

## ■ Implementation

我寫了兩個 function，分別是 `prekmp` 和 `KMP`。

function `prekmp`：演算法是用 failure function 去做比較，failure function 是一個字串函數，輸入字串的其中一個前綴，則輸出該前綴的「次長的相同前綴後綴」。

function `KMP`：是用來判斷 string `target` 有沒有 string `pattern` 的 substring。一開始先比較 `target[i]` 和 `pattern[k]`，如果相同則繼續比對(`i++`, `k++`)，如果不同，就呼叫 `prekmp`，對傳進來的 `pattern[]` 做 failure function 的運算，移動 `pattern` 繼續比對。如果 `target` 中找到 `pattern` 的 substring，則 `count++`。

main：先讀入要開起的 file 和 output 要寫進的 file，使用 `fopen` 開啟 file，然後將字串遇到空格就分割，然後丟回上面的 `KMP` function 做運算，用一個變數 `j` 去記切割了幾次，就可以得到該字串的 position，最後印出 output 的值。time calculation 是在 main 的一開始給一個 `clock_t time = clock();` 跑完中間的 code 後 `time = clock() - time;` 所以執行時間就會是 `time/CLOCKS_PER_SEC * 1000` milliseconds。

## ■ Failure Function

Definition: If  $p = p_0p_1...p_{n-1}$  is a pattern, then its failure function,  $f$ , is defined as

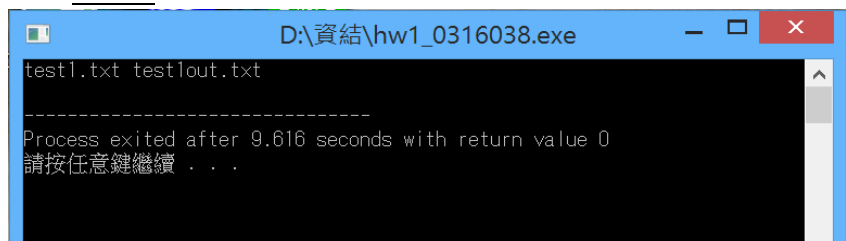
$$f(j) = \begin{cases} \text{largest } k < j \text{ such that } p_0p_1...p_k = p_{j-k}p_{j-k+1}...p_j & \text{if such a } k \geq 0 \text{ exists} \\ -1 & \text{otherwise.} \end{cases}$$

## ■ KMP algorithm

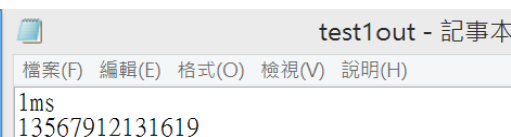
If a partial match is found such that  $si-j ... si-1 = p_0p_1...p_{j-1}$  and  $si \neq p_j$  then matching may be resumed by comparing  $si$  and  $Pf(j-1)+1$  if  $j \neq 0$ . If  $j = 0$ , we may continue by comparing  $si+1$  and  $p_0$

## ■ Sample testing Results

### Test1

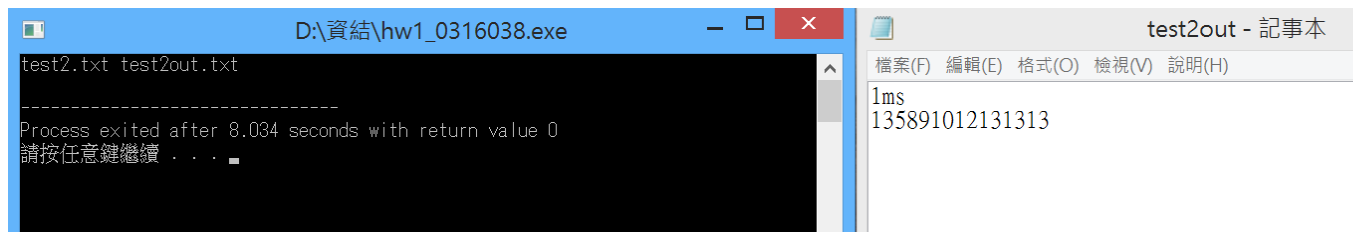


```
D:\資結\hw1_0316038.exe
test1.txt test1out.txt
-----
Process exited after 9.616 seconds with return value 0
請按任意鍵繼續 . . .
```



```
test1out - 記事本
檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)
1ms
13567912131619
```

## Test2

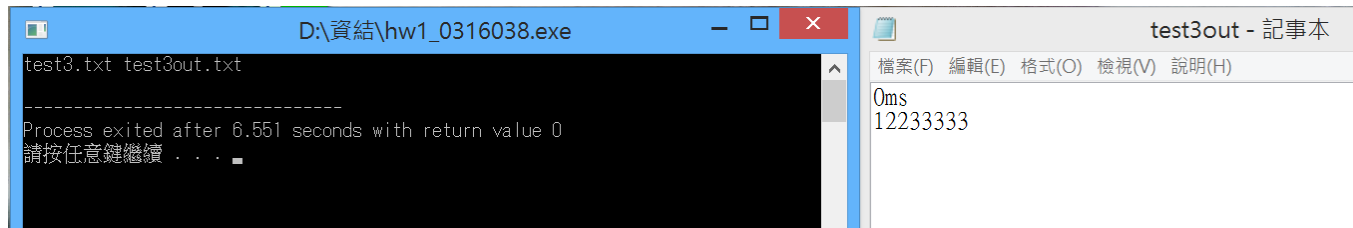


The screenshot shows two windows side-by-side. The left window is a command prompt titled "D:\資結\hw1\_0316038.exe" with a black background and white text. It displays the command "test2.txt test2out.txt", a separator line, and the message "Process exited after 8.034 seconds with return value 0" followed by "請按任意鍵繼續 . . .". The right window is a notepad titled "test2out - 記事本" with a white background and black text. It shows the menu bar "檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)" and the output "1ms" and "135891012131313".

```
test2.txt test2out.txt
-----
Process exited after 8.034 seconds with return value 0
請按任意鍵繼續 . . .
```

test2out - 記事本  
檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)  
1ms  
135891012131313

## Test3



The screenshot shows two windows side-by-side. The left window is a command prompt titled "D:\資結\hw1\_0316038.exe" with a black background and white text. It displays the command "test3.txt test3out.txt", a separator line, and the message "Process exited after 6.551 seconds with return value 0" followed by "請按任意鍵繼續 . . .". The right window is a notepad titled "test3out - 記事本" with a white background and black text. It shows the menu bar "檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)" and the output "0ms" and "12233333".

```
test3.txt test3out.txt
-----
Process exited after 6.551 seconds with return value 0
請按任意鍵繼續 . . .
```

test3out - 記事本  
檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)  
0ms  
12233333