Quiz-1 (ADA-2024) - Answers

January 31, 2024

Roll Number: **Section:**

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 $f(n) = 2^n n^9$ 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.

3. 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)**

4. 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) $O(n(\log n)^2)$. **(correct)**

(D) $O(n^2 \log n)$.

5. 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) $O(n^3)$. **(correct)**

6. Your friend wrote an algorithm for selecting k^{th} smallest element in an unsorted array of length n, with the help of medians of medians. If her recursive function partitions an input array A into $\lceil |A|/3 \rceil$ groups each group (possibly except one) having three elements, then what is the best (or tightest) running time of her algorithm.

(A) $O(n \log n)$. **(correct)**

(B) $O(n)$.

(C) $O(n^2)$.

(D) $O(n^2 \log n)$.

7. Consider an array of n distinct numbers. What is the maximum number of inversions that are possible in that array?

(A) $O(n^2)$.

(B) $\frac{n(n-1)}{2}$. **(correct)**

(C) 0.

(D) n.

8. Can Master's Theorem be applied on any recurrence relation?

(A) Yes.

(B) No. **(correct)**

(C) Cannot Say.