Assignment – II
Set-A

Course: B. Tech. Year/Semester: III & VI **Session:** 2024-25
Subject Name & Code: Design & Analysis of Algorithms (BCSC1012)

Date: **Date of Submission:**

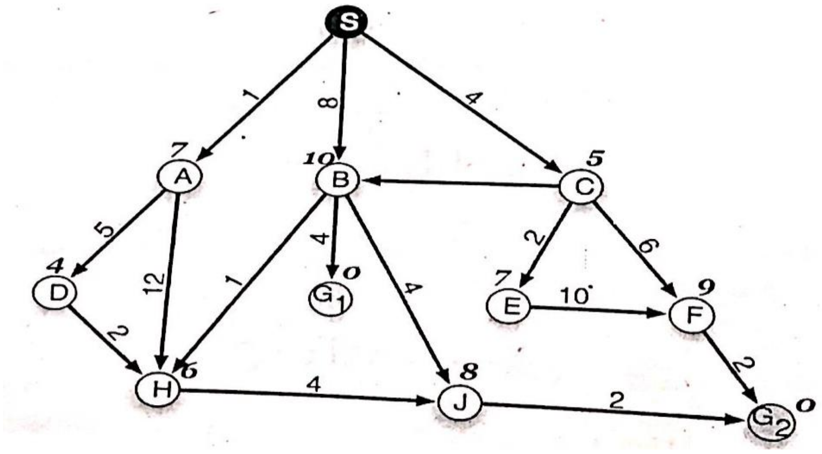
Q1. There is a conference hall in an institute, multiple events has been requested to be held in the same hall on a day, the starting (si) and finishing (fi) time of the events have been given in the table:

S	1	3	0	5	3	5	6	8	8	2	12
f_i	4	5	6	7	9	9	10	11	12	14	16

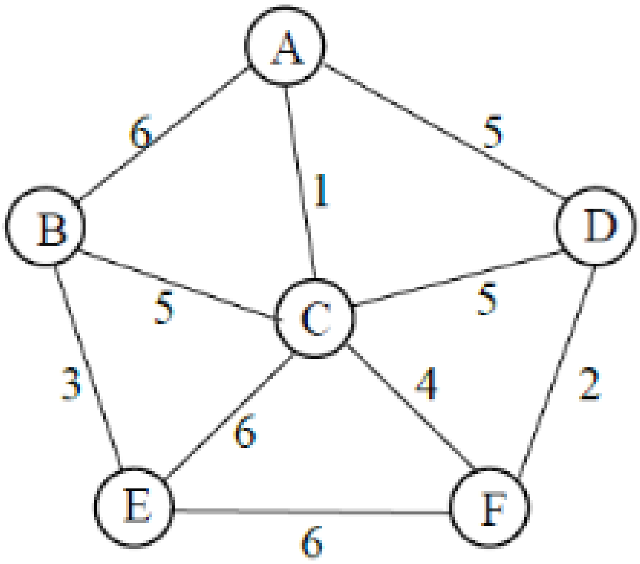
Devise an algorithm to solve this problem and find out the events that can be organized.

Q2. Use an algorithm for greedy strategies for the knapsack to find an optimal solution to the knapsack instance n=7,m=15, (p1,p2….,p7)= (10,5,15,7,6,18,3), and (w1,w2,…w7) =(2,3,5,7,1,4,1).

Q3. A directed graph is given below where G1 and G2 are two goals to achieve. Apply the BFS and DFS algorithm and find which goal will be achieved first in case of BFS and DFS traversal. Also provide the path achieved through BFS and DFS from S to second goal achieved.

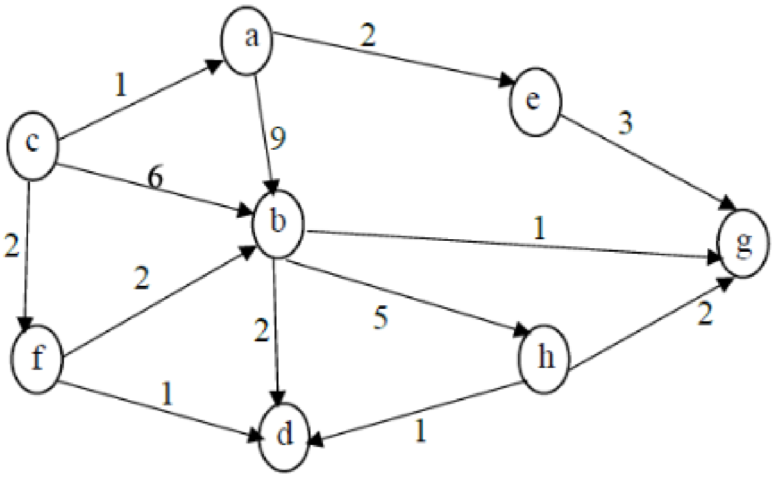


Q4. Sketch the Prim's algorithm for computing MST of a graph and analyze its complexity. Also trace the algorithm for the following graph:



Q5. Explain Kruskal's algorithm with an example. Derive its complexity of kruskal'salgorithm.

