BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE
BRANCH: CSE

SEMESTER : III
SESSION : MO/18

SUBJECT: CS6101 DESIGN & ANALYSIS OF COMPUTER ALGORITHMS

TIME: 3.00 HOURS

FULL MARKS: 60

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Verify: $2^{2n} = O(2^n)$. [2]
Q.1(b) Solve the recurrence by iterative or tree method: $T(n) = T(n/2) + n \log n$ and $T(1)=2$. [4]
Q.1(c) Write an algorithm for finding median of an array & derive its time complexity. [6]

Q.2(a) What is the recurrence equation for recursive merge sort? [2]
Q.2(b) Derive average case time complexity of Quick Sort. [4]
Q.2(c) Write an O(n) algorithm for the Dutch National Flag Problem: given 'n' objects coloured red, white or blue, sort them so that objects of the same colour are adjacent. (count-based algorithm is not allowed, and extra space should be optimal). Verify the time-complexity of your algorithm. [6]

Q.3(a) What do you mean by Minimum Cost Spanning Tree? [2]
Q.3(b) Derive the time and space complexity of Prim's algorithm. (properly mention the data structure used) [4]
Q.3(c) Discuss Huffman Coding algorithm and apply it to find the codes for the given symbols with the probability values in parenthesis: A (0.2), B (0.08), C(0.35), D(0.07), E(0.3). Find compression ratio. [6]

Q.4(a) What are the fundamental properties of Dynamic Programming? [2]
Q.4(b) Solve the 0/1 knapsack problem by dynamic programming method: n=4, profit (p1,p2,.....,p4) = (10,15, 6, 12), weight (w1, w2,...,w4)=(4, 6, 3, 4), and capacity m=9. [4]
Q.4(c) Solve the following TSP problem using DP method: [6]

TSP_Cost	a	b	c	d	e
a	–	15	21	40	16
b	10	–	18	35	14
c	6	30	–	12	8
d	16	42	7	–	20
e	11	23	33	50	–

Q.5(a) Differentiate between backtracking and 'branch & Bound'. [2]
Q.5(b) Explain the DP based algorithm for 'all pair shortest path' problem. [4]
Q.5(c) Write and explain the Backtracking based algorithm for N-Queens problem. [6]

Q.6(a) What are the variations of Branch & Bound? [2]
Q.6(b) Solve the 0/1 knapsack problem by Branch-and-Bound method: n=4, profit (p1,p2,.....,p4) = (12,15, 6, 16), weight (w1, w2,.....,w5)=(4, 6, 3, 4), and capacity m=10. [4]
Q.6(c) Solve the TSP problem given in Q. No. 4(c) using Branch and Bound method. [6]

Q.7(a) What do you mean by non-deterministic algorithms? [2]
Q.7(b) Write a short note on Randomized algorithm. [4]
Q.7(c) Discuss on P, NP, NPC and NPH. [6]

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