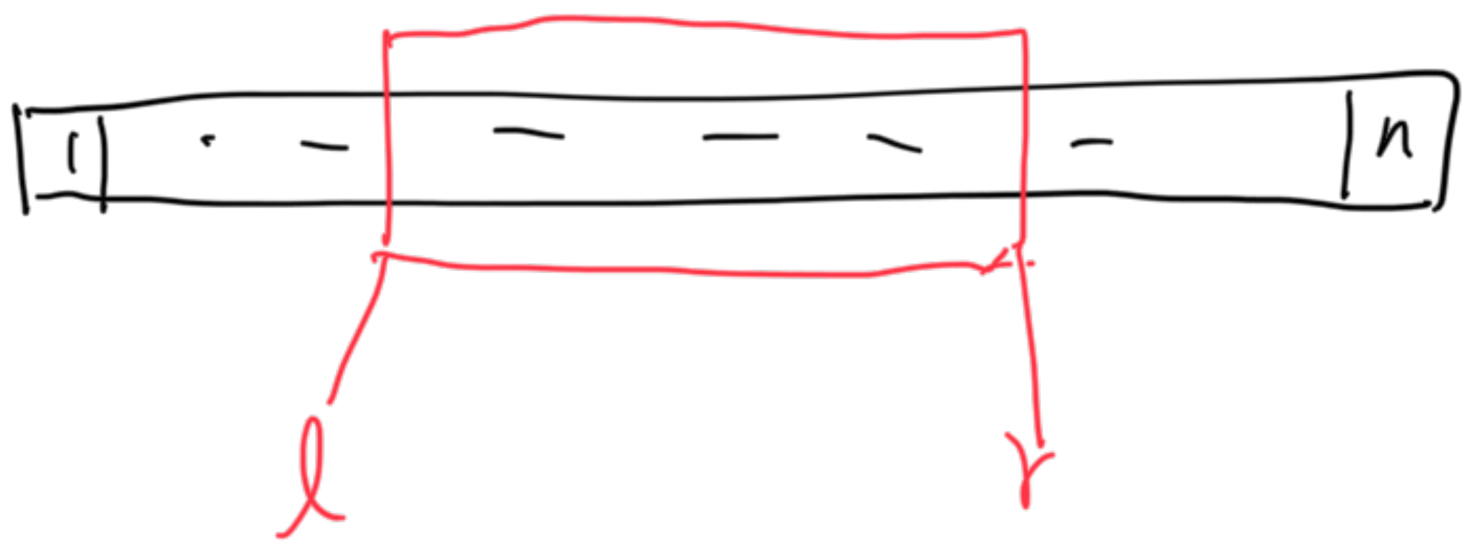
Spring 2022 Lecture 3



$\langle l, r \rangle$?

