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Assignment 3

Exercise 1

Analyze the following recurrences using the method that is indicated. In case you use the Master Theorem, state what the corresponding values of a , b , and $f(n)$ are and how you determined which case of the theorem applies.

- $T(n) = 3T(\frac{n}{4}) + 3$. Use the Master Theorem to find a $\Theta(\cdot)$ evaluation, or say "Master Theorem cannot be used", if this is the case.

$$\begin{aligned}a &= 3 \quad b = 4 \quad f(n) = 3 \\n^{\log_4 3} &\text{ vs. } 3 \\n^{\log_4 3} &> 3 \\\therefore \Theta(n)\end{aligned}$$

- $T(n) = 2T(\frac{n}{2}) + 3n$. Use the Master Theorem to find a $\Theta(\cdot)$ evaluation, or say "Master Theorem cannot be used", if this is the case.

$$\begin{aligned}a &= 2 \quad b = 2 \quad f(n) = 3n \\n^{\log_2 2} &= n \\n &\text{ vs. } 3n \\\therefore \Theta(n \log n)\end{aligned}$$

- $T(n) = 9T(\frac{n}{3}) + n^2 \log n$. Use the Master Theorem to find a $\Theta(\cdot)$ evaluation, or say "Master Theorem cannot be used", if this is the case.

"Master Theorem cannot be used"

Exercise 2

- $T(n) = 2T(n-1) + 1$, $T(0) = 1$. Use the iteration method to find a $\Theta(\cdot)$ evaluation for $T(n)$.

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- Give a $\Theta(\cdot)$ evaluation for the runtime of the following code:

```
i = n
while(i >= 1) {
    for (j=1; j <= n; j++)
        x = x+1
    i = i/2
}
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$$\Theta(n \log n)$$

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