INSTITUTE OF AERONAUTICAL ENGINEERING

Dundigal, Hyderabad -500 043

INFORMATION TECHNOLOGY

TUTORIAL QUESTION BANK
2015 - 2016

Course Name	:	**DESIGN AND ANALYSIS OF ALGORITHMS**
Course Code	:	A40508
Class	:	II B. Tech II Semester
Branch	:	Information Technology
Year	:	2016 – 2017
Course Faculty	:	Mr. T Vishnu Vardhan Reddy Assistant Professor

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

PART – A (SHORT ANSWER QUESTIONS)

S. No	Question	Blooms Taxonomy Level	Program Outcome
	UNIT – I		
1	**Define** the term algorithm and state the criteria the algorithm should satisfy.	Remember	1
2	**Define** order of an algorithm and the need to analyze the algorithm.	Remember	2
3	**Define** asymptotic notations: big 'Oh', omega and theta?	Remember	2
4	**List** the two different types of recurrence	Remember	4
5	**State** the best case and worst case analysis for linear search	Remember	7
6	If $f(n)=5n^2 + 6n + 4$, then **prove** that f(n) is $O(n^2)$	Remember	3
7	**Give** the recurrence equation for the worst case behavior of merge sort.	Remember	7
8	**Compute** the average case time complexity of quick sort	Remember	7
9	**Define** algorithm correctness	Remember	3
10	**Describe** best case, average case and worst case efficiency of an algorithm?	Remember	3
11	**Explain** the term amortized efficiency	Understand	3
12	**Define** order of growth	Remember	2
13	**How** do you measure the algorithm running time?	Understand	1

S. No	Question	Blooms Taxonomy Level	Program Outcome
14	**Describe** the role of space complexity and time complexity of a program are necessary?	Understand	1
15	**Explain** algorithm design technique?	Understand	3
16	**Use** step count method and analyze the time complexity when two n×n matrices are added	Apply	3
17	**What** is meant by divide and conquer? Give the recurrence relation for divide and conquer.	Understand	7
18	**Define** Control Abstraction and write the computing time of divide and conquer.	Remember	7
19	**List** out any two drawbacks of binary search algorithm.	Remember	7
20	**List** out the drawbacks of Merge Sort algorithm.	Remember	7
	UNIT – II		
1	**Describe** union operation on sets	Remember	5
2	**Describe** find operation on sets	Remember	5
3	**Define**a spanning tree and minimal spanning tree	Remember	6
4	**Define** depth first search	Remember	5
5	**Define** breadth first search	Remember	5
6	**Differentiate** Breadth first search and depth first search	Remember	5
7	**Describe** AND/OR graph	Remember	5
8	**Explain** game tree	Remember	5
9	**Define** an articulation point?	Remember	5
10	**Define** aconnected and bi-connected component.	Remember	5
	UNIT – III		
1	**Define** greedy method	Remember	8
2	**Define** job sequencing with deadlines problem	Remember	8
3	**Define** minimum cost spanning tree	Remember	8
4	**State** the principle of optimality	Remember	8
5	**Define** prims algorithm	Remember	8
6	**Define**kruskal algorithm	Remember	8
7	**Define** single source shortest path problem	Remember	8
8	**Define** dynamic programming.	Remember	8
9	**List** the features of dynamic programming	Remember	8
10	**Distinguish** greedy method and dynamic programming	Remember	8,9
	UNIT – IV		
1	**State** the principle of Backtracking	Remember	10
2	**Write** control abstraction for backtracking	Apply	10
3	**List** the applications of backtracking?	Remember	10
4	**Define** a dead node	Remember	10
5	**Differentiate** live node and dead node	Remember	10
6	**Define** state space tree	Remember	10
7	**Define** is solution space	Remember	10
8	**Define** solution states and answer state?	Remember	10

S. No	Question	Blooms Taxonomy Level	Program Outcome
9	**Explain** 8 – Queens problem	Apply	10
10	**Explain** Sum of Subsets problem	Apply	10
	UNIT – V		
1	**Define** class P	Remember	12
2	**Compare** NP-hard and NP-completeness	Remember	12
3	**Define** NP- hard problem	Remember	12
4	**Define** NP-complete problem	Remember	12
5	**Define** deterministic problem?	Remember	12
6	**Define** non-deterministic problem	Remember	12
7	**Define** a decision problem?	Remember	12
8	**Explain** optimization problem	Understand	12
9	**Explain**maxclique problem?	Understand	12
10	**Define** halting problem	Remember	12

