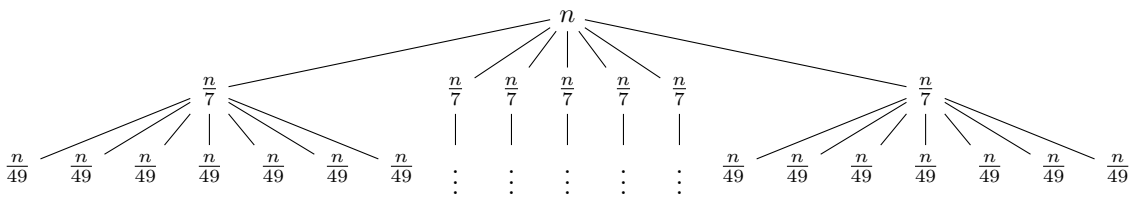
CSCI 305 Assignment 3

(Solo) Isaac Boaz

November 2, 2023

1. Provide a Θ bound for the solution of each of these recurrences.

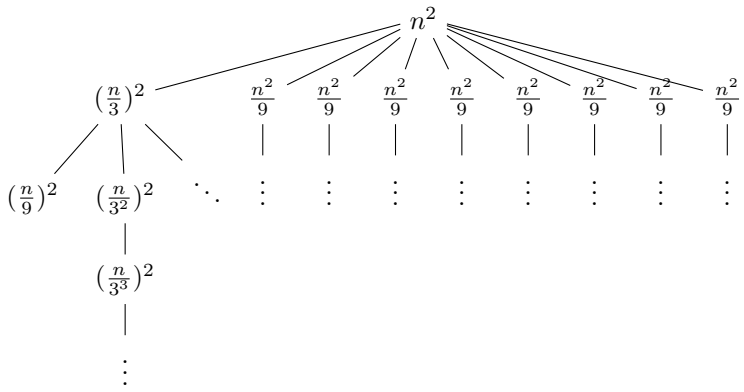
   1.
   $$T(n) = 7T(n/7) + n$$

   We see each level has $7^i \cdot \frac{n}{7^i} = n$ work done. Since n is being divided by 7 each level, this will be run $\log_7 n$ times.

   $$n \cdot \log_7 n \to \Theta(n \log n)$$

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

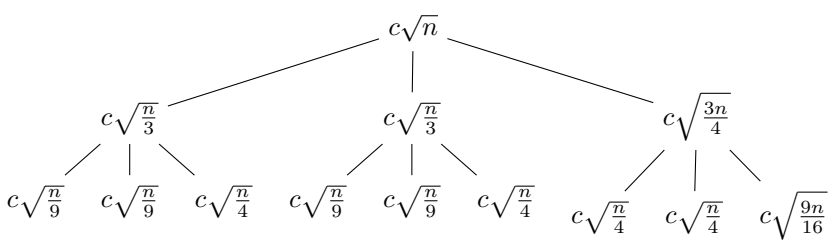
   

   At each level we do n^2 amount of work. Since we're dividing by 3 each time, we will do $\log_3 n$ levels. Thus, our runtime is $n^2 \cdot \log_3 n \to \Theta(n^2 \log n)$

   3.
   $$T(n) = 49T(n/25) + n^{3/2} \log n$$

2. Draw the recurrence tree for the following recurrence:

   $$T(n) = 2T(n/3) + T(3n/4) + c\sqrt{n}$$

3. FFT

    1. Give an asymptotic Θ-bound for lines 1-3.

    $$\Theta(1)$$

    2. Give an asymptotic Θ-bound for lines 6-9.

    $$\Theta(n)$$

    3. What size array is being input and output?
    By the definition of the function, the input array is n elements and the output is n elements.