P9. Way Back Home

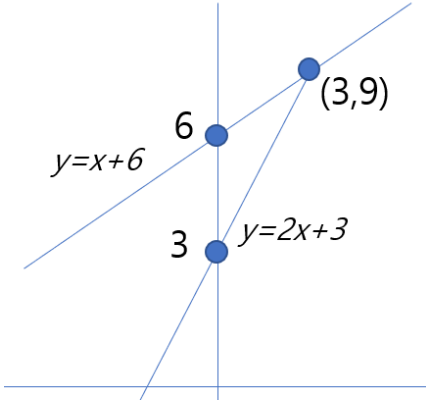
[홍원표 21701065]

문제 분석

n number of people start at particular position, $\mathbf{p_i}$, and they walk along the same road with their own constant speed $\mathbf{v_i}$. If two people meet as they walk, they walk together, with a constant speed that is lower between the two. Find number of groups that will be formed after **t** time.

문제 풀이

We can think of the people and their walk-path as 2 dimensional graph. For example, if a person starts at 6 with speed 1, we can graph this as y = 1x + 6. Likewise, if another person starts at 3 with speed 2, the graph will be y = 2x + 3. Then, **their intersection will be (3, 9)**. In another words, from x=3, the two graph will **meet together and become one, following the y = 1x + 6 line**. In another words, if t is given as 4, the maximum of (y=x+6) can be will be 10, as (x*4 + 6 = 10), and the maximum of (y=2x+3) was supposed to be 11 as (2*4 + 3 = 11), but it will become 10 as **it can't go past any line in front.**



문제 풀이 분석

Using the concept explained above, We'll be comparing the **maximum position of the last person and its left person**, using **for loop**. After **sorting the input by the people's initial position**, we'll find the **maximum distance that the last person can go in given time t**, which we will call $\mathbf{max_n}$. We'll check each person's max distance. If any max of person's previous initial position, max_i is over max_n, this means the **two people will meet before t and form a group.**

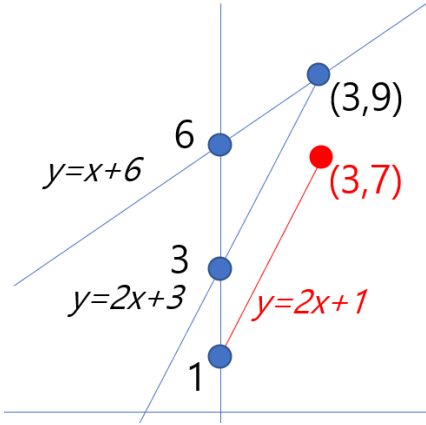
If $\mathbf{max_i}$ **is less than** $\mathbf{max_n}$, this means that the person i will **never be able to reach the group**. Therefore, the person i will form his/her own group, **meaning** $\mathbf{max_i}$ **will become a new max to compare with the rest of the people.**

Since it only takes n number of for-loop, and it takes one computation for each loop,

Time Complexity: O(n)

Since the pair array of initial position and constant position must be stored,

Space Complexity: O(n)



Discussion

This problem was simple because the combined speed was always set to the lower speed, but if the combined speed was the average of the people, how would we able to approach this problem? For example, consider people as objects with momentum so that when the two objects collide, they combine each other, yet having the same momentum of two combined.