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Paper Code : PEC-IT601A Advanced Algorithms

UPID : 006589

Time Allotted : 3 Hours *Full Marks :70*

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer *any ten* of the following : [1 x 10 = 10]

(I) **Which method is practical to perform a single search in an unsorted list of elements?**
a. Sequential search
b. Bubble sort
c. Horspool's method of string matching
d. Brute force method of string matching

(II) **___ is the technique by which we make a function perform faster by trading space for time.**
a. Divide and conquer
b. Greedy
c. Memoization
d. Recursion

(III) **The best possible value of the problem objective, written as a function of the state, is called the ___.**
a. Value function
b. Control variables
c. Policy function
d. Principle of Optimality

(IV) **An algorithm that defines every operation exclusively is called ___ algorithm.**
a. NP-hard
b. Deterministic
c. Non-deterministic
d. NP-complete

(V) **In which method of coding does the code of a symbol not depend on the frequency of occurrence of that symbol?**
a. Variable length coding
b. Fixed length coding
c. Static Huffman coding
d. Adaptive Huffman coding

(VI) **Which one of the following helps in calculating the longest amount of time taken for the completion of the algorithm?**
a. Theta notation
b. Big-Oh notation
c. Omega notation
d. Time complexity

(VII) **___ are node-based data structures used in many system programming applications for managing dynamic sets**
a. Stack
b. Queue
c. Binary search trees
d. List

(VIII) **Which method of encoding does not consider the probability of occurrence of symbols?**

a. Static Huffman coding
b. Variable length coding
c. Adaptive Huffman coding
d. Fixed length coding

(IX) If we have materials of different values per unit volume and maximum amounts, the ___ Knapsack problem finds the most valuable mix of materials that fit in a knapsack of fixed volume.
a. Bounded
b. Binary
c. 0-1
d. Fractional

(X) Identify the true and false statements from the following with respect to measuring the running time of an algorithm.
1. Firstly, recognize the basic operation of an algorithm.
2. Identifying the basic operation of an algorithm is difficult.
a. 1-T, 2-F
b. 1-T, 2-T
c. 1-F, 2-T
d. 1-F, 2-F

(XI) The smoothness rule assumes that T(n) $\in$ Θ(n2) if ___ is a smooth function and ___ is eventually non-decreasing.
a. n2, T(n)
b. Θ(n2), T(n)
c. T(n), n2
d. Θ(n),n

(XII) A ___ is a compact, informal, and environment-independent description of a computer programming algorithm.
a. Stack
b. Queue
c. Psuedocode
d. Non-linear data structure

Group-B (Short Answer Type Question)

Answer *any three* of the following : [5 x 3 = 15]

2. What is augmenting path? How it is computed with Edmonds Blossom Algorithm? [5]
3. Analyze Randomized Quick Sort Algorithm. https://www.makaut.com [5]
4. Prove that sub-paths of the shortest path are also shortest path. [5]
5. Explain Nondeterministic Bubble Sort Algorithm. [5]
6. Explain Schonhage-Strassen Integer Multiplication algorithm. [5]

Group-C (Long Answer Type Question)

Answer *any three* of the following : [15 x 3 = 45]

7. Illustrate topological sorting with algorithm. [5+ 10]
Suppose we perform a sequence of stack operations on a stack whose size never exceeds k. After every k operations, we make a copy of the entire stack for backup purposes. Show that the cost of n stack operations, including copying the stack, is O(n) by assigning suitable amortized costs to the various stack operations.
8. Discuss the difference between following [10+5]
a) Chromatic numbers in scheduling
b) Directed acyclic graphs in planning activities
Write an algorithm to find out maximum matching in graphs
9. Solve the system of equations x1 + x2 + x3 = 1, 3x1 + x2 − 3x3 = 5 and x1 − 2x2 − 5x3 = 10 by LU decomposition method. Discuss in detail about "Airlines scheduling" algorithm. [8+7]

10. If x(n) = {1, 2, 3, 4, 5, 6, 7, 8}, Find X(k) using DIT-FFT algorithm. Compare the computational complexity of above algorithm with DFT. [10+5]
11. Write a short note on approximation algorithms. Differentiate between sorting based on different design techniques. Write a complete LC branch-and-bound algorithm for the job sequencing with deadlines problems. Use the fixed tuple size formulation. [5+5+5]

*** END OF PAPER ***