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Question Paper Code : 27168

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Third/Fourth Semester

Computer Science and Engineering

CS 6402 — DESIGN AND ANALYSIS OF ALGORITHMS

(Common to Information Technology/Computer and Communication Engineering)

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. The $(\log n)$ th smallest number of n unsorted numbers can be determined in $O(n)$ average-case time (True/False).
2. Write the recursive Fibonacci algorithm and its recurrence relation.
3. Give the mathematical notation to determine if a convex direction is towards left or right and write the algorithm.
4. Prove that any comparison sort algorithm requires $\Omega(n \log n)$ comparisons in the worst case.
5. State how Binomial Coefficient is computed?
6. What is the best algorithm suited to identify the topography for a graph. Mention its efficiency factors.
7. Determine the Dual linear program for the following LP,
Maximize $3a + 2b + c$
Subject to,
 $2a + b + c \leq 3$
 $a + b + c \leq 4$
 $3a + 3b + 6c \leq 6$
 $a, b, c \geq 0$.
8. Define Network Flow and Cut.
9. Draw the decision tree for comparison of three values.
10. Depict the proof which says that a problem 'A' is no harder or no easier than problem 'B'.



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PART B — (5 × 16 = 80 marks)

11. (a) (i) Write the Insertion sort algorithm and estimate its running time. (8)
- (ii) Find the closest asymptotic tight bound by solving the recurrence equation $T(n) = 8T(n/2) + n^2$ with $(T(1) = 1)$ using Recursion tree method. [Assume that $T(1) \in \Theta(1)$]. (8)

Or

- (b) (i) Suppose W satisfies the following recurrence equation and base case (where c is a constant) : $W(n) = c.n + W(n/2)$ and $W(1) = 1$. What is the asymptotic order of $W(n)$. (6)
- (ii) Show how to implement a stack using two queues. Analyze the running time of the stack operations. (10)
12. (a) (i) Write the algorithm to perform Binary Search and compute its run time complexity. (8)
- (ii) Compute the multiplication of given two matrices using Strassen's matrix multiplication method : (8)

$$A = \begin{bmatrix} 1 & 0 & 2 & 1 \\ 4 & 1 & 1 & 0 \\ 0 & 1 & 3 & 0 \\ 5 & 0 & 2 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 0 & 1 & 0 & 1 \\ 2 & 1 & 0 & 4 \\ 2 & 0 & 1 & 1 \\ 1 & 3 & 5 & 0 \end{bmatrix}$$

Or

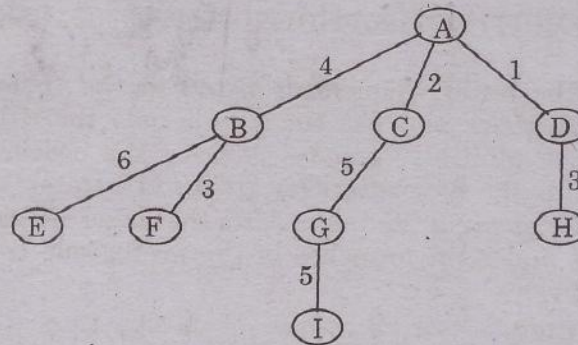
- (b) (i) Write down the algorithm to construct a convex hull based on divide and conquer strategy. (8)
- (ii) Find the optimal solution to the fractional knapsack problem with given data : (8)

Item	Weight	Benefit
A	2	60
B	3	75
C	4	90





- (b) (i) Illustrate the workings of the maximum matching algorithm on the following weighted tree. (12)



- (ii) Explain Max-Flow Problem. (4)
15. (a) (i) Using an example prove that, satisfiability of boolean formula in 3-Conjunctive Normal Form is NP – complete. (12)
- (ii) State the relationships among the complexity class algorithms with the help of neat diagrams. (4)

Or

- (b) (i) Show that the Hamiltonian Path problem reduces to the Hamiltonian Circuit Problem and vice versa. (10)
- (ii) What is an approximation algorithm? Give example. (6)