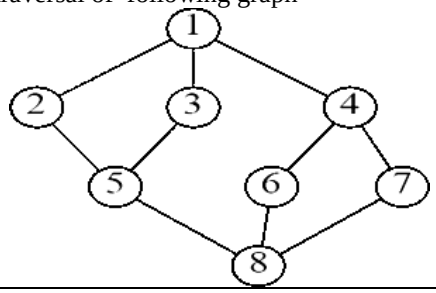
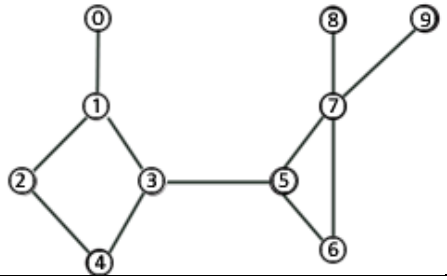
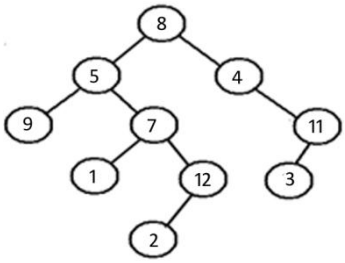
PART – B (LONGANSWER QUESTIONS)

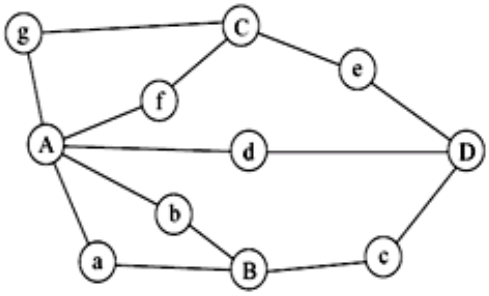
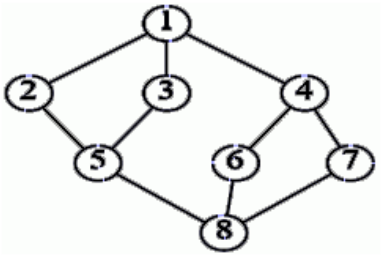
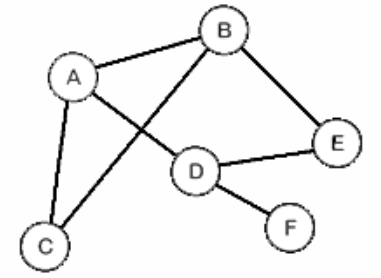
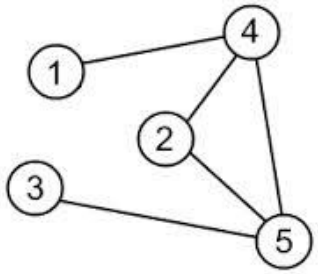
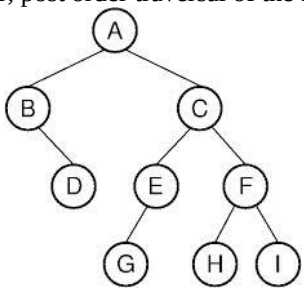
S. No	Question	Blooms Taxonomy Level	Program Outcome
	UNIT - I		
1	**Discuss** various the asymptotic notations used for best case average case and worst case analysis of algorithms.	Understand	1
2	**Differentiate** between priori analysis and posteriori analysis.	Understand	3
3	**Discuss**binary search algorithm and analyze its time complexity	Understand	7
4	**Explain** quick sort algorithm and simulate it for the following data 20, 35, 10, 16, 54, 21, 25	Understand	7
5	**Explain** Iterative binary search algorithm	Understand	7
6	**Illustrate**merge sort algorithm and discuss time complexity	Understand	7
7	**Describe**strassen's matrix multiplication.	Understand	7
8	**Discuss**amortized analysis	Understand	3
9	**Explain** probabilistic analysis	Understand	3
10	**Sort** the list of numbers using merge sort: 78, 32, 42, 62, 98, 12, 34, 83	apply	7
	UNIT - II		
1	**Explain** breadth first search algorithm with example	Understand	5
2	**Explain** depth first search algorithm with example	Understand	5
3	**Discuss** various tree traversal techniques with examples	Understand	5
4	**Compare** and contrast BFS and DFS.	Understand	5
5	**Explain** in detail about AND/OR graphs	Understand	5
6	**Explain** waiting rule for finding UNION of sets and collapsing rule	Understand	5
7	**Differentiate** divide and conquer and greedy method	Understand	8,9
8	**Discuss** game trees	Understand	5