Q6. Write an algorithm for a single source shortest path in DAG. Trace the algorithm for finding the shortest path from a source vertex in the following graph.

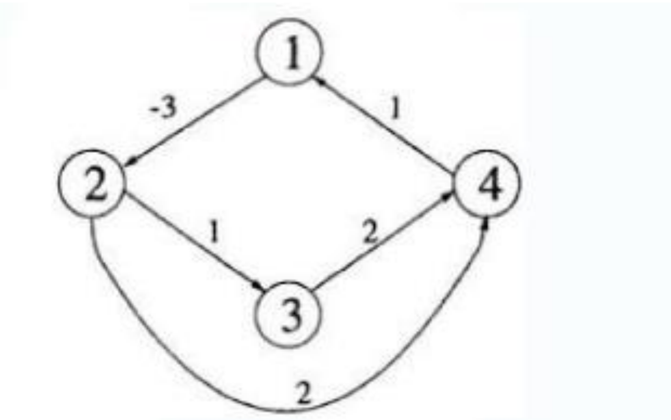


Q7. Derive the complexity of Bellman-Ford, assuming that Initialize(G,s) takes $\Theta(V)$ time.

```
Bellman-Ford(G,w,s)
// Graph G=(V,E), w:V->R a weight function, s is the source vertex
// uses distance estimates d[v] for v in V
// and parents p[v] for v in V with p[s]=s for the source
Initialize(G,s)
for i = 1 to |V|-1
 for each edge (u,v) in E do
    Relax(u,v,w)
 end
end
for each edge (u,v) in E do
 if d[v] > d[u]+w(u,v) then return false
end
return true
```

1. Give the code of the procedure Relax(u,v,s)

Q7. Apply Bellman Ford algorithm on the graph given below. Assume Node 1 as source vertex.



Q8. Differentiate between greedy method and dynamic programming. Apply dynamic programming to find the optimal order of multiplying 3 matrices A 5X25, B25X10, C10X15

Q9. Write an algorithm to compute the LCS of given two sequences. Trace the running of the algorithm to find the LCS of the sequences "XMJYAUZ" and "MZJAWXU"

Q10. Q. Explain in brief about the Backtracking approach for algorithm design. How it differs with recursion? Explain the N-Queen Problem and its algorithm using backtracking and analyze its time complexity.

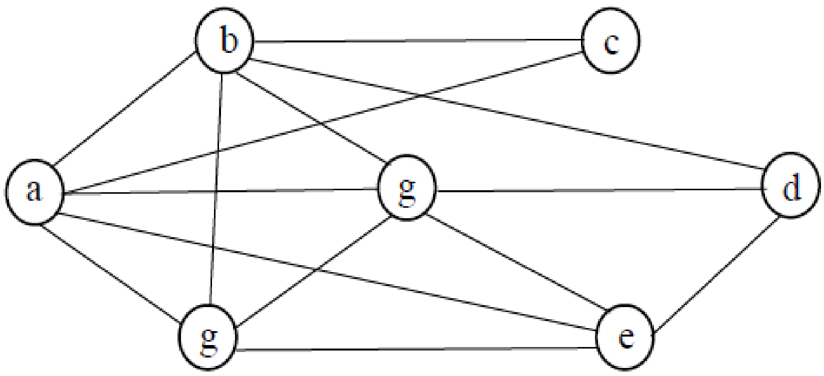
Assignment – II
Set-B

Course: B. Tech. Year/Semester: III & VI **Session:** 2024-25
Subject Name & Code: Design & Analysis of Algorithms (BCSC1012)

