*測試環境 windows 10 的 cmd

1. 實作演算法介紹：

KMP 是一個以 failure function 為輔助的演算法，當遇到重複的字串時可以依據 failure function 所計算出來的數值決定要往前移幾格，而非直接移到第一位重頭開始計算，如此一來當字串大量重複時可以節省許多時間。

2. 測試資料與結果並說明：

Pattern：

aAAaaaaAAAaaaaaAAaa

Text：

aasdaAsaaaaaaaAAAAAaaaaaaaaaAAaaaaaAAAAAaaaaaaaaaaAAAAAaaAAaaAAAAAAAaaaaaAAAaaadaxaaafadaAAAaaaAAAaaaaAAaaaaaaaaaaaaaaaaAAAAAasdadax

測試資料只有一行，而測試結果為第 8~60、88~106 個字都有找到相同的字串。

3. Brute-Force 與 KMP 的執行時間：

以防萬一我測了兩次 KMP 與 Brute-Force 同樣的測資。

KMP:

453.151000/349.051000

Brute-Force:

485.026000/400.835000

因字串大量重複，故可以發現 KMP 執行的速度比 Brute-Force 快。

4. 其他：

其實影響時間的也包括輸出，我測試了另一份檔案比較大的資料(測試資料放在最下面)，結果發現有輸出的 KMP 執行時間是 108524.012000ms / 110664.765000ms，而 Brute-Force 執行時間則是 108865.660000ms / 109921.322000ms，但沒有輸出的 KMP 執行時間是 515.184000ms / 515.640000ms / 530.055000ms，Brute-Force 執行時間則是 545.079000ms / 526.586000ms / 543.754000ms。有輸出的第一次測試說明 Brute-Force 比 KMP 快，但有輸出的第二次測試則說明 KMP 比較快，表示主要影響的是當時 CPU 的運轉狀態，以及輸出所花的時間。而沒有輸出的 KMP 三次測試都比 Brute-Force 快，雖然 CPU 的運轉狀態也需要列入考量，但我想因為輸出太花時間，導致 CPU 的運轉狀態變成了很重要的因素，才會導致如此情形發生吧。

*第四點提到的測資 Pattern 與 Text 皆為相同的檔案，內容如下：

CABBBAAABACCCCCBABAC

CACACCBAABBCBCCCABBCCB

ACCAABCAACAABBACCCCCCCC

BBAAABAAABCCBABAAAACACACABA

CBCABBABBCBAAAACBABCCBBACBCC

BABABCBABCBAACAAACCCCCCAACACAB

ABACBAAAAACACCCCABAABCACAACACBBAA

CCCAABCCCBCBABBCAACABBCABCACABCABC

ACCAABAAAABCBBBCAABABAABAABBACBBCBCCC

CACABBBBACABBACACAAACBBBAABCAACACBABBC

BABBABBACABABAACAAABACCB

ACABAAABBACABBBBCACBACCACCBBBBABCAABAABCCCAAACBA

BAAABBBCABBACCBBACCBCCCBABACBBCABACBCABAACAACACBCBB

CBBBABABCACCABAAAACACBABCBACCCAAACABAACACBABABCABBAABBCBC

ABBCACCABAABCABABCBAAACAABB

BBBBBCACBABACABCCBCCACBBACCABCBAABBBABCBBCCBCABCAABBCABCACBACBB

CBABABACBAA

CCBBBBBCACBBCBACBBBABACAAACCBCABBACACABAACBBBABCBCAACCACCAABAB

CABBCABACAAAAACBABBBBBBCBCC

ABCCABABBBBCBCAABBCBBABABCBBCACBACCCACABCBBBBABBBACABCAAABBABC
ACCAACACABAACCBCBCAAA

CBCABACBACABACBCCBBCCCCABBABCABBCBCBBBCAB

AACAACCCCCABBCABACABABACACABA

BABBAABBCBCCABBBACCABAABAABCBCCBCACBBBABBABCABBAB

BBABBBBBCABCCCCCBBAAABABBBBCBCBBBBCACBCCCBCBBAACCBCBBABB

CAACBCAABBCABBBAABBBBACAAAAABBAACAACABCAABCCCABBBB

BBBABCBACCCBACAAACCCAABBBBCBCAACCAABBAACCBBA

ABABBBBCACACAAAABACCBBCBCCABABBBCBAACBBCCCCACCBCACBA

ABBBCBABBBBBACAABBBBBBBABABBCBBCCACACBBCABBCCBBBBBACCCAABCCA
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BACCBABCABABCCCBAACA

