DAA Tutorial 4

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

$a = 3, b = 2, f(n) = n^2$

$c = \log_b a = 1.5$

$n^c = n^{1.5}$

$n^c < f(n)$

$TC = O(n^2)$

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

$a = 4, b = 2, f(n) = n^2$

$c = 2$

$n^c = f(n)$

$TC = O(n^2 \log n)$

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

$a = 1, b = 2, f(n) = 2^n$

$c = \log_2 1 = 0$

$n^c = n^0 = 1$

$TC = O(2^n)$

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

Master's Theorem not applicable since value of n can alter & make the value of $a < 1$.

5. $T(n) = 16T(n/4) + n$

$a = 16, b = 4, f(n) = n$

$c = \log_2 16 = 2$

$n^c = n^2$

$O(n^2)$

6. $T(n) = 2T(n/2) + n\log n$

$a = 2, b = 2, f(n) = n\log n$

$c = \log 2 = 1 = n$

$O(n\log n)$

7. $T(n) = 2T(n/2) + n\log n$

$a = 2, b = 2, f(n) = n\log n$

$c = 1 = n$

$O(n\log n) < O(n)$

$TC = n$

8. $T(n) = 2T(n/4) + n^{0.51}$

$a = 2, b = 4, f(n) = n^{0.51}$

$c = \log_4 2 = 0.5$

$n^{0.5} < n^{0.51} = O(n^{0.51})$

9. $T(n) = 0.5(n/2) + (1/n)$

$a = 0.5 < 1$

Master's theorem N/A.

10. $T(n) = 16T(n/4) + n!$

$a = 16, b = 4, f(n) = n!$

$c = 2$

$n^2 = TC\ O(n!)$

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

$a = 4, b = 2, f(n) = \log n$

$c = \log_2 4 = 2 = n^2$

$n^2 > \log n$

$TC = O(n^2)$

12. $T(n) = \text{sqrt}(n)\, T(n/2) + \log n$

master's theorem N/A.

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

$a = 3, b = 2, f(n) = n$

$c = \log_2 3 = 1.5$

$n^{1.5} > n$

$TC: O(n^{1.5})$

4. $T(n) = 3T(n/3) + \text{sqrt}(n)$

$a = 3, b = 3, f(n) = \sqrt{n}$

$c = \log_3 3 = 1 = n$

$n > \sqrt{n}$

$TC: O(n)$

15. $T(n) = 4T(n/2) + cn$

$a = 4, b = 2, f(n) = cn$

$c = \log_2 4 = 2$

n^2

$O(n^2)$

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

$a = 3, b = 4, f(n) = n\log n$

$c = \log_4 3 < n\log n$

TC: $T(n\log n)$

17. $T(n) = 3T(n/3) + n/2$

$a = 3, b = 3, f(n) = n/2$

$c = \log 3 = 1$

$n > n/2 \quad = O(n)$

18. $T(n) = 6T(n/3) + n^2\log n$

$a = 6, b = 3, f(n) = n^2\log n$

$c = \log_3 6 = \log 2$

$f(n) = n^2\log n > n^{\log_3 6}$

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

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

$a = 4, b = 2, f(n) = n\log n$

$c = \log_2 4 = 2$

$n^2 > n/\log n$

$O(n^2)$

20. $T(n) = 64T(n/8) - n^2\log n$

Masters Theorem N/A.

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

$a = 7, b = 3, f(n) = n^2$

$c = 1.7$

$n^{1.7} < n^2$

$O(n^2)$

22. $T(n) = T(n/2) + n(2 - \cos n)$

$a = 1, b = 2, f(n) = n(2 - \cos n)$

$c = \log_2 1 = 0 = n^0$

$2 - \cos n > 0$

$TC = O(n)$