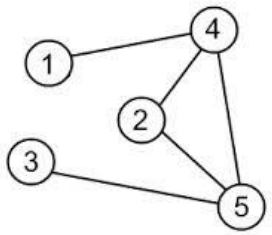
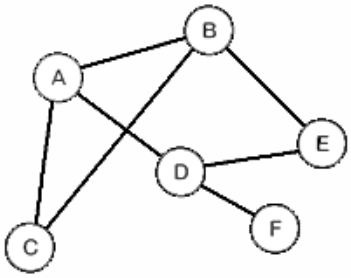
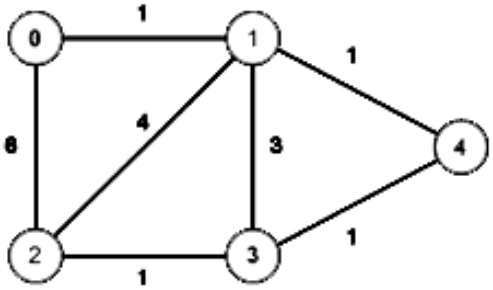
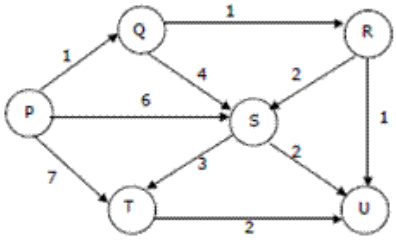
UNIT - III			
1	**Explain** in detail job sequencing with deadlines problem with example	Apply	8
2	**Explain** single source shortest path problem with example	Apply	8
3	**Explain** knapsack problem with example	Apply	8
4	**Explain** prims algorithm with example	Understand	8
5	**Explain**kruskal algorithm with example	Understand	8
6	**Explain** the concept multistage graphs with example.	Understand	8
7	**Explain** optimal binary search tree algorithm with example	Understand	8
8	**Explain** 0/1 knapsack problem with example	Understand	8
9	**Explain** all pairs shortest path problem with example	Understand	8
10	**Describe** the travelling salesman problem and discuss how to solve it using dynamic programming?	Understand	9
UNIT – IV			
1	**Write** an algorithm for N-queens problem using backtracking	Apply	11
2	**Explain** subset-sum problem and discuss the possible solution strategies using backtracking.	Apply	10
3	**Describe** graph coloring problem and write an algorithm for m-coloring problem	Understand	10
4	**Write** an algorithm for Hamiltonian cycle with an example	Apply	10
5	**Explain** properties of LC search	Apply	11
6	**Describe** control abstraction for LC Search	Understand	11
7	**Explain** principle of FIFO branch and bound	Apply	11
8	**Explain** principle of LIFO branch and bound	Apply	11
9	**Explain** the method of reduction to solve travelling sales person problem using branch and bound	Apply	11
10	**Explain** TSP using branch and bound method with example	Apply	11
UNIT – V			
1	**State** and prove cook's theorem	Remember	12
2	**Explain** deterministic and non-deterministic algorithms	Apply	12
3	**Write** non deterministic algorithm for sorting and searching	Apply	12
4	**Write** a non-deterministic knapsack algorithm	Apply	12
5	**Explain**how P and NP problems are related	Apply	12
6	**Distinguish** NP- hard and NP-complete problems	Understand	12
7	**Explain** decision problem with an example	Apply	12
8	**Explain** chromatic number decision problem and clique decision problem	Apply	12
9	**Explain** the strategy to prove that a problem is NP-hard	Apply	12
10	**Explain** intractable problems with examples	Apply	12

