$\log(n) = 3...$

for (i=1; i ≤ n; i=i×2) {

n=

T.C

$= \log(n)$

$\underline{4}$ $\quad$ 2

$\underline{4\log(n)}$ $\quad$ $\underline{2}(\log(n))$

$\frac{n}{2}$

$\frac{\ }{2}$ $\quad$ $1 = 1$

$\frac{\ }{2}$

$\vdots$

$\frac{\ }{2}$

$= 10$

$= ?$

$\frac{10}{2} = 5$ - 1

$\frac{5}{2} = 2$ - 2

$\frac{2}{2} = 1$ - 3

for (i=1 ; i ≤ n ;   T.C

}

i=1 — 1

i=2 — 2

i=4 — 3

i=8 —

i=16

for(i=1 ; i×i ≤ n ; i++){

}

$$x^k = n$$

$$\log_x(n) = k$$

$n = 100$

$O\sqrt{n}$

$i = 1$ 1

$i = 2$ 2

$i = 4$ 3

$i = 8$ 4

$i = 16$ 5

$i = 32$ 6

$i = 64$ 7

$i = 128$