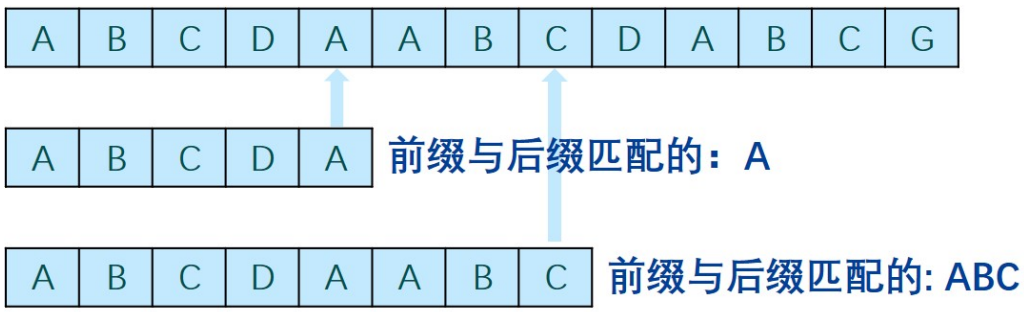
KMP

0. 综述

1. 减少回退，空间换时间
2. 状态机：状态转移
3. 用`next`记录前缀

1. next表

前缀后缀匹配最长字符串的长度



index	-1	0	1	2	3	4	5	6	7	8	9	10	11	12
P	*(通配)	A	B	C	D	A	A	B	C	D	A	B	C	G
next		-1	0	0	0	0	1	1	2	3	4	5	2	3

代码构造

- 已知next表中前[0,j]项，推出$next[j+1]$
- 有 $next[j+1] \leq next[j]+1$
  - 若$P[j] == P(t)$，$next[j+1] = next[j]+1$
  - 否则，循环替换 $t = next[t]$，直到满足上条

```
int* buildNext(char* P) {
    size_t m = strlen(P), j = 0; //“主”串指针
    int* Next = new int[m]; //next表
    int t = Next[0] = -1; //模式串指针
    while (j < m - 1)
        if (t < 0 || P[j] == P[t]) { //匹配
            j ++; t ++;
            Next[j] = t;
        } else //失配
            t = Next[t];
    return Next;
}

j = 1  t = 0   Next[1] = 0

P[1] = b, P[0] = a
back: t= -1
j = 2  t = 0   Next[2] = 0

P[2] = c, P[0] = a
back: t= -1
j = 3  t = 0   Next[3] = 0

P[3] = d, P[0] = a
back: t= -1
j = 4  t = 0   Next[4] = 0

P[4] = P[0] = a
j = 5  t = 1   Next[5] = 1

P[5] = a, P[1] = b
back: t= 0
P[5] = P[0] = a
j = 6  t = 1   Next[6] = 1

P[6] = P[1] = b
j = 7  t = 2   Next[7] = 2

P[7] = P[2] = c
j = 8  t = 3   Next[8] = 3

P[8] = P[3] = d
j = 9  t = 4   Next[9] = 4

P[9] = P[4] = a
j = 10  t = 5   Next[10] = 5

P[10] = b, P[5] = a
back: t= 1
P[10] = P[1] = b
j = 11  t = 2   Next[11] = 2

P[11] = P[2] = c
```

```
j = 12  t = 3   Next[12] = 3

```

复杂度

构表：$O(m)$

2. 主代码

```
int match(char* P, char* T) {
    int* next = buildNext(P);
    int n = (int) strlen(T), i = 0; //主串指针
    int m = (int) strlen(P), j = 0; //模式串指针
    while ((j < m) && (i < n)) //自左向右逐个比对字符
    if (j < 0 || T[i] == P[j]) //未越界且匹配
        { i ++; j ++; } //转到下一字符
    else //否则
        j = next[j]; //模式串右移，主串不回退
    delete [] next;
    return i - j;
}
```

复杂度

遍历：$O(n)$

3. 小结

- 复杂度：$O(m+n)$
- 与模式串长度无关