Math 135

Announcements

- No class Monday
- HW due Wed
- Building closed all weekend

Ex:

$$\text{ALGA}(A[0\ldots n-1])$$
$$x \leftarrow n$$
$$\text{for } i = 1 \text{ to } 2^{1000}$$
$$\quad x \leftarrow x + A[i \bmod n] + n$$
$$\text{return } x$$

$a_0, \ldots, a_{n-1}$

$1 \to$ $x := n$

2^{1000} $\Bigg[$ for $i := 1$ to 2^{1000}

$\qquad 3 \to x := x + \underbrace{A[i \bmod n]}_{} + n$

$1 \to$ return x

$\uparrow$

$a_{i \bmod n}$

Big-O ?

Total: $1 + 2^{1000} + 2^{1000}(3) + 1$

$= O(1)$

Ex:

$$\text{ALGD}(A[1\ldots n]):$$
$$k \leftarrow \lfloor n/2 \rfloor \qquad 1$$
$$x \leftarrow 0 \qquad 1$$
$$\text{for } i = 1 \text{ to } k \qquad k$$
$$\qquad \text{for } j = k+1 \text{ to } n \qquad n-k$$
$$\qquad\qquad x \leftarrow x + A[i] * A[j] \qquad 3$$
$$\text{return } x \qquad 1$$
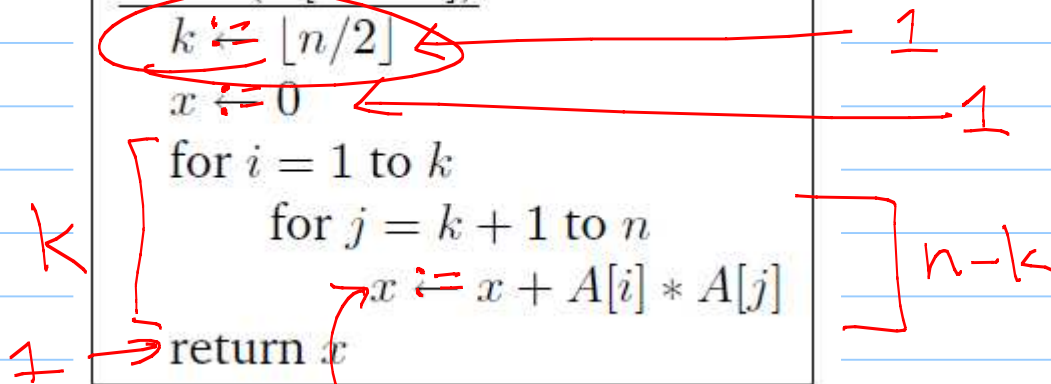
Total: $1 + 1 + \sum_{i=1}^{k} \sum_{j=k+1}^{n} 3 + 1 = 3 + 3\sum_{i=1}^{k}(n-k)$

$\underbrace{\sum_{j=k+1}^{n} 3} = 3(n-k)$

Big-O bound

$$3 + 3\sum_{i=1}^{k}(n-k) = 3 + 3\Big((n-1) + (n-2) + \cdots + (n-k)\Big)$$

$$= 3 + 3\Big((n-1) + (n-2) + \cdots + \frac{n}{2}\Big)$$

$$\leq 3 + 3\big(\underbrace{n + n + n + \cdots + n}_{n/2}\big)$$

$$= 3 + 3n\left(\frac{n}{2}\right) \approx O(n^2)$$