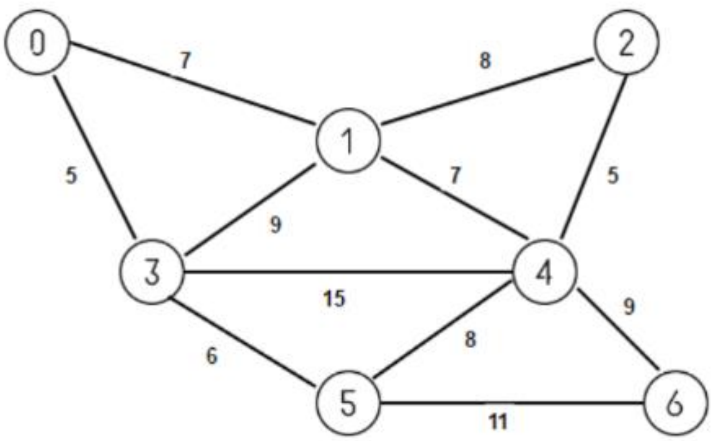
Date: **Date of Submission:**

Q1. Find an optimal solution to the fractional knapsack problem for an instance with number of items 7, Capacity of the sack W=15, profit associated with the items (p1,p2,...,p7)= (10,5,15,7,6,18,3) and weight associated with each item (w1,w2,...,w7)= (2,3,5,7,1,4,1).

Q2. Write an algorithm for depth first search. Use depth first search to find a spanning tree of the following graph.

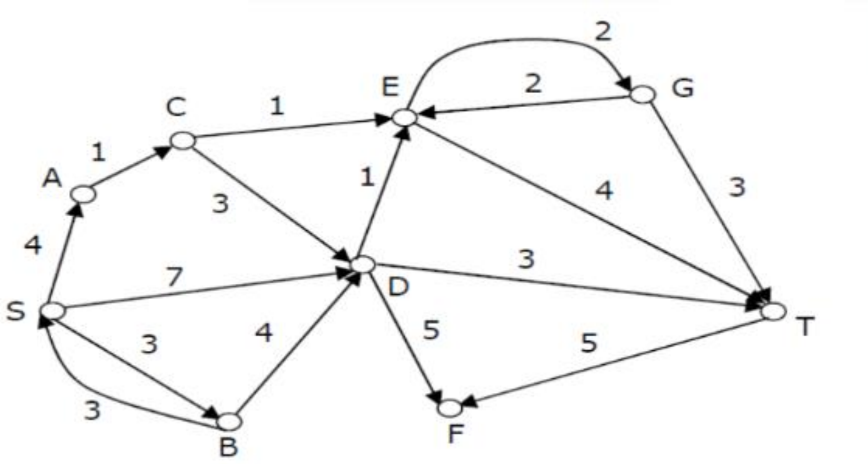


Q3. Compute the Minimum Spanning Tree and its cost for the following graph using Kruskal's Algorithm. Indicate each step clearly.



Q4. In a weighted graph, assume that the shortest path from a source 's' to a destination 't' is correctly calculated using a shortest path algorithm. Is the following statement true? If we increase weight of every edge by 1, the shortest path always remains same. Justify your answer with proper example.

Q5. Find the shortest path from s to all other vertices in the following graph using Dijkstra's Algorithm.



Q6. Obtain the solution to knapsack problem by Dynamic Programming method n=6, (p1, p2,…p6)=(w1,w2,…w6)=(100,50,20,10,7,3) and m=165

Q7. What is dynamic programming? Find the longest common subsequence between "XYYXXY" and "XXYXXYY".

Q8. Q. Explain in brief about the Backtracking approach for algorithm design. How it differs with recursion? Explain the N-Queen Problem and its algorithm using backtracking and analyze its time complexity.

Assignment – II
Set-C

Course: B. Tech. Year/Semester: III & VI **Session:** 2024-25

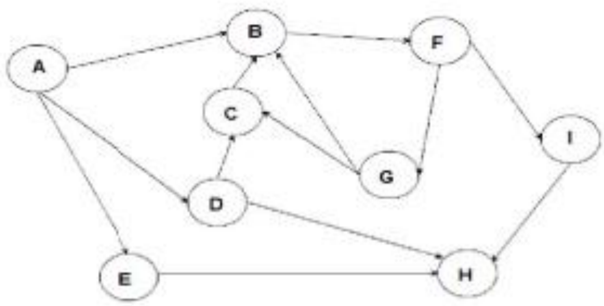
Subject Name & Code: Design & Analysis of Algorithms (BCSC1012)

Date: **Date of Submission:**

Q1. Derive time complexity of job sequencing with deadlines. Obtain the optimal solution when n=5, (p1, p2,…)=(20,15,10,5,1) and (d1,d2,…)=(2,2,1,3,3).

