$x_i \rightarrow$ -1, 10, 4, 7, 8

$v_i \rightarrow$ 5, 3, 2, 10, 1

Ans $\rightarrow$ 1.5

Precision to be 6 decimal pts.

Q. There are n people on a st. line, & want to gather at one point. Each person knows his current position x_i & his speed v_i. find the min time in which they can gather at the point they choose.

$n \leq 10^5$ $\quad -10^9 \leq x_i \leq 10^9$ $\quad 1 \leq v_i \leq 10^9$

-1	5
10	3
4	2
2	10
8	1

Ans → 1.5 → t

1×1.5

1.5

$s = 2$

$t = 1.5$

$s = \frac{d}{t}$

$d = s \times t \rightarrow 2 \times 1.5 \rightarrow 3$

There are n persons.

$\longrightarrow$ i^{th} person $\rightarrow$ x_i = current pos

v_i = speed (any one)

Min time in which every one meets at some point

assume the point of net is x.

$t_1 \to \dfrac{|x(1) - x|}{v(1)}$

$t_2 \to \dfrac{|x(2) - x|}{v(2)}$

$\vdots$

$t_{i^\circ} \to \dfrac{|x(i^\circ) - x|}{v(i)}$

all of them walk parallely

Time req'd such that everyone reaches x.

$T(x)$ → time reqd to reach x

$$T(x) = \max\left(\frac{|x(i)-x|}{v(i)}\right) \quad \forall\, i$$

$$\min\left(T(x)\right) \rightarrow \min\left(\max\left(\frac{|x(i)-x|}{v(i)}\right)\right)$$

↳ Binary Search

$\min(T(x)) \longrightarrow$ t is the min value & ooo ans.

$min(\tau(x)) \le t$ → we need to find value of t.

to get min of $\tau(x)$ we use BS.

Because we need to minimize this t.

Search space represents t only.

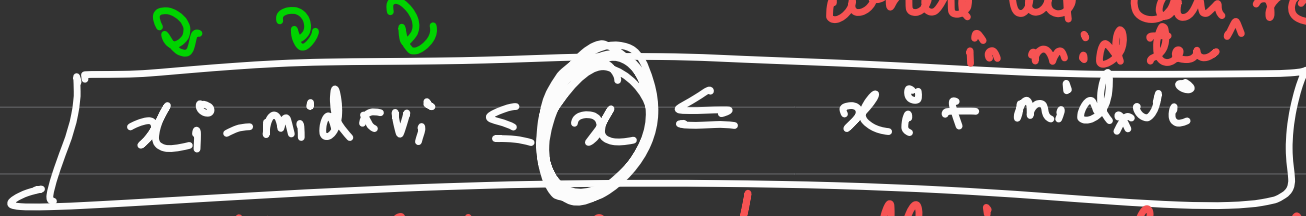
By choosing any mid:

$$T(x) \leq mid$$

$$\max\left(\frac{|x_i - x|}{v_i}\right) \leq mid \quad \forall i$$

$$\hookrightarrow |x_i - x| \leq mid \times v_i$$

$$\boxed{x_i - mid \times v_i \leq x \leq x_i + mid \times v_i}$$



if intersection exist, run for all i, we have a range

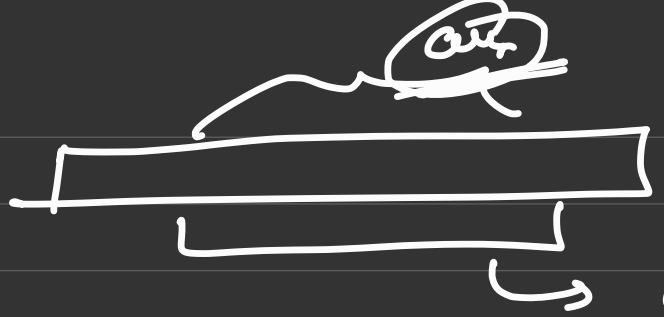
for each i, we will get some range of x_i

Q: Given an array of size n and an integer d. find a subarray with length atleast d, such that average of elements of this subarray is max possible.