AAACBBCABABCAACACAABBABBACBBBC

BCABCBCABBABAABBBABCBCACACAABAACAABCABBAAABACA

CCBABA

ABACBCC

BBAC

ACBCCABBAACBA

BCABBCACBBCBAAC

ABCBBBBCBCCAACCAABCBBA

ACBBACB

CBCBBAAABCAA

AACAC

ACBABCBB

BCCBCA

CCABAACB

BAABBBABAAC

CCCABA

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BCBAACCACCCCBCACABB

ABCCBCCAACAACBBCCCCCABB

CBBABACCACACBCCAAAACBBBCAACCCABAA

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ABBABBCCAABAACBBACCBBBCCAACCCCAACBAACCACABCAACBCCABBBA

BABBCAACBBBBAABBBCABBBCCABAACCBBACBBCAABCAABCCCCABBBCBAACCA

BBAAACCCBABBACCBBBCBBCAACBCBBCBBAACACAAACACBBCABCCBAACBCACBACABA

BCBBACAAAACCCCCAABAACCCBACABACAABABBBBAABCCCBACBCACABACABCCBABBBBBAA

CBCBBABCBCACACABBBACABCBBCBAAACACBAABCAA

CACBBAAACBACCCCBBAACCABBBCBCCC

BABACCBBAACCCABBCCABAC

AABCCAABABBCBB

ACABCABBBAAABACCCCCBABAC

CACACCBAABBCBCCCABBCCB

ACCAABCAACAABBACCCCCCCC

BBAAABAAABCCBABABAAAACACACABA

CBCABBABBCBAAAACBABCCBBACBCC

BABABCBABCBAACAAACCCCCCAACACAB

ABACBAAAAACACCCCABAABCACAACACBBAA

CCCAABCCCBCBABBCAACABBCABCACABCABC

ACCAABAAAABCBBBCAABABAABAABBACBBCBCCC

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CBBBABABCACCABAAAACACBABCBACCCAAACABAACACBABABCABBAABBCBC

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BBAAACCCBABBACCBBBCBBCAACBCBBCBBAACACAAACACBBCABCCBAACBCACBACAB
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BCBBACAAAACCCCCAABAACCCBACABACAABABBBBAABCCCBACBCACABACABCCBAB
BBBBAA
CBCBBABCBCACACABBBACABCBBCBAAACACBAABCAA
CACBBAAACBACCCCBBAACCABBBCBCCC
BABACCBBAACCCABBCCABAC
AABCCAABABBCBB
ACAB
CABBBAAABACCCCCBABAC
CACACCBAABBCBCCCABBCCB
ACCAABCAACAABBACCCCCCCC
BBAAABAAABCCBABAAAACACACABA
CBCABBABBCBAAAACBABCCBBACBCC
BABABCBABCBAACAAACCCCCCAACACAB
ABACBAAAAACACCCCABAABCACAACACBBAA
CCCAABCCCBCBABBCAACABBCABCACABCABC
ACCAABAAAABCBBBCAABABAABAABBACBBCBCCC
CACABBBBACABBACACAAACBBBAABCAACACBABBC
BABBABBACABABAACAAABACCB
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BAAABBBCABBACCBBACCBCCCBABACBBCABACBCABAACAACACBCBB
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CBABABACBAA
CCBBBBBCACBBCBACBBBABACAAACCBCABBACACABAACBBBABCBCAACCACCAABAB
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ABCCABABBBBCBCAABBCBBABABCBBCACBACCCACABCBBBBABBBACABCAAABBABC
ACCAACACABAACCBCBCAAA
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BABBAABBCBCCABBBACCABAABAABCBCCBCACBBBABBABCABBAB
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CCBABA

ABACBCC

BBAC

ACBCCABBAACBA

BCABBCACBBCBAAC

ABCBBBBCBCCAACCAABCBBA

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CBCBBAAABCAA

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BABACCBBAACCCABBCCABAC

AABCCAABABBCBB

ACAB

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A

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BBBBAA

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CACBBAAACBACCCCBBAACCABBBCBCCC

BABACCBBAACCCABBCCABAC

AABCCAABABBCBB

ACABCABBBAAABACCCCCBABAC

CACACCBAABBCBCCCABBCCB

ACCAABCAACAABBACCCCCCCC

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CBABABACBAA

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ABACBCC

BBAC

ACBCCABBAACBA

BCABBCACBBCBAAC

ABCBBBBCBCCAACCAABCBBA

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CCABAACB

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AABCCAABABBCBB

ACAB

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CACACCBAABBCBCCCABBCCB

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CCBABA

ABACBCC

BBAC

ACBCCABBAACBA

BCABBCACBBCBAAC

ABCBBBBCBCCAACCAABCBBA

ACBBACB

CBCBBAAABCAA

AACAC
ACBABCBB
BCCBCA
CCABAACB
BAABBBABAAC
CCCABA
CABACCAABCBBC
BCBAACCACCCCBCACABB
ABCCBCCAACAACBBCCCCCABB
CBBABACCACACBCCAAAACBBBCAACCCABAA
ABCCACCBACCCB
BCBBCCCABBACCCCABCBCAABBBBBABCBABAAABBCCCCABC
ABBABBCCAABAACBBACCBBBCCAACCCCAACBAACCACABCAACBCCABBBA
BABBCAACBBBBAABBBCABBBCCABAACCBBACBBCAABCAABCCCCABBBCBAACCA
BBAAACCCBABBACCBBBCBBCAACBCBBCBBAACACAAACACBBCABCCBAACBCACBACAB
A
BCBBACAAAACCCCCAABAACCCBACABACAABABBBBAABCCCBACBCACABACABCCBAB
BBBBAA
CBCBBABCBCACACABBBACABCBBCBAAACACBAABCAA
CACBBAAACBACCCCBBAACCABBBCBCCC
BABACCBBAACCCABBCCABAC
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