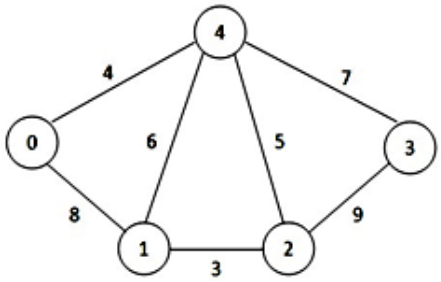
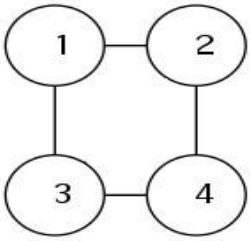
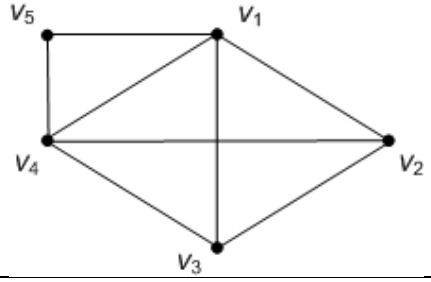
PART – C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)

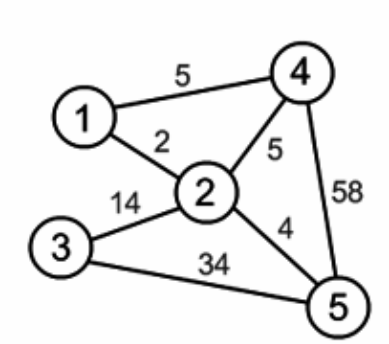
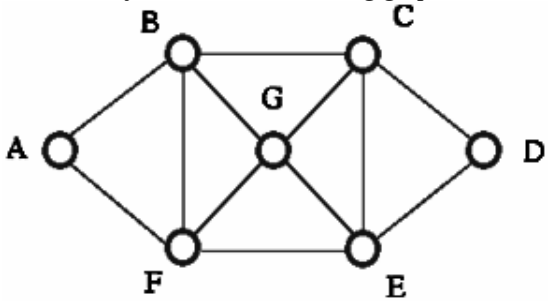
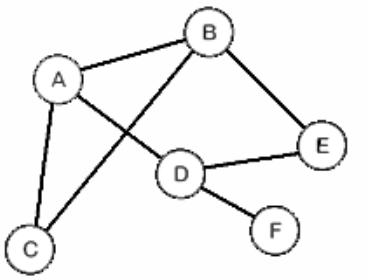
S. No	Question	Blooms Taxonomy Level	Program Outcome
UNIT – I			
1	**Solve** the following recurrence relation	Understand	4

S. No	Question	Blooms Taxonomy Level	Program Outcome
	$T(n) = \left\{2T\left(\frac{n}{2}\right) + n, \quad and\ T(1) = 2\right.$		
2	**Solve** the following recurrence relation $T(n) = 7T(n/2)+cn^2$	Understand	4
3	**Solve** the recurrence relation $T(n) = \begin{cases} k, & n = 1 \\ 3T\left(\frac{n}{2}\right) + kn, & n > 1, \quad n\ is\ power of\ 2 \end{cases}$	Understand	4
4	**Explain** quick sort algorithm and simulate it for following data sequence: 3 5 9 7 1 4 6 8 2	Apply	7
5	**Sort** the list of numbers using merge sort 33, 44, 2, 10, 25, 79, 86, 47, 14, 36	Understand	7
6	**Show** that the average case time complexity of quick sort is O(nlogn)	Apply	7
7	**Understand** merge sort on letters H, K, P,C,S,K,R,A,B,L	Understand	7
8	**Understand**strassen's matrix multiplication on following matrices $\begin{bmatrix} 4 & 5 \\ 5 & 9 \end{bmatrix}, \begin{bmatrix} 2 & 10 \\ 1 & 6 \end{bmatrix}$	Understand	7
9	**Write** and solve recurrence relation for strassen's matrix multiplication	Apply	7
10	**Solve** the following recurrence relation $T(n) = \left\{2T\left(\frac{n}{2}\right) + 1, \quad and\ T(1) = 2\right.$	Understand	4
	UNIT - II		
1	**Illustrate** BFS traversal of following graph 	Understand	5
2	**List** the articulation points from the following graph 	Understand	5
3	**Write**inorder, preoreder, post order traversal of the following tree 	Understand	5

S. No	Question	Blooms Taxonomy Level	Program Outcome
4	**Illustrate** DFS and BFS traversals of following graph 	Understand	5
5	**Illustrate** DFS traversal of following graph 	Understand	5
6	**Illustrate** BFS traversal of following graph 	Understand	5
7	**List** the articulation points from the following graph 	Understand	5
8	**Write**inorder, preorder, post order traversal of the following tree 	Understand	5

