Paper Code: 0

Course Title:DESIGN AND ANALYSIS OF ALGORITHMS **Course Code:CSE408**

Time Allowed: 01:30hrs. **Max Marks: 30**

Read the following instructions carefully before attempting the question paper.

1. *Match the Paper Code shaded on the OMR Sheet with the Paper code mentioned on the question paper and ensure that both are the same.*
2. *This question paper contains 30 questions of 1 mark each. 0.25 marks will be deducted for each wrong answer.*
3. *All questions are compulsory.*
4. *Do not write or mark anything on the question paper and/or on rough sheet(s) which could be helpful to any student in copying, except your registration number on the designated space.*
5. *Submit the question paper and the rough sheet(s) along with the OMR sheet to the invigilator before leaving the examination hall.*

Q(1) Which of the following number is the 6th catalan number?
(a) 14 (b) 429 (c) 132 (d) 42 CO1,L2

Q(2) What is the time complexity of fun() ?

```
int fun(int n)
{
int count=0;
for (i=0; i<n; i++)
for (j=i; j>0 ; j--)
count++;
return count;
}
```

(a) Theta (n) (b) Theta (n^2) (c) Theta (nlogn) (d) Theta (n(log(nlogn)))

Q(3) How can a suffix array be used to efficiently search for a pattern in a string? CO1,L2
(a) By performing binary search on the suffixes.
(b) By comparing the pattern with each suffix individually.
(c) By using dynamic programming to match the pattern.
(d) By traversing the suffix tree constructed from the suffix array.

Q(4) Which of the following operations can be efficiently performed using a suffix array? CO2,L
(a) Finding the longest common substring between two strings.
(b) Counting the number of occurrences of a substring in a string.
(c) Identifying the shortest palindrome in a string.
(d) Removing duplicate characters from a string.

Q(5) In the context of Divide and Conquer, what is the time complexity of the Binary Search algorithm? CO2,
(a) O(n) (b) O(log n) (c) O(n log n) (d) O(1)

Q(6) How does the Divide and Conquer approach generally decrease the time complexity of a problem? CO1
(a) By breaking the problem into subproblems that are themselves smaller instances of the same type of problem
(b) By solving the problem iteratively rather than recursively
(c) By applying dynamic programming to store the results of subproblems
(d) By increasing the problem size to make the solution simpler

Q(7) Which of the following operations can be efficiently performed using a suffix array? CO
(a) Counting the number of occurrences of a substring
(b) Reversing the characters of a string
(c) Finding the longest palindrome in a string
(d) Sorting the characters of a string in lexicographic order

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Q(8) Which data structure is commonly used in combination with suffix arrays to enhance their functionality?
(a) Trie (b) Heap (c) Binary Search Tree (d) Hash Table
CO2,L3

Q(9) Analyze The QuickSort algorithm chooses a 'pivot' element and then partitions the array. What is the worst-case time complexity of QuickSort?
(a) O(n log n) (b) O(n) (c) O(log n) (d) O(n^2)
CO1,L4

Q(10) Classify Which algorithm uses the Divide and Conquer approach to find the closest pair of points in a plane?
(a) Graham's scan algorithm (b) Closest Pair algorithm
(c) Dijkstra's algorithm (d) Floyd-Warshall algorithm
CO1,L4

Q(11) What is the primary advantage of using a suffix array over a suffix tree?
(a) Lower memory usage (b) Faster construction time
(c) More compact representation (d) Better support for dynamic updates
CO2,L3

Q(12) What is a suffix array?
(a) An array containing all possible suffixes of a string sorted lexicographically.
(b) An array containing all characters of a string sorted in reverse order.
(c) An array storing the positions of suffixes within the original string.
(d) An array storing the lengths of all suffixes in a string.
CO2,L3

Q(13) Which of the following problems can be solved using the Divide and Conquer approach?
(a) Binary Search (b) Linear Search (c) Depth-First Search (d) Breadth-First Search
CO1,L4