Q2. Formulate Fractional Knapsack Problem. Write Greedy Algorithm for fractional Knapsack Problem. Find the optimal solution for the following fractional Knapsack problem.
n=4, m = 60, W={40, 10, 20, 24} and P={280, 100, 120, 120}

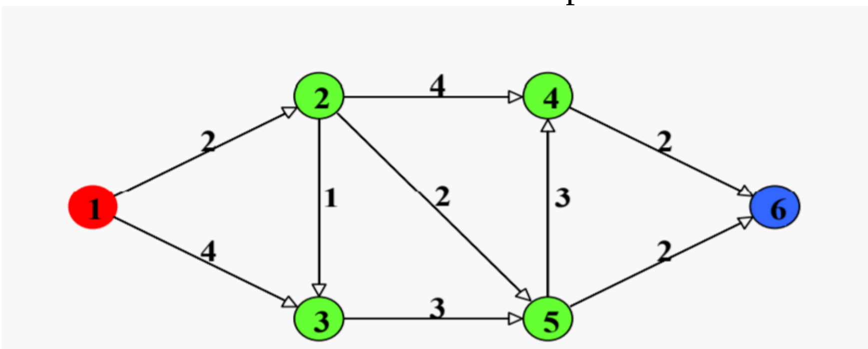
Q3. Perform DFS traversal on the above graph starting from node A. Where multiple node choices may be available for next travel, choose the next node in alphabetical order. Classify the edges of the graph into different category.



Q4. Consider a complete undirected graph with vertex set {0, 1, 2, 3, 4}. Entry wij in the matrix W below is the weight of the edge {i, j}. What is the Cost of the Minimum Spanning Tree T using Prim's Algorithm in this graph such that vertex 0 is a leaf node in the tree T?

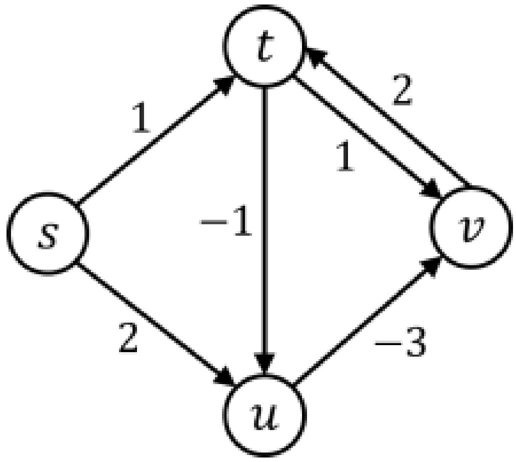
$$W = \begin{pmatrix} 0 & 1 & 8 & 1 & 4 \\ 1 & 0 & 12 & 4 & 9 \\ 8 & 12 & 0 & 7 & 3 \\ 1 & 4 & 7 & 0 & 2 \\ 4 & 9 & 3 & 2 & 0 \end{pmatrix}$$

Q5. Consider the given directed graph, and 1 is the source node from where the shortest path is to be computed for all other nodes. Apply an appropriate algorithm to find shortest path from source 1 and show all the steps.



If negative weights will be added in this graph, then, will the same algorithm work to find the shortest path?

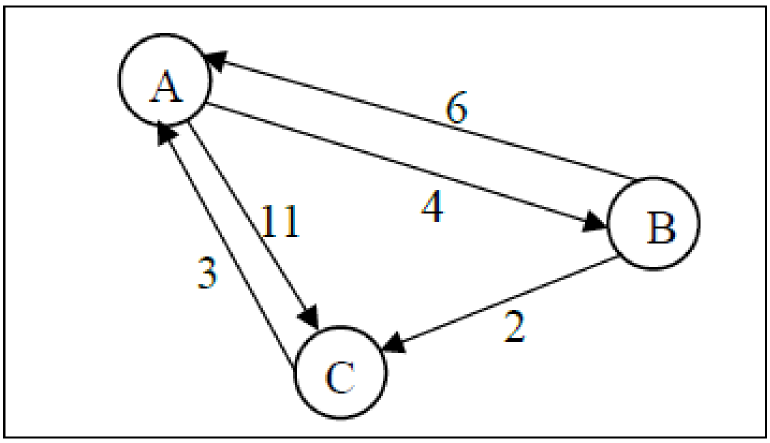
Q6. (a) Run the Bellman-Ford algorithm on the graph to find the shortest path from s to every other node. Show the table that you fill in while running the algorithm. (b) Now suppose you ran one extra iteration of Bellman-Ford. How could you use that last iteration to detect whether the graph has a negative-weight cycle?