$1 \le l \le r \le n$

$l = 1 \ldots n$

$r \quad l \ldots n$

$n + (n-1) \ldots + 1 = \frac{n(n+1)}{2} = \Theta(n^2)$

$\langle l^*, r^* \rangle$

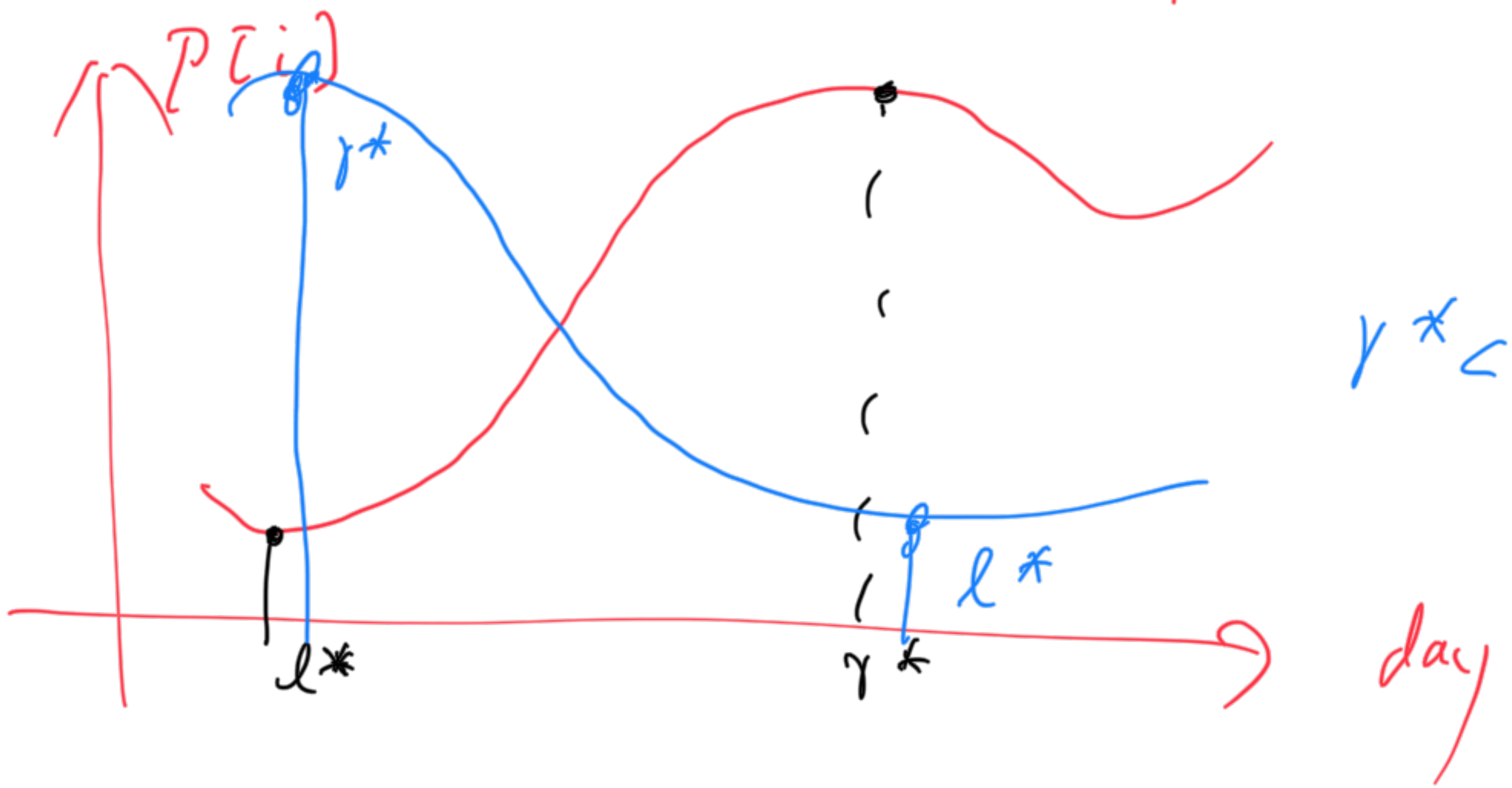
$\sum_{i=l}^{r} A[i]$

$A[i]$: stock price increase during day i,

$\sum_{i=l}^{r} A[i]$: price increase from day l till r

$P[0]$ is day 0 stock price

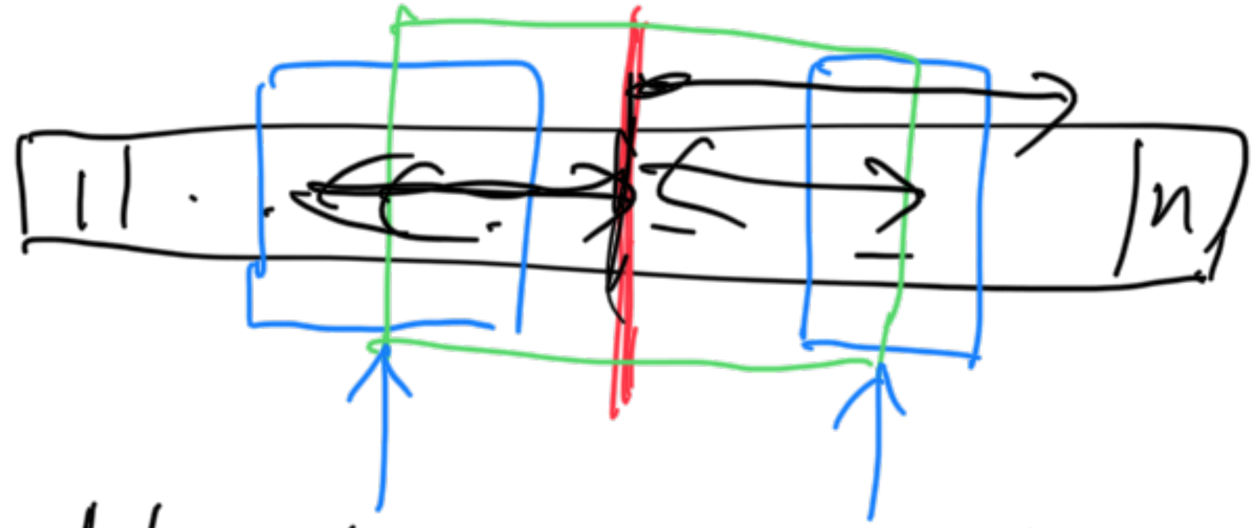
$$P[i] = P[0] + \sum_{k=1}^{i} A[k] :$$ stock price at day i



$r^* < l^*$

$$l^* = \operatorname*{argmin}_{1 \le i \le n} P[i] \qquad r^* = \operatorname*{argmax}_{1 \le i \le n} P[i]$$

$\Theta(n)$



A

sub-problem 1: max_subarray in left half of A

- - - 2: - - - right - - -

sub_problem 3: . . - - - - . . crossing midpoint of A

$$T(n) = 2T\left(\frac{n}{2}\right) + f(n)$$

$$1 \le l \le \frac{n}{2} \le r \le n$$

$$\langle l, r \rangle \ ?$$

$$\frac{n^2}{4}$$

$$T(n) = 2T\left(\frac{n}{\ }\right) + \frac{n^2}{\ }$$

$$a = b = 2 \qquad n^{\log_b a} = n$$

$$\Theta(n^2)$$

$$\max_{(l,r)} \sum_{i=l}^{r} A[i] = \max\left(\sum_{i=l}^{n/2} A[i] + \sum_{i=\frac{n}{2}+1}^{r} A[i] \right)$$

$$= \max_{l} \sum_{i=l}^{n/2} A[i] + \max_{r} \sum_{i=\frac{n}{2}+1}^{r} A[i]$$

$$n/2$$

$$f(n) = \Theta(n)$$

$$T(n) = 2T\left(\frac{n}{2}\right) + \Theta(n)$$

$\hookrightarrow \Theta(n \log n)$