Q(14) Analyze Merge Sort algorithm is based on which technique?
(a) Decrease and Conquer (b) Divide and Conquer (c) Transform and Conquer (d) Dynamic Programming
CO2,L4

Q(15) What is the primary purpose of the Trie Matching Algorithm?
(a) Sorting a list of strings (b) Searching for patterns or words in a text
(c) Compressing a dictionary of words (d) Encrypting messages
CO2,L3

Q(16) What data structure does the Trie Matching Algorithm employ for efficient pattern matching?
(a) Array (b) Linked List (c) Trie (Prefix Tree) (d) Binary Search Tree
CO2,L3

Q(17) Master's theorem is used for?
(a) solving recurrences (b) solving iterative relations
(c) analysing loops (d) calculating the time complexity of any code
CO1,L2

Q(18) What is the result of the recurrences which fall under first case of Master's theorem (let the recurrence be given by T(n)=aT(n/b)+f(n) and f(n)=nc?
(a) T(n) = O(n^logba) (b) T(n) = O(nc log n) (c) T(n) = O(f(n)) (d) T(n) = O(n2)
CO1,L2

Q(19) What is the time complexity of the Merge Sort algorithm in the worst-case scenario?
(a) O(n log n) (b) O(n^2) (c) O(log n) (d) O(n)
CO1,L4

Q(20) Illustrate Which step is not a part of the Divide and Conquer algorithm strategy?
(a) Divide the problem into smaller subproblems.
(b) Conquer the subproblems by solving them recursively.
(c) Combine the solutions to the subproblems into the solution for the original problem.
(d) Increase the problem size to simplify the solution.
CO1,L

Q(21) What is the objective of the Maximum Subarray Problem?
(a) To find the subarray with the minimum sum. (b) To find the subarray with the maximum product.
(c) To find the subarray with the maximum sum. (d) To find the maximum element in an array.
CO1,

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Q(22) Illustrate Which algorithmic strategy is commonly used to solve the Maximum Subarray Problem efficiently?
(a) Greedy Algorithm (b) Divide and Conquer
(c) Dynamic Programming (d) Both B and C

Q(23) Indicate constant time complexity in terms of Big-O notation CO3,L4
(a) O(n) (b) O(1) (c) O(nlogn) (d) O(n^2)

Q(24) What is the time complexity of the linear search algorithm? CO1,L2
(a) O(n) (b) O(n^2) (c) O(2^n) (d) O(1)

Q(25) Let f(n) = n and g(n) = n(1+sin n), where n is a positive integer. Which of the following statements is/are correct? CO1,L2
I. f(n) = O(g(n))
II. f(n) = Ω(g(n))
(a) Only I (b) Only II (c) Both I and II (d) Neither I or II

Q(26) What is the worst case time complexity for search, insert and delete operations in a general Binary Search T CO1
for a skewed tree ?
(a) O(n) for all (b) O(Logn) for all
(c) O(Logn) for search and insert, and O(n) for delete (d) O(Logn) for search, and O(n) for insert and delet C

Q(27) Which of the following operations is NOT typically performed in the Trie Matching Algorithm?
(a) Insertion of patterns into the Trie (b) Deletion of patterns from the Trie
(c) Searching for patterns in the text (d) Sorting the patterns alphabetically

Q(28) What is the primary purpose of a suffix array in string algorithms?
(a) To efficiently store all possible substrings of a string
(b) To facilitate quick sorting of characters in a string
(c) To provide a compact representation of all suffixes of a string
(d) To compress a string for efficient storage

Q(29) What is the worst case time complexity of a quick sort algorithm?
(a) O(N) (b) O(N log N) (c) O(N^2) (d) O(log N)

Q(30) Find the value of a4 for the recurrence relation $a_i=2a_{n-1}+3$, with a0=6.
(a) 320 (b) 221 (c) 141 (d) 65

--End of Question paper--

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