

Tutorial-10

● Graded

Student

Abhinav Shripad

Total Points

2.75 / 3 pts

Question 1

(no title)

■ 2.75 / 3 pts

+ 0.6 pts Written "I do not know how to approach this problem"

✓ + 0.25 pts Sorting in non-decreasing order of r_i

✓ + 0.25 pts Correct base case for the recurrence

✓ + 1.5 pts Correct recurrence relation

✓ + 0.25 pts Brief justification of the recurrence relation

+ 0.25 pts Mentioning the correct order of filling the DP table

✓ + 0.5 pts Brief justification of the time complexity

+ 0 pts Incorrect

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algo will fail if $k(\text{number of stab points}) > n$

COL351: Analysis and Design of Algorithms
Tutorial 10

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Group: 3

Claim:- If \exists a k -stabbing points then \exists a k -stabbing soln where all the stabbing points are at the beginning (left end) of some interval.

Proof:- Assume it is not the case & X be a k -stabbing soln. $\exists x \in X$ such that x is not at starting of any interval. let S be set of interval x stabs. $x-1$ also stabs S because $x-1 \in$ interval in S , since x was not starting of any interval.

$\rightarrow X - \{x\} + \{x-1\}$ is a valid k -stabbing soln.

Algorithm:- Sort intervals in increasing order of d_i . intervals $\rightarrow 1, 2, 3, \dots, n$
and 0th interval = $[0, 0]$

$dp(i, j) \rightarrow$ True if possible to stab interval $1, 2, \dots, i$ using j stabs, $0 \leq i \leq n$
else False, $0 \leq j \leq k$

$dp(0, i) = \text{False}$ for $1 \leq i \leq k$

$dp(0, 0) = \text{True}$

$$dp(i, j) = dp(i, j-1) \quad \text{or}$$

or dp

$$dp(i, j) = \max_{k=0}^{i-1} dp(k, j-1) \quad \text{--- (I)}$$

~~where $k = \arg \max_{x < i} (r_x < l_i)$~~

$$\text{answer} = dp(n, k) \quad \text{where } k = \arg \max_{x < i} (r_x < l_i)$$

$$T.C. = \text{(I)} \times \text{(II)} = O(nk) \cdot O(n) = O(n^2k)$$

states
of dp

finding k

$$= O(n^2k)$$

$$S.C. = O(nk)$$

Proof:- Since r_i has largest beginning, it must be stabbed by $x = r_i$, it also stabs all those intervals which end after r_i so the last interval which is not covered by r_i is this, so it must be stabbed by $j-1$ stabs.

