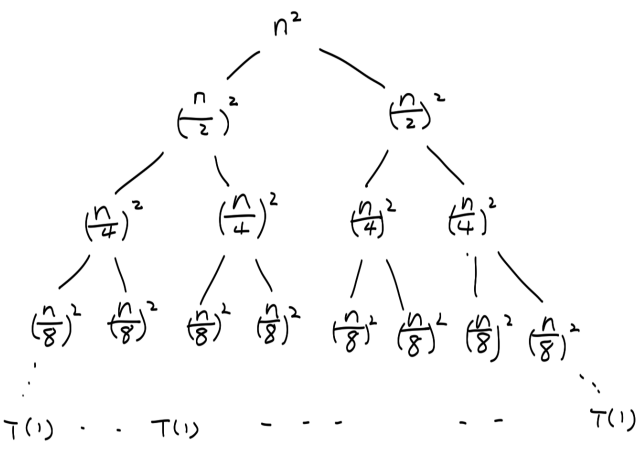
Assignment 3 (answer)
279/377
winter 2022

1. Use the recursion tree method to solve the recurrence:

$$T(n) = 2T(n/2) + n^2$$

answer

recursion tree for $T(n) = 2T(\frac{n}{2}) + n^2$



	level	num of nodes	running time
	0	2^0	n^2
	1	2^1	$2^1 \cdot (\frac{n}{2})^2$
	2	2^2	$2^2 (\frac{n}{4})^2$
	i	2^i	$2^i (\frac{1}{2^i})^i \cdot n^2 = (\frac{1}{2})^i n^2$
	$\log n$	$2^{\log n} = n$	

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

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

$$\leq 2n^2 + n$$

$$= O(n^2)$$

2. Use master theorem to solve (if master theorem can not be applied, write the reason):

a. $T(n) = 9T(n/3) + n$ n^2

b. $T(n) = 9T(n/3) + 1000n^2$ n^2logn

c. $T(n) = 9T(n/3) + 1000n^3$ n^3

d. $T(n) = 9T(n/3) + n^2 \log n$ not applied

e. $T(n) = 0.5T(n/2) + n$ not applied

f. $T(n) = 2T(n/2) - n$ not applied, f(n) should be positive function

g. $T(n) = nT(n/2) + n\log n$ not applied

h. $T(n) = T(n-2) + n^2$ not apply

i. $T(n) = T(7n/10) + n$ $\log_b a = 0$ so o(n)

j. $T(n) = 4T(n/2) + n^2 \log n$. not applied