## 字符串

## **KMP**

```
1
    //can be overed
 2
    #include<bits/stdc++.h>
 3
    #define ll long long
    using namespace std;
 5
    int n;
 6
    const int MAXN=1000020;
 7
    char s[MAXN],p[MAXN];
 8
    11 nex[MAXN];//you can add 1 to get normal next
 9
    void getNext(char strp[],ll nextt[]){
            11 las,pl=strlen(strp);
10
            nextt[0]=las=-1;
11
            for(ll i=1;i<pl;i++){</pre>
12
                     while(las>-1&&strp[i]!=strp[las+1]){
13
                             las=nextt[las];
14
15
                     }
16
                     if(strp[i]==strp[las+1]){
17
                             las++;
18
19
                     nextt[i]=las;
            }
20
21
22
    11 KMP(char strp[],char strs[],ll nextt[]){
23
            11 las=-1,pl=strlen(strp),sl=strlen(strs),ans=0;
24
            getNext(strp,nextt);
            for(ll i=0;i<sl;i++){
25
                     while(las>-1&&strs[i]!=strp[las+1]){
26
27
                             las=nextt[las];
28
                     }
                     if(strs[i]==strp[las+1]) las++;
29
30
                     if(las+1==pl){
                             ans++;
31
32
                             las=nextt[las];
33
                             //printf("%d\n",i-pl+2);//output the start
34
                     }
35
36
            return ans;
37
38
    int main(){
39
            scanf("%d",&n);
40
            while(n--){
41
                     scanf("%s%s",p,s);
42
                     printf("%11d\n",KMP(p,s,nex));
43
            }
            return 0;
44
45
    }
46
```

## 扩展KMP

```
//char
 2
    #include<bits/stdc++.h>
    #define ll long long
 3
 4
    #define db double
    #define ioss ios::sync_with_stdio(false);cin.tie(0);cout.tie(0)
 5
    using namespace std;
 6
 7
    const int MAXN=100020;
 8
    int n;
 9
    11 ext[MAXN],nex[MAXN];
    char s[MAXN],p[MAXN];
10
    void getNext(char strp[],ll nextt[]){
11
12
        nextt[0]=0;
13
        11 pl=strlen(strp);
        11 fir=0, las=0;
14
15
        for(ll i=1;i<pl;i++) {</pre>
16
             nextt[i] = min(las - i + 1, nextt[i - fir]);
17
             if (nextt[i] < 0) nextt[i] = 0;</pre>
18
             while (i+nextt[i]<pl && strp[nextt[i]] == strp[i + nextt[i]]) {</pre>
19
                 nextt[i]++;
20
             if (i + nextt[i] - 1 > las) {
21
22
                 las = i + nextt[i] - 1;
23
                 fir = i;
24
             }
25
        }
26
27
    void exKMP(char strp[],char strs[],ll nextt[],ll extt[]){
28
        getNext(strp,nextt);
29
        11 pl=strlen(strp),sl=strlen(strs);
30
        11 fir=0,las=-1,mnl=min(sl,pl);
        while(las<mnl-1&&strp[las+1]==strs[las+1]){</pre>
31
32
             las++;
33
        }
34
        extt[0]=las+1;
        for(ll i=1;i<sl;i++){</pre>
35
36
             extt[i]=min(las-i+1,nextt[i-fir]);
37
             if(extt[i]<0) extt[i]=0;</pre>
38
             while(extt[i]<pl && i+extt[i]<sl && strp[extt[i]]==strs[i+extt[i]]){</pre>
39
                 extt[i]++;
40
             }
41
             if(i+extt[i]-1>las){
42
                 las=i+extt[i]-1;
43
                 fir=i;
44
             }
45
        }
46
    int main() {
47
48
        scanf("%s%s",s,p);
49
        exKMP(p,s,nex,ext);
50
        printf("%d",strlen(p));
51
        for(int i=1;i<strlen(p);i++){</pre>
52
             printf(" %lld",nex[i]);
```

```
53
         }
         printf("\n");
54
55
         for(int i=0;i<strlen(s);i++){</pre>
             if(i!=0) printf(" ");
56
             printf("%lld",ext[i]);
57
58
         printf("\n");
59
60
         return 0;
61
    }
```

## AC自动机

```
1
    //char
 2
    #include<bits/stdc++.h>
    #define ll long long
    #define db double
 5
    #define ioss ios::sync_with_stdio(false);cin.tie(0);cout.tie(0)
    using namespace std;
 6
    const int MAXN=100020;
 7
 8
    int n;
9
    11 ext[MAXN],nex[MAXN];
    char s[MAXN],p[MAXN];
10
    void getNext(char strp[],ll nextt[]){
11
12
        nextt[0]=0;
        11 pl=strlen(strp);
13
14
        11 fir=0,las=0;
        for(ll i=1;i<pl;i++) {
15
             nextt[i] = min(las - i + 1, nextt[i - fir]);
16
17
             if (nextt[i] < 0) nextt[i] = 0;
18
            while (i+nextt[i]<pl && strp[nextt[i]] == strp[i + nextt[i]]) {</pre>
19
                 nextt[i]++;
20
             }
             if (i + nextt[i] - 1 > las) {
21
22
                 las = i + nextt[i] - 1;
23
                 fir = i;
24
            }
        }
25
26
27
    void exKMP(char strp[],char strs[],ll nextt[],ll extt[]){
28
        getNext(strp,nextt);
29
        11 pl=strlen(strp),sl=strlen(strs);
30
        11 fir=0,las=-1,mnl=min(sl,pl);
31
        while(las<mnl-1&&strp[las+1]==strs[las+1]){</pre>
32
             las++;
33
        }
34
        extt[0]=las+1;
35
        for(ll i=1;i<sl;i++){
36
             extt[i]=min(las-i+1,nextt[i-fir]);
37
             if(extt[i]<0) extt[i]=0;</pre>
38
             while(extt[i]<pl && i+extt[i]<sl && strp[extt[i]]==strs[i+extt[i]]){</pre>
39
                 extt[i]++;
40
             if(i+extt[i]-1>las){
41
```

```
las=i+extt[i]-1;
42
43
                 fir=i;
44
            }
        }
45
46
47
    int main() {
48
        scanf("%s%s",s,p);
49
        exKMP(p,s,nex,ext);
        printf("%d",strlen(p));
50
51
        for(int i=1;i<strlen(p);i++){</pre>
            printf(" %lld",nex[i]);
52
53
        }
54
        printf("\n");
        for(int i=0;i<strlen(s);i++){</pre>
55
            if(i!=0) printf(" ");
56
57
            printf("%lld",ext[i]);
58
        }
59
        printf("\n");
60
        return 0;
61
    }
```