

## LCS → Longest Common Subsequence

$S_1 = "a b c x y"$   
 $S_2 = "x b y"$

$LCS \Rightarrow \overset{2}{\underset{\uparrow}{\text{xy}}}, \overset{1}{\text{x, y, b}}, \overset{2}{\text{b y}}$   
LCS

$LCS = 2$

Definition

$fun(i, j) = \text{max length of LCS}$

$S_1 = "a b c x y"$   
 $S_2 = "x b y"$

$S_1 = \text{---} \overset{i}{\downarrow} \text{---} \text{---} \text{---} \text{---}$   
 $S_2 = \text{---} \text{---} \text{---} \overset{j}{\uparrow} \text{---} \text{---}$

Transition

$fun(i, j) = \begin{cases} 1 + fun(i+1, j+1) & \text{if } S_1[i] == S_2[j] \\ \max \begin{cases} fun(i, j+1) \\ fun(i+1, j) \end{cases} & \text{if } S_1[i] != S_2[j] \end{cases}$

$S_1 = \begin{matrix} 0 & 1 & 2 & 3 & 4 & 5 \\ a & a & b & x & w & y \end{matrix}$   
 $S_2 = \begin{matrix} 0 & 1 & 2 & 3 \\ b & y & x & a \end{matrix}$

Base Case

$fun(|S_1|, j) = fun(i, |S_2|) = 0$

T.C:  $O(N \cdot M)$

$\underline{T.C} \geq \underline{S.C}$

S.C:  $O(N \cdot M)$

Time =  $\boxed{1s}, \boxed{2s}, 3s, 5s$

## LIS → Longest Increasing Sequence

$nums = \begin{matrix} 5 & 3 & 2 & 6 & 9 & 8 & 11 \\ 0 & 1 & 2 & 3 & 4 & 5 & 6 \end{matrix}$

5, 6

$i=0 \rightarrow fun(3, 4, 5, 6)$   
 $fun(0) \rightarrow$

Definition

$fun(3) = 3 / fun(4) = 2$

$fun(i) = \text{max LIS length starting at index } i$

$\text{④}$   
 $2, 6, 9, 11$   
 $3, 6, 9, 11$   
 $5, 6, 9, 11$   
 $5, 6, 8, 11$

Definition  $fun(i) = 3 / fun(i) - 2$

$fun(i) = \max \text{ LIS length starting at index } i$

Transition

$$fun(i) = \max \begin{cases} j=i+1, & \text{value}[i] < \text{value}[j] \rightarrow 1 + fun(i+1) \rightarrow \underline{i+1} \\ j=i+2, & 1 + fun(i+2) \rightarrow \underline{i+2} \\ j=i+3, & 1 + fun(i+3) \\ \vdots & \vdots \\ j=N-1, & 1 + fun(N-1) \end{cases}$$

Base Case

$N \geq \text{size of Array} \rightarrow \text{return } 0$

$fun(N) = 0 \checkmark$

CF  $\rightarrow \left\{ \begin{array}{l} \text{Observation (Hard)} \rightarrow \text{Easy} \\ \text{Topic (Medium)} \rightarrow \text{Medium-Hard} \\ \text{Coding (Easy)} \rightarrow \text{Medium} \end{array} \right\} \underline{\underline{\text{Interview}}}$

10  $\rightarrow$  (8)

10  $\rightarrow$  (8/9)

