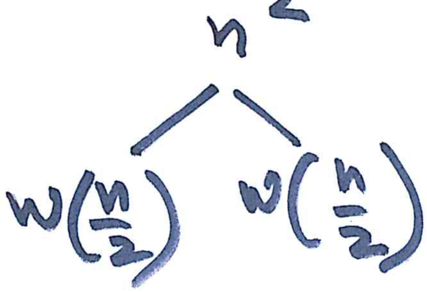
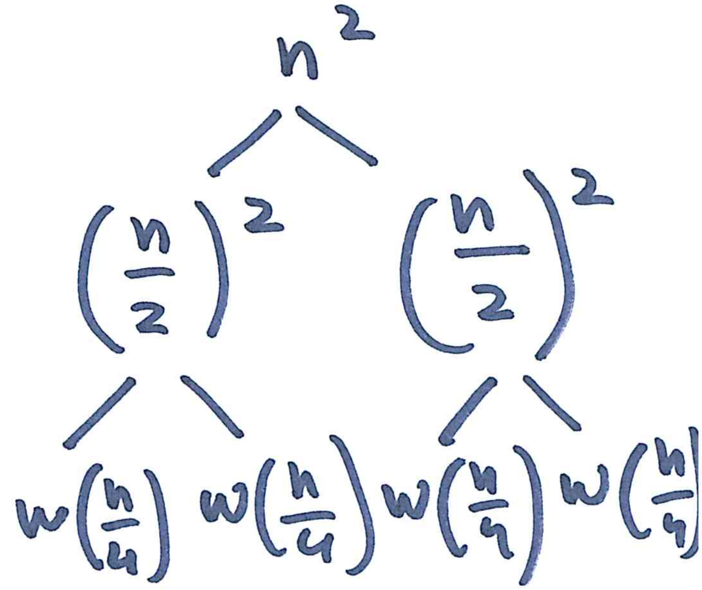
$$w(n) = 2w\left(\frac{n}{2}\right) + n^2$$



$$w\left(\frac{n}{2}\right) = 2w\left(\frac{n}{4}\right) + \left(\frac{n}{2}\right)^2$$



		pb. size	# pbs
level 0:	n^2	n	1
level 1:	$\left(\frac{n}{2}\right)^2$ $\left(\frac{n}{2}\right)^2$	$\frac{n}{2}$	2^1
level 2:	$\left(\frac{n}{4}\right)^2$ $\left(\frac{n}{4}\right)^2$ ...	$\frac{n}{4}$	2^2
level i	$\left(\frac{n}{2^i}\right)^2$	$\frac{n}{2^i}$	2^i
level...	$w(1)$ ---- $w(1)$	$\frac{n}{2^i} = 1 \Rightarrow \boxed{i = \lg n}$	

$$W(n) = \sum_{i=0}^{\lg n - 1} 2^i \left(\frac{n}{2^i}\right)^2 + 2^{\lg n} \cdot W(1) =$$

$$= n^2 \sum_{i=0}^{\lg n - 1} \frac{1}{2^i} + n \cdot W(1)$$

$$\leq n^2 \sum_{i=0}^{\infty} \frac{1}{2^i} + n \cdot W(1)$$

$$= n^2 \cdot \frac{1}{1 - 1/2} + n \cdot W(1)$$

$$= O(n^2)$$

not Θ

$$T(n) = 3T\left(\frac{n}{4}\right) + cn^2$$

		pb. size	# pbs
level 0:	cn^2	n	1
level 1:	$c\left(\frac{n}{4}\right)^2 \; c\left(\frac{n}{4}\right)^2 \; c\left(\frac{n}{4}\right)^2$	$\frac{n}{4}$	3
level 2:		$\frac{n}{4^2}$	3^2
$\vdots$	$\vdots$	$\vdots$	$\vdots$
level i	$\boxed{c\left(\frac{n}{4^i}\right)^2}$	$\frac{n}{4^i}$	3^i
$\vdots$		$\vdots$	
	$T(1) \dots\dots T(1)$	$\frac{n}{4^i} = 1$	$3^{\log_4 n}$

$$\boxed{i = \log_4 n}$$

$$T(n) = \sum_{i=0}^{\log_4 n - 1} c\left(\frac{n}{4^i}\right)^2 \cdot 3^i + 3^{\log_4 n} \cdot T(1) =$$

$$= cn^2 \sum_{i=0}^{\log_4 n - 1} \left(\frac{3}{16}\right)^i + n^{\log_4 3}\, T(1) =$$

$$\leq cn^2 \cdot \frac{1}{1 - 3/16} + n^{\log_4 3} \cdot T(1) = O(n^2)$$

$$T(n) = 3T\left(\frac{n}{4}\right) + cn^2$$

Guess : $T(n) = O(n^2)$

Goal : $T(n) \leq d \cdot n^2$, d, n_0

Assume : $T\left(\frac{n}{4}\right) \leq d \cdot \left(\frac{n}{4}\right)^2$

$$T(n) = 3T\left(\frac{n}{4}\right) + cn^2$$

$$\leq 3 \cdot d\left(\frac{n}{4}\right)^2 + cn^2$$

$$= \boxed{\frac{3}{16} dn^2 + cn^2 \leq dn^2}$$

$$\boxed{d \geq \frac{16}{13} c}$$

$n = 1$

Base case!

$$W(n) = W\left(\frac{n}{3}\right) + W\left(\frac{2n}{3}\right) + n$$

Cost

level 0: n $\longrightarrow$ n

level 1: $\frac{n}{3}$ $\frac{2n}{3}$ $\longrightarrow$ n

level 2: $\frac{n}{9}$ $\frac{2n}{9}$ $\frac{2n}{9}$ $\frac{4n}{9}$ $\longrightarrow$ n

$\vdots$ $\longrightarrow$ n

$W(1)$

$< n$

$W(1)$

level i : $\left(\frac{2}{3}\right)^i n = 1 \Rightarrow \boxed{i = \log_{3/2} n}$

$$W(n) \leq \underbrace{n + n + \ldots + n}_{\text{all levels}} = n \cdot \log_{3/2} n = O(n \lg n)$$