Q6 Little E's Monster Challenge

Solution ① key Insight

find the longest increasing subsequence (LIS)

② Appraach

(1) find the monster cannot be defeated

(2) both h and a values strictly increasing

(3) Dynamic Programming

1. DP array dp[i] represents the length of the longest valid increasing subsequence end at monster i

2. Initialize $dp[i] = 1$ for all i

because monster i can end at itself

3. for each pair (i, j) with $i < j$

$a[i] < a[j]$

update $dp[j] = \max(dp[j], dp[i]+1)$

4. answer the max val in dp

Example 1

$n=3$ $H=4$ $A=5$ $h=[1,2,3]$ $a=[3,2,1]$

Solution ① monster M_1 1 3 (defeatable?) ✓

M_2 2 2 ✓

M_3 3 1 ✓

② potential subsequence

M_1 $(1,3)$ $dp[0] = 1$

M_2 $(2,2)$ $dp[1] = 1$

M_3 (3, 1) dp[2] = 1

③ try to chain them

loop monster

loop after monster

dp[after] = max(after, before+1)

fail

M_1 (1, 3) (2, 2) ✗ (3, 1) ✗

M_2 (2, 2) (1, 3) ✗ (3, 1) ✗

M_3 (3, 1) (1, 3) ✗ (2, 2) ✗

④ output : 1

Example 2

M_1 (6, 8)

M_2 (9, 9)

M_4 (4, 2)

M_5 (7, 5)

DP = [1 1 1 1]

loop monster [M_1 M_2 M_4 M_5]

loop after monster [M_2 M_4 M_5]

i = 0 j = 1

(6, 8) → (9, 9)

dp[j] = max(dp[j], dp[i]+1

DP = [1 2 1 1]

$i = 3 \quad j = 4$

$[4,2) \rightarrow (7,5]$

$dp[4] = \max(1, 1+1) = 2$

$DP = [1 \quad 2 \quad | \quad 2]$

Answer 1