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Homework 1

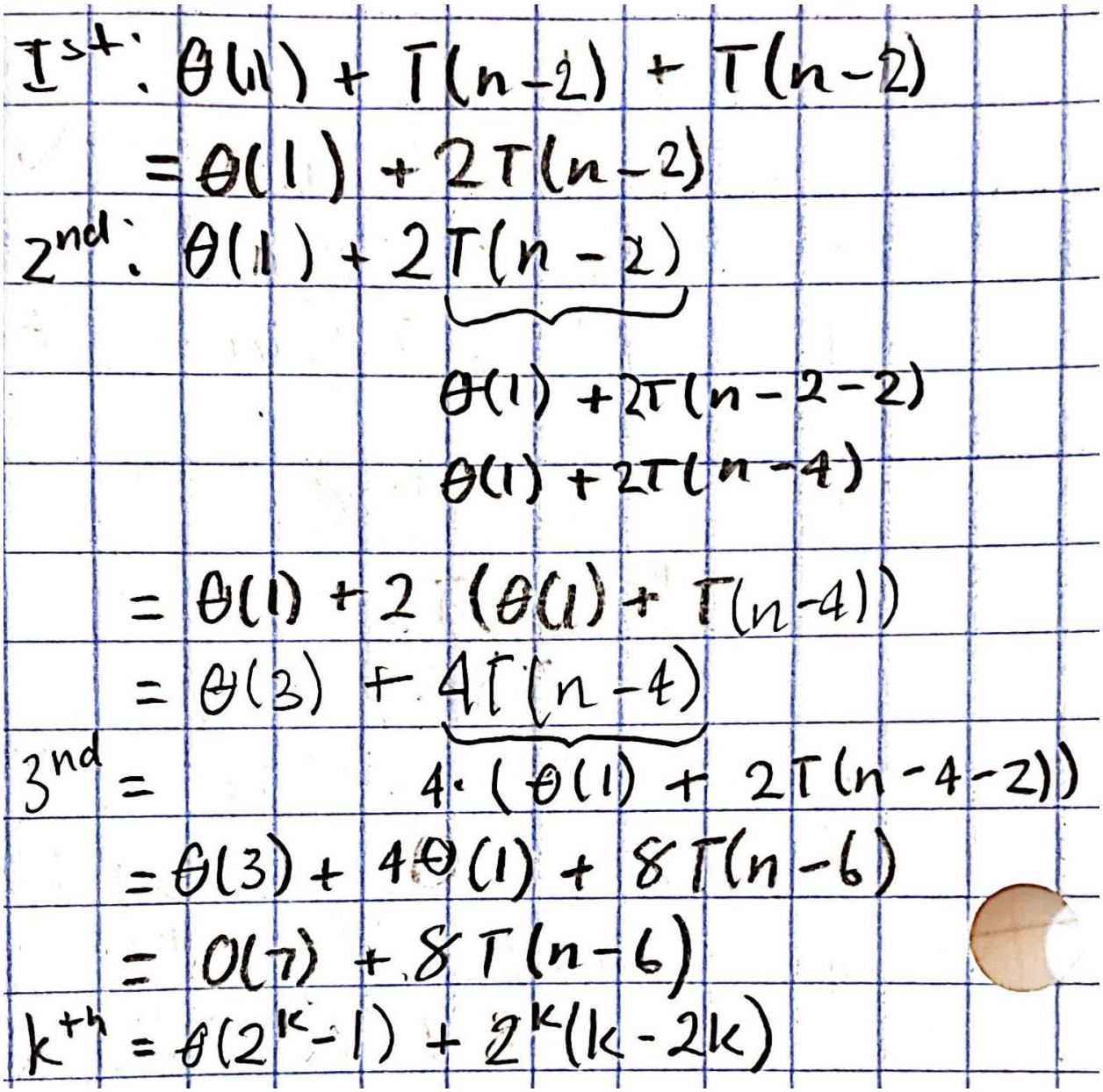
Part A

1. The outer for loop will be $\Theta(\sqrt{n})$ since it will run from 0 to $\sqrt{n}$. This is because n decreases by $\sqrt{n}$ each time the loop is run and $n/\sqrt{n} = \sqrt{n}$.
2. The inner for loop will be $\Theta(n)$ as it always runs from 0 to n, even if the n decreases.
3. Since the contents of the inner for loop are O(1), it does not impact the runtime of the function as a whole.
4. The Big-Θ is $\sqrt{n} \ * \ n$ or $\Theta(n\sqrt{n})$.

Part B

1. The inner most loop will increase by 2m since (m + m = 2m) up until n. Thus this loop will be logarithmic or $\Theta(log(n))$.
2. The second loop increases linearly up until n therefore the loop will be $\Theta(n)$.
3. The outermost loop also increases linearly like the second loop. Therefore it will also have a runtime of $\Theta(n)$.
4. The end result is $\Theta(n^2 log(n))$ because the outermost and second loop are n^2 (n * n = n^2). You then must multiply this result by the innermost loop.

Part C


1st: θ(1) + T(n-2) + T(n-2)
= θ(1) + 2T(n-2)
2nd: θ(1) + 2T(n-2)
θ(1) + 2T(n-2-2)
θ(1) + 2T(n-4)
= θ(1) + 2 (θ(1) + T(n-4))
= θ(3) + 4T(n-4)
3nd = 4·(θ(1) + 2T(n-4-2))
= θ(3) + 4θ(1) + 8T(n-6)
= θ(7) + 8T(n-6)
k+h = θ(2^k - 1) + 2^k(k-2k)

Part D