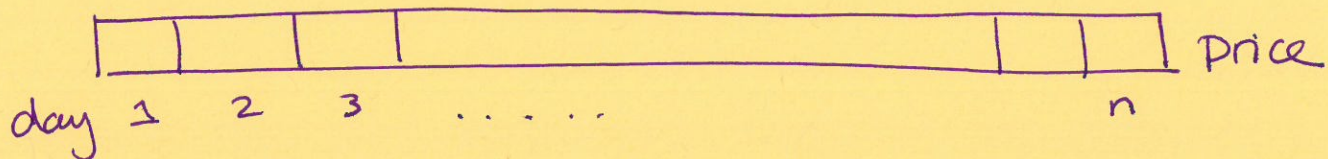


§4.1 of CLRS



want: to ~~buy~~ buy stock on day i + sell on day j such that $\text{price}[j] - \text{price}[i]$ is maximized.

$$i = \text{argmin}(\text{price})$$

$$j = \text{argmax}(\text{price})$$

can't do that! As, we also need $i < j$.

ex:

3	6	2	7	2	9	8	5
1	2	3	4	5	6	7	8

$\text{argmin}(p) = 3$
 $\min(p) = 1$

Sol'n 1: Brute force

Try every $\binom{n}{2}$ possibility

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

Sol'n 2: want $\Theta(n^2)$

BuySELL(price)

$\Theta(1)$ {

if $n \leq 1$
| return 0
endif

$T(n/2)$

$a \leftarrow \text{BuySELL}(\text{price}[1 \dots \lfloor \frac{n}{2} \rfloor])$

$T(n/2)$

$b \leftarrow \text{BuySELL}(\text{price}[\text{~~1 to } n/2~~ \lfloor \frac{n}{2} \rfloor + 1 \dots n])$

$\Theta(n)$ {

left min \leftarrow min value in 1st half

right max \leftarrow max value in 2nd half

return $\max\{a, b, \text{right max} - \text{left min}\}$

$$T(n) = \begin{cases} \Theta(1) & \text{if } n \leq 1 \\ 2T(n/2) + \Theta(n), & n > 1 \end{cases}$$

So, $T(n) = \Theta(n \log n)$

6 September 2019

Group Exercises:

① Show $\frac{1}{2}n^2 - \frac{1}{2}n$ is $O(n^2)$.

② What is the closed form of

$$T(n) = T(n/2) + 1, \text{ where } T(1) = 1?$$

① $f(n) = \frac{1}{2}n^2 - \frac{1}{2}n$ is $O(n^2)$

Let $n_0 = 1, c = 1$.

Then, $f(n) = \frac{1}{2}n^2 - \frac{1}{2}n$

$$\leq \frac{1}{2}n^2 + \frac{1}{2}n, \forall n \geq 0$$

$$\leq \frac{1}{2}(n^2 + n)$$

$$\leq \frac{1}{2}(2n^2), \text{ since } n \leq n^2 \forall n \geq 1$$

$$\leq 1 \cdot n^2$$

So, $f(n) \leq c \cdot n^2$, as was to be shown.

Skratzen:

$$\frac{1}{2}n^2 - \frac{1}{2}n \leq c \cdot n^2$$

$$\frac{1}{2}n^2 + \frac{1}{2}n \leq c \cdot n^2$$

$$2\left(\frac{1}{2}n^2\right) \leq c \cdot n^2$$

$$n^2 \leq 1 \cdot n^2$$

② $T(n)$ is ①

example: Binary Search

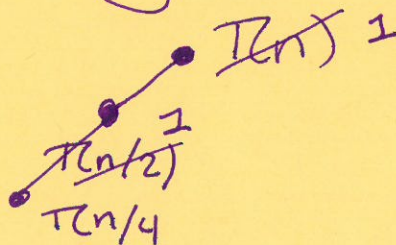
1

1

1

⋮

1



$$\sum_{i=0}^{\log n}$$

$$1 = 1 \cdot \log n = \log n$$