

binarySearch

```
//  
// Created by yjs on 2022/4/21.  
//  
  
#include <bits/stdc++.h>  
  
using namespace std;  
  
class Search {  
public:  
  
    int binarySearch(const vector<int> nums, const int &target) {  
        int left = 0, right = nums.size() - 1;  
        while (left <= right) {  
            int mid = left + (right - left) / 2;  
            if (nums[mid] == target) {  
                return mid;  
            } else if (nums[mid] < target) {  
                left = mid + 1;  
            } else if (nums[mid] > target) {  
                right = mid - 1;  
            }  
        }  
        return -1;  
    }  
  
    int lowerSearch(const vector<int> nums, const int &target) {  
        // [a,b)  
        int left = 0, right = nums.size();  
        while (left < right) {  
            int mid = left + (right - left) / 2;  
            if (nums[mid] == target) {  
                right = mid;  
            } else if (nums[mid] < target) {  
                left = mid + 1;  
            } else if (nums[mid] > target) {  
                right = mid;  
            }  
        }  
        return left;  
    }  
  
    int upperSearch(const vector<int> nums, const int &target) {  
        // (a,b]  
        int left = 0, right = nums.size();  
        while (left < right) {  
            int mid = left + (right - left) / 2;
```

```

        if (nums[mid] == target) {
            left = mid + 1;
        } else if (nums[mid] < target) {
            left = mid + 1;
        } else if (nums[mid] > target) {
            right = mid;
        }
    }
    return left - 1;
}

};

int main() {

    vector<int> nums{1, 25, 69, 25, 17, 17, 14};
    sort(nums.begin(), nums.end());
    for_each(nums.begin(), nums.end(), [](auto c) { cout << c << " "; });
    cout << endl;
    Search search1;

    cout << search1.binarySearch(nums, 17) << endl;
    cout << search1.lowerSearch(nums, 17) << endl;
    cout << search1.upperSearch(nums, 17) << endl;

    return 0;
}

```

KMP

```

#include <bits/stdc++.h>

using namespace std;

class KMP1{

private:
    string pat;
    vector<int> next;
public:

    KMP1(const string & pat):pat(pat){
        // init next
        int j=0,k=-1;
        next.resize(pat.length());
        next[0]=-1;
        while (j<pat.length()-1){

```

```

        if(k== -1 || pat[j]==pat[k]){
            j++;
            k++;
            next[j]=k;
        }else{
            k=next[k];
        }

    } // end init next
}

int search(const string & txt ){
    int i=0,j=0;
    while (i<txt.length() && j<pat.length()){

        if(j== -1 || txt[i]==pat[j]){
            i++;
            j++;

        }else{
            j=next[j];
        }

    }
    if(j>=pat.length()){
        return i-pat.length();
    }else{
        return -1;
    }

}

};

class KMP2{
private:
    string pat;
    vector<int> arcnext;
public:

    KMP2(const string & pat):pat(pat){
        // init next

```

```

int j=0,k=-1;
arcnext.resize(pat.length());
arcnext[0]=-1;
while (j<pat.length()-1){

    if(k==-1 || pat[j]==pat[k]){
        j++;
        k++;
        if(pat[j]==pat[k]){
            arcnext[j]=arcnext[k];
        }else{
            arcnext[j]=k;
        }
    }else{
        k=arcnext[k];
    }
} // end init next
}

```

```

int search(const string & txt ){
    int i=0,j=0;
    while (i<txt.length() && j<pat.length()){

        if(j==-1 || txt[i]==pat[j]){
            i++;
            j++;

        }else{
            j=arcnext[j];
        }

    }
    if(j>=pat.length()){
        return i-pat.length();
    }else{
        return -1;
    }

}

```

```

};

```

```

int main(){

```

```
string res{"abaabc"};
KMP1 * kmp=new KMP1(res);
int pos=kmp->search("abaabaabcab");
cout <<pos<<endl;

return 0;
}
```