(vi) For 0/1 KNAPSACK problem, the algorithm takes _______ amount of time for memory table, and _____time to determine the optimal load, for N objects and W as the capacity of KNAPSACK.

(a) O(N+W), O(NW) (b) O(NW), O(N+W)
(c) O(N), O(NW) (d) O(NW), O(N).

(vii) We use dynamic programming approach when
(a) it provides optimal solution
(b) the solution has optimal substructure
(c) the given problem can be reduced to the 3-SAT problem
(d) it's faster than Greedy.

(viii) Match the following :

	Group A		Group B
(a)	Dijkstra's single shortest path algo	(p)	Dynamic Programming
(b)	Bellmen Ford's single shortest path algo	(q)	Backtracking
(c)	Floyd Warshell's all pair shortest path algo.	(r)	Greedy Algorithm

(a) a-r, b-q, c-p (b) a-p, b-p, c-p
(c) a-r, b-p, c-p (d) a-p, b-r, c-q

(ix) Time complexity for Floyd's algorithm to find all pairs of shortest paths of a graph G with vertices V and edges E using dynamic programming method is

(a) O (V2) (b) O (E2)
(c) O (V3) (d) O (E3).

(x) The total running time of matrix chain multiplication of n matrices
(a) Θ (n4) (b) Θ (n3) (c) Θ (n2) (d) Θ (n).

Group - B

2. (a) State master theorem.

(b) Solve the following in the best possible way
(i) $T(n)= 4T(n/2)+ n^2$
(ii) $T(n)= 2T(n^{½}) + \log n$
(iii) $T(n)=2^nT(n/2) + n^n$
(iv) $T(n)=T(n/2) + 2^n$

(c) Show that the lower bound for comparison sort is O(n lgn).

3 + 6 + 3 = 12

9. (a) Define P , NP, NP- hard, NP-complete. With a diagram show the relationship between them. Give an example of NP-hard problem which is not NP-complete. Also explain why?

(b) Write a polynomial-approximation algorithm for TSP problem.

(3+2+2) + 5 = 12

2016

DESIGN AND ANALYSIS OF ALGORITHM
(INFO 2202)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following: **10 x 1=10**

(i) The solution to the recurrence relation T(n)=2T(n/2) + n is
(a) O (log n) (b) O (n log n)
(c) O (n) (d) O (n^2).

(ii) The upper bound of computing time of m coloring decision problem is
(a) O(nm) (b) O(n^mm)
(c) O(nm^n) (d) O($n^m m^n$).

(iii) The Big O notation of the expression f(n)=n log n + n^2 + $e^{\log n}$ is
(a) O(n) (b) O (n log n)
(c) O (n2) (d) O (e log n).

(iv) If every square of the board is visited, then the total number of knight moves of 4-queen problem is
(a) 14 (b) 15 (c) 16 (d) 12.

(v) Which of the following condition is sufficient to detect cycle in a directed graph?
(a) There is an edge from currently being visited node to an already visited node.
(b) There is an edge from currently being visited node to an ancestor of currently visited node in DFS forest.
(c) Every node is seen twice in DFS.
(d) None of the above.

3. (a) State divide and conquer principle. Apply the quick sort algorithm to sort the following unsorted data: 23 11 52 09 62 31 75 19. Analyze quick sort for average case time complexity.

(b) How priority queues can be implemented using heap?

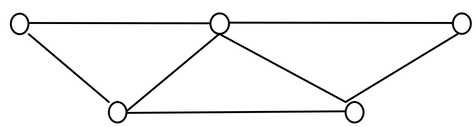
(c) Show that by using Strassen's algorithm for matrix multiplication there is a slight improvement in the running time than the traditional matrix multiplication algorithm.