3, 1, 8, 5, 7, 2 d=2

$d, n \leq 10^5$ $a_i \leq 10^2$

(3,5) → valid



→ atteint $\underline{d}$

$$\max \left(\frac{\sum_{i=l}^{r} a_i}{r-l} \right) \rightarrow \text{avg}$$

$r - l \geq d$

→ réel ≥ 0

BS

↓

BS on réel ≥ 0

100 - 150

$$\frac{\sum_{i=1}^{k} q_i}{k-1} \geq mid$$

$$\sum_{i=l}^{r} a_i \geq mid \cdot (r-l)$$

$$\sum_{i=l}^{r} (a_i - mid) \geq 0$$

$r - l \geq d$

Prefix sum technique

$$\sum_{i=l}^{r} (a_i - mid) \geq 0 \qquad r - l \geq d$$

$$p[i] = \sum_{j=0}^{i-1} a_j - mid \longrightarrow \text{let's define pref}$$

$$\sum_{i=l}^{r} (a_i - mid) \geq 0$$

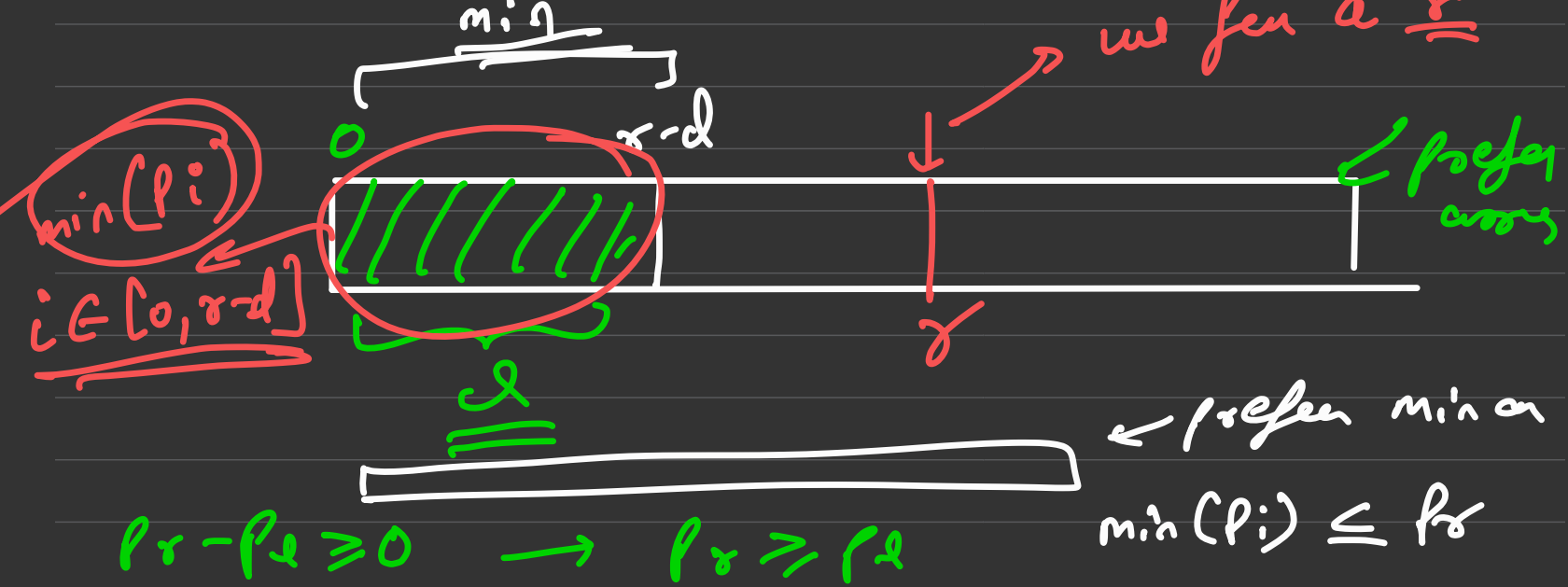
$$\longrightarrow \boxed{p[r] - p[l] \geq 0 \quad r - l \geq d}$$

$r \to [d-1, n-1]$

$d \to$ we know

$p[r] - p[l] \geq 0$

$r - l \geq d$ → $l \leq r - d$



$p_r - p_l \geq 0$ → $p_r \geq p_l$

$\min[x-d] \leq p(x)$

mid exists & works so go on right

$\min(0, x-d) = \min(\min(0, x-d-1), p[x-d])$

$p[i] \rightarrow$ range sum $\Sigma(q_i - mid)$

Q. You're getting 100% scholarship in a clg by giving a test. To avoid any losses clg came up with a scheme. Clg has N students & M discount coupon, A student gets 100% scholarship if he/she gets X coupons.
To have more coupons, in addition to the initial M, clg says that those who perform badly in test need to pay additional Y coupons. find max no. of students who get 100% schol

$1 \le N, M, X, Y \le 10^9$

N=5 M=10 X=2 Y=1 Ans → 5

N=3 M=10 X=4 Y=2 Ans → 2

mid → guess

O(log n)

Can we give 100 Rs scholarship to mid students ?.?

How many coupons reqd → atleast x*mid

$$m + (N-mid)*y \geq x*mid$$

undergo

BS on own