S. No	Question	Blooms Taxonomy Level	Program Outcome
9	**Illustrate** BFS and DFS traversals of following graph 	Understand	5
10	**Illustrate** DFS traversal of following graph 	Understand	5
	UNIT - III		
1	**Compute** the optimal solution for job sequencing with deadlines using greedy method. N=4, profits (p1,p2,p3,p4) = (100,10,15,27), Deadlines (d1,d2,d3,d4) = (2,1,2,1)	Understand	8
2	**Compute** the optimal solution for knapsack problem using greedy methodN=3, M= 20, (p1,p2,p3)= (25,24,15), (w1,w2,w3) =(18,15,10)	Understand	8
3	**Construct** minimum cost spanning tree using a) prims algorithm b) kruskal algorithm 	Understand	8
4	**Apply** single source shortest path algorithm for the following graph 	Apply	8
5	**Use** optimal binary search tree algorithm and compute wij, cij, rij, 0<=i<=j<=4,p1=1/10, p2=1/5, p3=1/10, p4=1/120, q0=1/5, q1=1/10, q2=1/5, q3=1/20,q4=1/20.	Understand	9
6	**Construct** optimal binary search for (a1, a2, a3, a4) = (do, if,int, while), p(1 : 4) = (3,3,1,1) q(0 : 4)= (2,3,1,1,1)	Understand	9

S. No	Question	Blooms Taxonomy Level	Program Outcome
7	**Solve** the solution for 0/1 knapsack problem using dynamic programming(p1,p2,p3, p4) = (11, 21, 31, 33), (w1, w2, w3, w4) = (2, 11, 22, 15), M=40, n=4	Apply	9
8	**Solve** the solution for 0/1 knapsack problem using dynamic programming N=3 , m=6 profits (p1,p2,p3) = (1,2,5) weights (w1,w2,w3) = (2,3,4)	Apply	9
9	**Find** the shortest tour of traveling sales person for the following cost matrix using dynamic Programming $\begin{bmatrix} \infty & 12 & 5 & 7 \\ 11 & \infty & 13 & 6 \\ 4 & 9 & \infty & 18 \\ 10 & 3 & 2 & \infty \end{bmatrix}$	Understand	9
10	**Calculate** shortest distances using all pairs shortest path algorithm 	Understand	9
	UNIT - IV		
1	**Sketch** the state space tree degenerated by 4 queens problem	Understand	10
2	**Apply** the backtracking algorithm to solve the following instance of the sum of subsets problem S={5,10,12,13,15,18} and d=30	Understand	10
3	**Sketch** the state space tree generated all possible 3-color,4-node graph 	Understand	10
4	**Identify** Hamiltonian cycle from the following graph 	Understand	10
5	**Solve** the following instance of travelling sales person problem using Least Cost Branch Bound	Understand	11

S. No	Question	Blooms Taxonomy Level	Program Outcome
	$\begin{bmatrix} \infty & 12 & 5 & 7 \\ 11 & \infty & 13 & 6 \\ 4 & 9 & \infty & 18 \\ 10 & 3 & 2 & \infty \end{bmatrix}$		
6	**Draw** the portion of state space tree generated by LCBB by the following knapsack problem n=5 , (p1,p2,p3,p4,p5) =(10,15,6, 8, 4), (w1,w2,w3,w4,w5)=(4,6,3,4,2) and m=12	Understand	11
7	**Draw** the portion of state space tree generated by FIFO knapsack for the instance N=4 , (P1, P2, P3, P4)= (10, 10, 12, 18) , (w1, w2,w3,w4) = (2, 4, 6, 9) , m=15	Understand	11
8	**Solve** the following instance of travelling sales person problem using Least Cost Branch Bound 	Understand	11
9	**Identify** Hamiltonian cycle from the following graph 	Understand	10
10	**Apply** the backtracking algorithm to color the following graph 	Understand	10

S. No	Question	Blooms Taxonomy Level	Program Outcome
	UNIT – V		
1	**Show** that satisfiability is at most three literals reduces to chromatic number	Remember	12
2	**Prove** Hamiltonian cycle is in NP	Understand	12
3	**Prove** circuit-SAT is in NP	Understand	12
4	**List** two problems that have polynomial time algorithms justify your answer	Understand	12
5	**Explain** 3CNF satisfiability problem	Remember	12
6	**Explain** P type problems with examples	Remember	12

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