(1+4+3) + 2 + 2= 12

Group - C

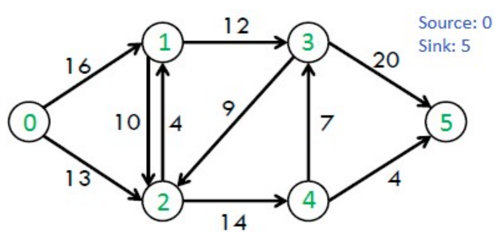
4. (a) Write an algorithm for N-queens problem. Find its complexity

(b) Apply the backtracking technique to solve the 3 coloring problem for the following graph and also draw the corresponding search space tree.

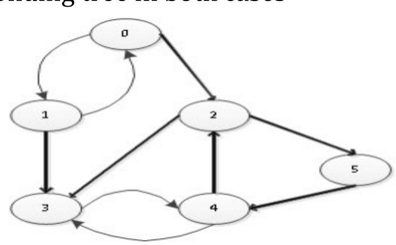


(5+1) + (4+2) + = 12

5. (a) Write the Ford-Fulkerson algorithm and apply the Ford-Fulkerson algorithm for the following graph using source node 0 and sink node as 5.



(b) Apply BFS and DFS to the following graph and generate the corresponding tree in both cases



(3+5) + (2+2) = 12

B.TECH/IT/4TH SEM /INFO 2202/2016
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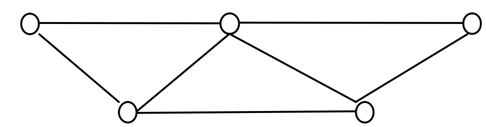
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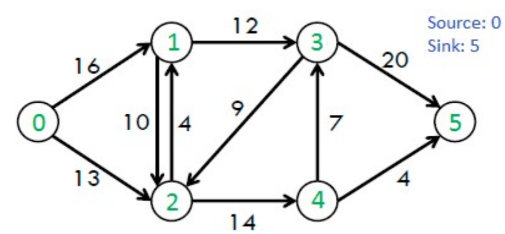
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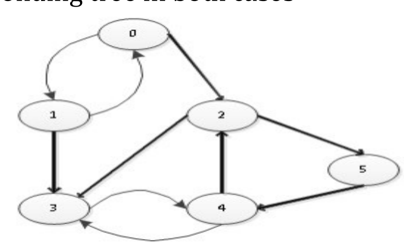
(3+5) + (2+2
INFO 2202 3

Group - D

6. (a) An instance of the problem of scheduling unit time Task/Jobs with deadlines and profits for a single processor is given. Only one job can be processed at a time. Find all possible feasible solutions. Among these find the optimal solution. Show the order in which the jobs have to be scheduled and the total profit for each feasible solution.

Jobs	J1	J2	J3	J4	J5	J6	J7
Deadlines	6	4	4	3	1	2	4
Profits	10	20	50	40	30	60	70

(b) Solve the following instance of 0/1 Knapsack problem using dynamic programming.
No. Of objects = 5; Sack Capacity = 7;
W : < 2,4,2,3,1 > B : <8,9,16,15,4>.

6 + 6 = 12

7. (a) Find the minimum number of operations required for the following matrix chain multiplication using dynamic programming
A(10 x 20) * B(20 x 50) * C(50 x 1) * D(1 x 100).

(b) Find out the shortest path from vertex 1 to all remaining vertices for the following graph (Adjacency Matrix is given) using Bellman Ford algorithm.

i/j	**1**	**2**	**3**	**4**	**5**	**6**
1	0	2	4	0	0	0
2	0	0	-3	1	5	0
3	0	0	0	-4	-2	0
4	0	0	0	0	0	8
5	0	0	0	4	0	6
6	0	0	0	0	0	0

5 + 7 = 12

Group - E

8. (a) What is branch & bound technique? If we apply BFS & DFS to solve 15 puzzle problem, what will happen? Write some alternative algorithm to overcome this problem.

(b) Prove that CDP (clique decision problem) is NP-complete.

(2+2+3) + 5 = 12

B.TECH/IT/4TH SEM /INFO 2202/2016

Group - D

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3	0	0	0	-4	-2	0
4	0	0	0	0	0	8
5	0	0	0	4	0	6
6	0	0	0	0	0	0

5 + 7 = 12

Group - E

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