Quiz-1 (ADA-2023)

February 2, 2023

1. Let $f(n) = 25^n n^3$ and $g(n) = 36^n n$. Then which of the following statement(s) is/are true?

(A) $g(n) = O(f(n))$.

(B) $f(n) = O(g(n))$. (correct)

(C) Both the above.

(D) None of the above.

2. Let $f(n) = \log_{20} n$ and $g(n) = \log_5 n$. Then which of the following statement(s) is/are true?

(A) $g(n) = O(f(n))$.

(B) $f(n) = O(g(n))$.

(C) Both the above. (correct)

(D) None of the above.

3. Let $f(n) = 6^{2\log_6 n}$ and $g(n) = n^2$. Then which of the following statement(s) is/are true?

(A) $g(n) = O(f(n))$.

(B) $f(n) = O(g(n))$.

(C) Both the above. (correct)

(D) None of the above.

4. Let $f(n) = 2^n n^9$ and $g(n) = 2^n n^7$. Then which of the following statement(s) is/are true?

(A) $g(n) = O(f(n))$. (correct)

(B) $f(n) = O(g(n))$.

(C) Both the above.

(D) None of the above.

5. Suppose that an algorithm $\mathcal{A}$ partitions a problem of size n into 7 subproblems each of size $n/3$ and then combines the solutions in $6n^2$-time. When $n \leq 6$, then it takes only 4 primitive operations. Then what is the recurrence relation of algorithm $\mathcal{A}$?

(A) $T(n) = 6T(n/3) + 6n^2$ for all $n \geq 7$ and $T(n) = 2$ for all $n \leq 6$.

(B) $T(n) = 6T(n/3) + 6n^2$ for all $n \geq 2$ and $T(n) = 4$ for all $n \leq 6$..

(C) $T(n) = 7T(n/3) + 6n^2$ for all $n \geq 2$ and $T(n) = 2$ for all $n \leq 6$..

(D) $T(n) = 7T(n/3) + 6n^2$ for all $n \geq 2$ and $T(n) = 4$ for all $n \leq 6$.. (correct)

6. Suppose that an algorithm $\mathcal{A}$ partitions a problem of size n into 16 subproblems each of size $n/4$ and then combines the solutions in $64n^2$-time. Then what is the tightest asymptotic running time of algorithm $\mathcal{A}$ in Big-Oh notation?

(A) $O(n \log n)$. (B) $O(n^2)$. (C) $O(n^2 \log n)$. (D) $O(n^3)$.

Option C

7. Suppose that an algorithm $\mathcal{A}$ partitions a problem of size n into 4 subproblems each of size $n/4$ and then combines the solutions in $2n \log n$ time. Then what is the tightest asymptotic running time of algorithm $\mathcal{A}$ in Big-Oh notation?

(A) $O(n \log n)$. (B) $O(n^2)$. (C) $O(n(\log n)^2)$. (D) $O(n^2 \log n)$.

Option C.

8. Suppose that an algorithm $\mathcal{A}$ partitions a problem of size n into 6 subproblems each of size $n/2$ and then combines the solutions in $6n^3$ time. Then what is the tightest asymptotic running time of algorithm $\mathcal{A}$ in Big-Oh notation?

(A) $O(n^2 \log n)$. (B) $O(n^2)$. (C) $O(n^3 \log n)$. (D) $O(n^3)$.

Option D.

9. Consider the following recurrence.

$$T(n) = T(n/4) + T(2n/5) + 1 \text{ for all } n \geq 6$$

$$T(n) \leq 10 \text{ for all } n \leq 5$$

Then, what is $T(n)$? Give the tightest possible function $f(n)$ using Big-Oh notation.

(A) $O(n)$.

(B) $O(\log n)$.

(C) $O(\sqrt{n})$.

(D) None of the above.

Option A.

10. What is the solution to the recurrence relation $T(n) = T(n-1) + n^3$ and $T(1) = 1$ in Big-Oh notation? Give the tightest possible running time.

(A) $O(n^4 \log n)$. (B) $O(n^4)$. (C) $O(n^3 \log n)$. (D) $O(n^3)$.

Option B