Case 1: $T, \Theta(n^k)$

Case 2: $=, \Theta(n^2 \log n)$

Case 3: $<, \Theta$

Master Theorom Worksheet

1) $T(n) = 3T(n/2) + n^2$

$a=3, b=2 \rightarrow \log_2 3 \approx 1.585$

$n^2 > n^{1.585}$

$\rightarrow$ Regularity: $3(n/2)^2$

$T(n) = \Theta(n^2)$

2) $T(n) = 7T(n/2) + n^2$

$a=7, b=2 \rightarrow \log_2 7 \approx 2.807$

$n^2 < n^{2.807}$

$T(n) = \Theta(n^{\log_2 7})$

3) $T(n) = 4T(n/2) + n^2$

$a=4, b=2 \rightarrow \log_2 4 = 2$

$n^2 = n^2$

$T(n) = \Theta(n^2 \log n)$

4) $T(n) = 3T(n/4) + n \log n$

$a=3, b=4 \rightarrow \log_4 3 \approx 0.792$

$n \log n > n^{0.792}$

$T(n) = \Theta(n \log n)$

5) $T(n) = 4T(n/2) + \log n$

$a=4, b=2 \rightarrow \log_2 4 = 2$

$\log n < n^2$

$T(n) = \Theta(n^2)$

6) $T(n) = T(n-1) + n$

Doesn't fit theorom

7) $T(n) = 4T(n/2) + n^2 \lg n$

$a=4, b=2 \rightarrow \log_2 4 = 2$

$n^2 \lg n, n^2$

$T(n) = \Theta(n^2 (\lg n)^2)$

8) $T(n) = 5T(n/2) + n^2 \lg n$

$a=5, b=2 \Rightarrow \log_2 5 \approx 2.322$

$n^2 \lg n < n^{2.322}$

$T(n) = \Theta(n^{\log_2 5})$

9) $T(n) = 3T(n/3) + n/\lg n$

$a=3, b=3 \rightarrow \log_3 3 = \underline{1}$

$n/\lg n < n$

$T(n) = \Theta(n \lg \lg n)$

10) $2T(n/4)+c$

$a=2, b=4 \Rightarrow \log_4 2 = 1/2$

$1 < n^{0.5}$

$T(n) = \Theta(n^{1/2})$

11) $T(n/4)+\lg n$

$a=1, b=4 \Rightarrow \log_4 1 = 0$

$\lg n > 0$

$T(n) = \Theta((\lg n)^2)$

12) $T(n) = T(n/2)+T(n/4)+n^2$

Doesn't fit theorom

13) $T(n) = 2T(n/4)+\lg n$

$a=2, b=4 \Rightarrow \log_4 2 = 0.5$

$\lg n < n^{0.5}$

$T(n) = \Theta(n^{1/2})$

14) $T(n) = 3T(n/3)+n\lg n$

$a=3, b=3 \Rightarrow \log_3 3 = 1$

$n\lg n > n$

$T(n) = \Theta\, n(n(\lg n)^2)$

15) $T(n) = 8T((n-\sqrt{n})/4)+n^2$

Doesn't fit theorom

16) $2T(n/4)+\sqrt{n}$

$a=2, b=4 \Rightarrow \log_4 2 = 0.5$

$\sqrt{n} = n^{0.5}$

$T(n) = \Theta(\sqrt{n}\log n)$

17) $2T(n/4)+n^{0.51}$

$a=2, b=4 \Rightarrow \log_4 2 = 0.5$

$n^{0.51} > n^{0.5}$

$T(n) = \Theta(n^{0.51})$

18) $T(n) = 16T(n/4)+n!$

$a=16, b=4 \Rightarrow \log_4 16 = 2$

$n! > n^2$

$T(n) = \Theta n!$

19) $T(n) = 3T(n/2)+n$

$a=3, b=2 \Rightarrow \log_2 3 \approx 1.585$

$n < n^{1.585}$

$T(n) = \Theta(n^{\log_2 3})$

20) $T(n) = 4T(n/2)+cn$

$a=4, b=2 \Rightarrow \log_2 4 = 2$

$cn < n^2$

$T(n) = \Theta(n^2)$

21) $T(n) = 3T(n/3) + n/2$

$a=3, b=3 \rightarrow \log_3 3 = 1$

$n/2 < n$

22) $T(n) = 4T(n/2) + \frac{n}{\log n}$

$a=4, b=2 \Rightarrow \log_2 4 = 2$

$\frac{n}{\log n} < n^2$

$T(n) = \Theta(n^2)$

23) $T(n) = 7T(n/3) + n^2$

$a=7, b=3 \rightarrow \log_3 7 \approx 1.77$

$n^2 > n^{1.77}$

$T(n) = \Theta(n^2)$

24) $T(n) = 8T(n/3) + 2^n$

$a=8, b=3 \rightarrow \log_3 8 \approx 1.89$

$2^n < n^{1.89}$

$T(n) = \Theta(n^{\log_3 8})$

25) $T(n) = 16T(n/4) + n$

$a=16, b=4 \rightarrow \log_4 16 = 2$

$n < n^2$

$T(n) = \Theta(n^2)$