

LCS

(Longest Common Subsequence)



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LCS

- 最長共同子序列
- 子序列
 - 'a**ab**cc' => 'abc'
- 共同子序列
 - 'a**ab**cc', 'a**b**ccc' => 'abc'

LCS

- DP
- $DP[n][m] = ?$

LCS

- 假設已知 $s1, s2$ 的 LCS 長度為 n , 若將 $s1, s2$ 分別加上字元 $c1, c2$ 則 LCS 長度為?
- $c1 == c2$
 - $c1, c2$ 可以分別加入 $s1, s2$ 的 LCS 始其長度加一
- $c1 != c2$
 - 表示 $c1, c2$ 無法配對增加 LCS 長度, 考慮下列狀況
 - $s1 + c1, s2$
 - $s1, s2 + c2$

Example

- ABCABCBA
- CBABCABCC

		0	1	2	3	4	5	6	7	8	9
			C	B	A	B	C	A	B	C	C
0		x 0	x 0	x 0	x 0	x 0	x 0	x 0	x 0	x 0	x 0
1	A	x 0									
2	B	x 0									
3	C	x 0									
4	A	x 0									
5	B	x 0									
6	C	x 0									
7	B	x 0									
8	A	x 0									

圖片擷取自：<http://www.csie.ntnu.edu.tw/~u91029/LongestCommonSubsequence.html>

		0	1	2	3	4	5	6	7	8	9
			C	B	A	B	C	A	B	C	C
0		x 0	x 0	x 0	x 0	x 0	x 0	x 0	x 0	x 0	x 0
1	A	x 0	↑ 0	↑ 0	↖ 1						
2	B	x 0									
3	C	x 0									
4	A	x 0									
5	B	x 0									
6	C	x 0									
7	B	x 0									
8	A	x 0									

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		0	1	2	3	4	5	6	7	8	9
			C	B	A	B	C	A	B	C	C
0		x 0	x 0	x 0	x 0	x 0	x 0	x 0	x 0	x 0	x 0
1	A	x 0	↑ 0	↑ 0	↖ 1	← 1	← 1	↖ 1	← 1	← 1	← 1
2	B	x 0	↑ 0	↖ 1	↑ 1	↖ 2	← 2	← 2	↖ 2	← 2	← 2
3	C	x 0	↖ 1	↑ 1	↑ 1	↑ 2	↖ 3	← 3	← 3	↖ 3	↖ 3
4	A	x 0	↑ 1	↑ 1	↖ 2	↑ 2	↑ 3	↖ 4	← 4	← 4	← 4
5	B	x 0	↑ 1	↖ 2	↑ 2	↖ 3	↑ 3	↑ 4	↖ 5	← 5	← 5
6	C	x 0	↖ 1	↑ 2	↑ 2	↑ 3	↖ 4	↑ 4	↑ 5	↖ 6	↖ 6
7	B	x 0	↑ 1	↖ 2	↑ 2	↖ 3	↑ 4	↑ 4	↖ 5	↑ 6	↑ 6
8	A	x 0	↑ 1	↑ 2	↖ 3	↑ 3	↑ 4	↖ 5	↑ 5	↑ 6	↑ 6

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		0	1	2	3	4	5	6	7	8	9
			C	B	A	B	C	A	B	C	C
0		x 0	x 0	x 0	x 0	x 0	x 0	x 0	x 0	x 0	x 0
1	A	x 0	↑ 0	↑ 0	↖ 1	← 1	← 1	↖ 1	← 1	← 1	← 1
2	B	x 0	↑ 0	↖ 1	↑ 1	↖ 2	← 2	← 2	↖ 2	← 2	← 2
3	C	x 0	↖ 1	↑ 1	↑ 1	↑ 2	↖ 3	← 3	← 3	↖ 3	↖ 3
4	A	x 0	↑ 1	↑ 1	↖ 2	↑ 2	↑ 3	↖ 4	← 4	← 4	← 4
5	B	x 0	↑ 1	↖ 2	↑ 2	↖ 3	↑ 3	↑ 4	↖ 5	← 5	← 5
6	C	x 0	↖ 1	↑ 2	↑ 2	↑ 3	↖ 4	↑ 4	↑ 5	↖ 6	↖ 6
7	B	x 0	↑ 1	↖ 2	↑ 2	↖ 3	↑ 4	↑ 4	↖ 5	↑ 6	↑ 6
8	A	x 0	↑ 1	↑ 2	↖ 3	↑ 3	↑ 4	↖ 5	↑ 5	↑ 6	↑ 6

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Practice

UVa - 111

Thank You for Your Listening.

