23CMU637N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2026
(Sixth Semester)

Branch - **COMPUTER SCIENCE**

DESIGN AND ANALYSIS OF ALGORITHMS

Time: Three Hours | Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	An _______ is a sequence of unambiguous instructions for solving a problem. (i) Flowchart (ii) Blueprint (iii) Algorithm (iv) Program	K1	CO1
	2	A __________ schedule is a schedule in which the processing of a task on any processor is not terminated until the task is complete. (i) nonpreemptive (ii) preemptive (iii) optimal finish time (iv) optimal mean finish time	K2	CO1
2	3	Which of the following areas do closest pair problem arise? (i) Graph Coloring problems (ii) Numerical problems (iii) Computational geometry (iv) String matching	K1	CO2
	4	What is the optimal time required for solving the closest pair problem using divide and conquer approach? (i) O(N) (ii) O(log N) (iii) O(N log N) (iv) O(N2)	K2	CO2
3	5	Which algorithm is used to find all pair shortest paths in a graph? (i) Backtracking (ii) Greedy (iii) Divide and Conquer (iv) Dynamic programming	K1	CO3
	6	Backtracking algorithm is implemented by constructing a tree of choices called as? (i) State-space tree (ii)State-chart tree (iii) Backtracking tree (iv) Node tree	K2	CO3
4	7	How does the LC Branch and Bound method estimate the bound for a node in the 0/1 Knapsack problem? (i) By considering the total weight of items left. (ii) By calculating the maximum profit obtainable from the items that could still fit. (iii) By the number of items remaining. (iv) By the number of items remaining.	K1	CO4
	8	Infer the transformation of Problem instance I to I' is __________ (i) Interval Partitioning (ii) Separation (iii) Rounding (iv) Approximation	K2	CO4
5	9	Let X be a problem that belongs to the class NP, then which of the following is TRUE? (i) There is no polynomial time algorithm for X (ii) If X can be solved deterministically in polynomial time, then P=NP (iii) If X is NP-hard, then it is NP-complete (iv) X may be undecidable	K1	CO5

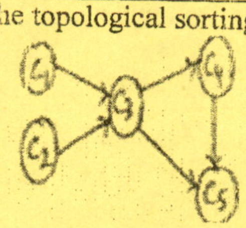
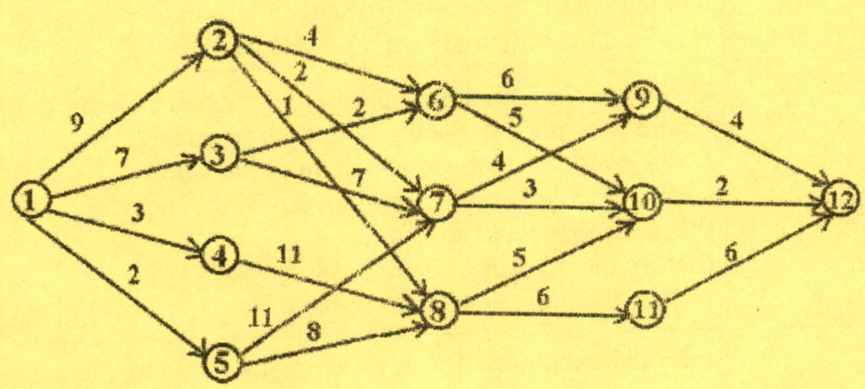
Cont...

<table>
<tr><td>5</td><td>10</td><td>According to Cook's theorem, which statement is true?
(i) The Boolean satisfiability problem (SAT) is NP-Complete.
(ii) All problems in P are also in NP.
(iii) NP-complete problems are solvable in polynomial time.
(iv) P equals NP.</td><td>K2</td><td>CO5</td></tr>
</table>

SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks (5 × 7 = 35)

<table>
<tr><th>Module No.</th><th>Question No.</th><th>Question</th><th>K Level</th><th>CO</th></tr>
<tr><td rowspan="3">1</td><td>11.a.</td><td>Develop a non-recursive algorithm for the element uniqueness problem: check whether all the elements in a given array of n elements are unique.</td><td rowspan="3">K3</td><td rowspan="3">CO1</td></tr>
<tr><td></td><td>(OR)</td></tr>
<tr><td>11.b.</td><td>Identify the General Plan for the Empirical Analysis of Algorithm Time Efficiency.</td></tr>
<tr><td rowspan="3">2</td><td>12.a.</td><td>Apply the principles of the topological sorting for the following graph.

</td><td rowspan="3">K3</td><td rowspan="3">CO2</td></tr>
<tr><td></td><td>(OR)</td></tr>
<tr><td>12.b.</td><td>Solve the given assignment problem using exhaustive search technique.
<table>
<tr><th></th><th>Job1</th><th>Job2</th><th>Job3</th><th>Job4</th></tr>
<tr><td>Person1</td><td>9</td><td>2</td><td>7</td><td>8</td></tr>
<tr><td>Person2</td><td>6</td><td>4</td><td>3</td><td>7</td></tr>
<tr><td>Person3</td><td>5</td><td>8</td><td>1</td><td>8</td></tr>
<tr><td>Person4</td><td>7</td><td>6</td><td>9</td><td>4</td></tr>
</table></td></tr>
<tr><td rowspan="3">3</td><td>13.a.</td><td>Discover the minimum cost path from 1 to 12 for the following multistage graph using Dynamic Programming.
</td><td rowspan="3">K4</td><td rowspan="3">CO3</td></tr>
<tr><td></td><td>(OR)</td></tr>
<tr><td>13.b.</td><td>Examine the concept of Backtracking method using 4-Queens Problem.</td></tr>
<tr><td rowspan="3">4</td><td>14.a.</td><td>Demonstrate the portion of the state space tree generated by LCBB for the following knapsack instances: n = 5, (P1,P2,...,p5) = (10, 15, 6, 8, 4), (w1, w2,..., w5) = (4, 6, 3, 4, 2), and m = 12.</td><td rowspan="3">K2</td><td rowspan="3">CO4</td></tr>
<tr><td></td><td>(OR)</td></tr>
<tr><td>14.b.</td><td>Show the result of applying the Fourier transform to the sequence (a0......a7).</td></tr>
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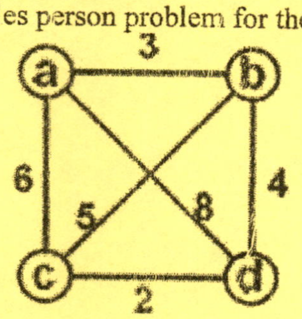
5	15.a.	Show that CLIQUE problem is NP Complete.	K2	CO5
		(OR)		
	15.b.	Define the Bin Packing problem and explain about the First Fit strategy for solving it.		

SECTION -C (30 Marks)
Answer **ANY THREE** questions
ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16.	Design an algorithm to compute the nth Fibonacci number using the simple recurrence.	K3	CO1
2	17.	Explain the Rubber-band interpretation of the convex hull Problem.	K3	CO2
3	18.	Using Dynamic Programming, solve the given instance of 0/1 Knapsack problem. Consider the capacity of Knapsack (m) = 5. Item: 1, 2, 3, 4 Weight: 2, 1, 3, 2 Value: 12, 10, 20, 15	K4	CO3
4	19.	Apply Branch and Bound technique to solve a travelling sales person problem for the given graph.  	K4	CO4
5	20.	Discuss the approximation algorithm for NP hard problems.	K5	CO5

Z-Z-Z END