Group: Friday 9:30 AM with Sophia
Names: Miriam Brody, kambeh karshe, Collins Kariuki, thomas mcconnell

1. On average the ratio is 8
    a. θ(n^3)
        i. Work: O(2n) = 2, O((2n)^2) = 4n^2, O((2n)^3) = 8n^3
2. Ratio:
    a. θ(1)
        i. We consider 8000 to be an anomaly, outside of 800 everything is constant
3. Ratio:
    a. θ(n)
        i. A3 doubles thus it is linear
4. Ratio:
    a. θ(log(n))
        i. Increases slowly by about 100 each time
5. Ratio:
    a. θ(n^2)
        i. The ratio is four, so a similar logic to 1. To how we got n^3 when the ratio was 8 we get n^2 when the ratio is 4
6. Ratio:
    a. θ(nlogn)
        i. While the runtimes are roughly doubling (the n part), we are also adding a constant number to the doublings (the log n part).

Recurrences

$$T(n) = 2T(n/3) + d \qquad T(n) = 7T(n/7) + n$$

if $f(n) = O(n^{\log_b a - \varepsilon})$ for $\varepsilon > 0$, then $T(n) = \Theta(n^{\log_b a})$
if $f(n) = \Theta(n^{\log_b a})$, then $T(n) = \Theta(n^{\log_b a} \log n)$
if $f(n) = \Omega(n^{\log_b a + \varepsilon})$ for $\varepsilon > 0$ and $af(n/b) \le cf(n)$ for $c < 1$
then $T(n) = \Theta(f(n))$

$$T(n) = T(n-1) + \log n \qquad T(n) = 8T(n/2) + n^3$$

$O(n^{3-\varepsilon})$

$\Theta(n^3)$

$\Omega(n^{3-\varepsilon})$

$$T(n) = 8T\left(\frac{n}{2}\right) + n^3$$

$a = 8 \quad n^{\log_b a} = n^{\log_2 8} = \underline{\underline{n^3}}$

$b = 2$

$f(n) = n^3$

$$T(n) = \Theta\left(n^{\log_b a} \log n\right)$$

$$= \Theta\left(n^3 \log n\right)$$

is $n^3 = O(n^{3-\varepsilon})$

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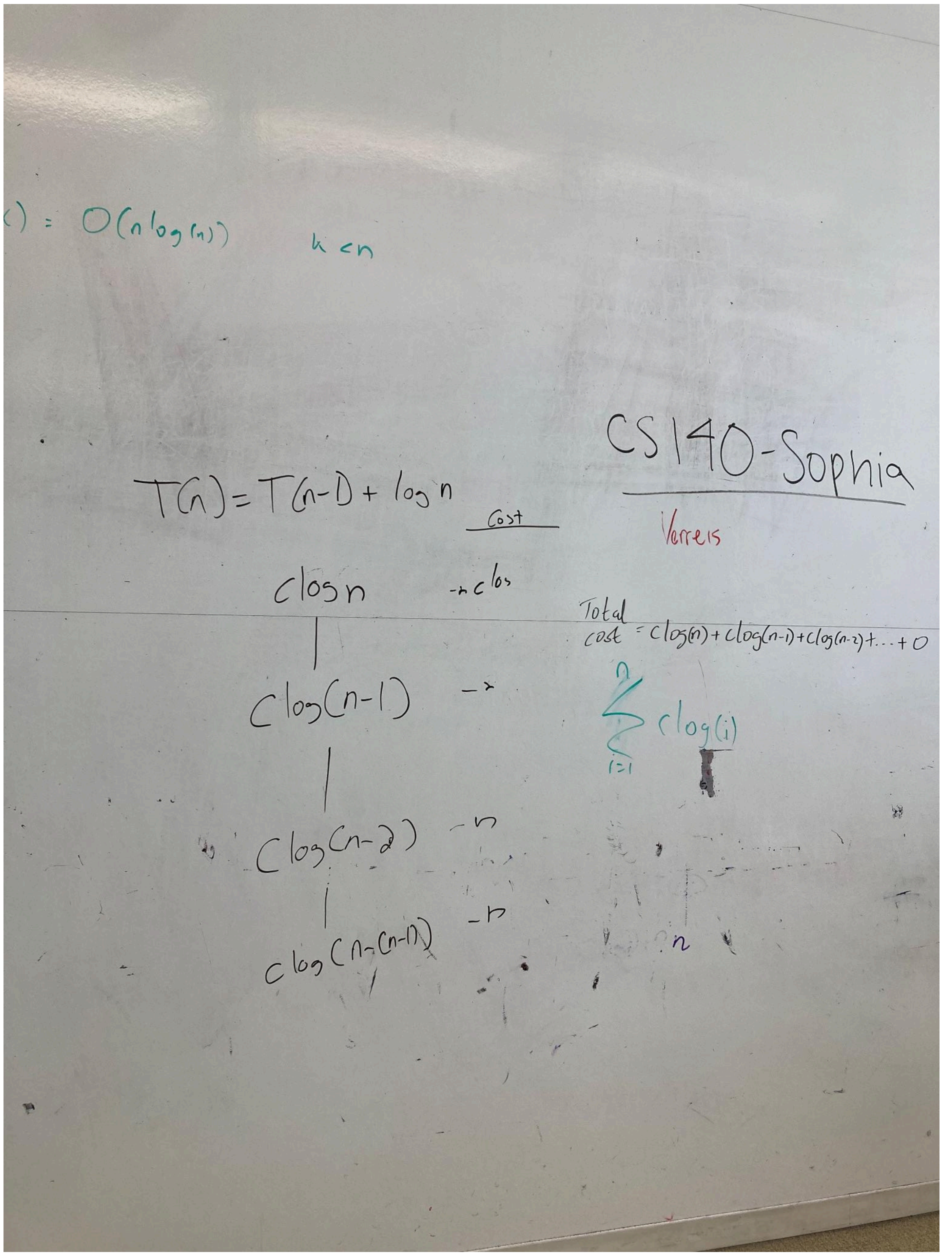

For T(n) = T(n-1) + log(n), we were not able to finish it up before the hour mark but we made an educated guess that the Theta complexity is nlog(n) because for the total cost, despite the n decreasing we are adding up a significant amount of log(n)'s multiple times, n times so we guessed that the recurrence should be big theta nlog(n). We did not have enough time to validate our solution with the substitution method.

3. Everyone was at the group. Everyone felt comfortable to share and was included.