Searching

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1 Searching

As the name suggests, it is basically hunting down a given element in a datastructure.

It is much easier to search in a sorted dataset than an unsorted one, in case of ordered keys we could search any sorted array in $O(\log n)$ time and any unsorted array in $O(n)$.

2 Binary Search

The are two variations of this mentioned in skienna's book-

2.1 When the size of an array is known

```
int bin_search(int a[],int low,int high,int key){
    if(low > high) return -1; // the base case

    int mid = (low+high)/2;

    if(a[mid]==key) return mid;
    else if(a[mid]>key) return bin_search(a,low,mid-1,key);
    else return bin_search(a,mid+1,high,key);
}
```

Figure 1: Binary search when size of array is known

This code would return the index of the number if it has been found, if not it will return -1.

This simply works by checking the middle element if there is a match then

it returns it otherwise it checks from `low` to `mid-1` or from `mid+1` to `high` depending on the value of `arr[mid]`.

2.2 When the size of array is unknown

```
int bin_search_without_n(int a[],int key){
    int p=1;
    while(a[2*p] < key){
        p *= 2;
    }
    return bin_search(a,p,2*p,key);
}
```

Figure 2: Binary search when size of array is not known

This code essentially checks for the value in intervals at powers of two. By this we find the interval in which our required value lies. This could also be used if we know that our value is rather close to the starting position.

2.3 Searching in maps,vectors and sets

We could search for elements in these standard data structures using the find function.

```
auto x = map_name.find(key);
auto y = set_name.find(key);
auto z = vec_name.find(key);
```

In the code, `x`, `y`, and `z` are iterators pointing to the corresponding elements in the data structure. If the keys are not present, these iterators point to `var_name.end()`.

The searching in maps and sets is done in $O(\log n)$ complexity,whereas the searching in vectors is done in $O(n)$ time i.e. Linear Search.