Q7. Explain in brief about the Dynamic Programming Approach for algorithm design. How it differs with recursion? Explain the algorithm for solving the 0/1 knapsack problem using the dynamic programming approach and explain its complexity.

Q8. What are the advantages of dynamic programming? Find Longest Common Subsequence (LCS) between "abbaab" and "aabaabb".

Q9. Explain and analyze the floyd's warshall algorithm for all pair shortest path problem. Trace the algorithm for the following graph:



Q10. Explain the concept of backtracking with an example. How it differs with Greedy and Dynamic Programing approach?

Assignment – II
Set-D

Course: B. Tech. Year/Semester: III & V **Session:** 2023-2024
Subject Name & Code: Design & Analysis of Algorithms (BCSC1012)

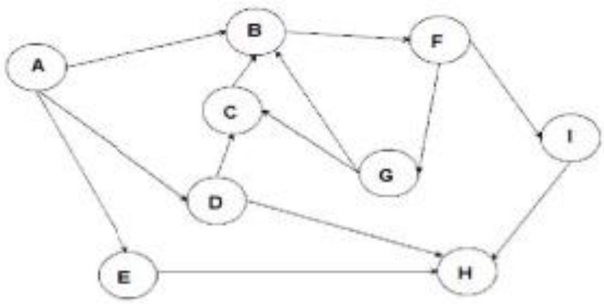
Date: **Date of Submission:**

Q1. Formulate the Knapsack problem with greedy method and find the optimal solution for n=7, m=15, (p1-p7)=(10,5,15,7,6,18,3), (w1-w2)=(2,3,5,7,1,4,1).

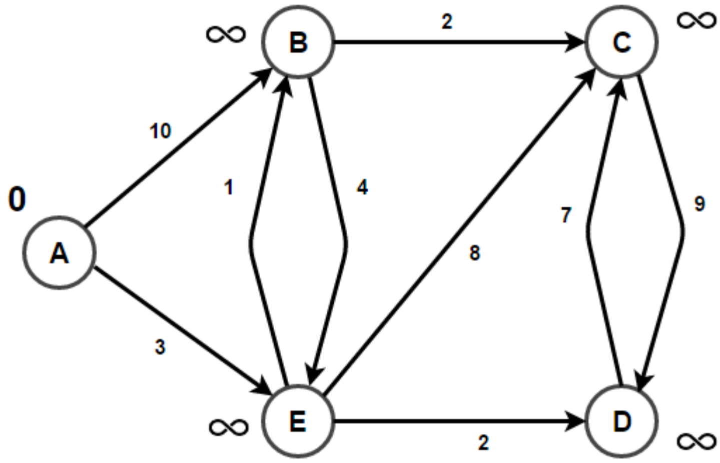
Q2. Consider a complete undirected graph with vertex set {0, 1, 2, 3, 4}. Entry wij in the matrix W below is the weight of the edge {i, j}. What is the Cost of the Minimum Spanning Tree T using Prim's Algorithm in this graph such that vertex 0 is a leaf node in the tree T?

$$W = \begin{pmatrix} 0 & 1 & 8 & 1 & 4 \\ 1 & 0 & 12 & 4 & 9 \\ 8 & 12 & 0 & 7 & 3 \\ 1 & 4 & 7 & 0 & 2 \\ 4 & 9 & 3 & 2 & 0 \end{pmatrix}$$

Q3. Perform DFS traversal on the above graph starting from node A. Where multiple node choices may be available for next travel, choose the next node in alphabetical order. Classify the edges of the graph into different category.



Q4.Consider the following graph. What is the shortest path from node A to node E?



S = { }

Q5. Obtain reduced cost matrix for travelling sales person problem. Consider the instance define by the cost matrix

$$\begin{bmatrix} \infty & 5 & 1 & 10 & 6 \\ 1 & \infty & 4 & 12 & 7 \\ 3 & 6 & \infty & 4 & 16 \\ 7 & 1 & 3 & \infty & 9 \\ 16 & 12 & 7 & 6 & \infty \end{bmatrix}$$

Q6. Given a chain of 4 matrices <A1,A2,A3,A4> with dimensions <5X4>,<4X6>,<6X2>,<2X7> respectively. Using Dynamic programming find the minimum number of scalar multiplications needed and also write the optimal multiplication order.

Q7. Explain Branch and bound technique. How Travelling Salesperson Problem can be solved using Branch and bound.

Q8. Obtain the solution to knapsack problem by Dynamic Programming method n=6, (p1, p2,…p6)=(w1,w2,…w6)=(100,50,20,10,7,3) and m=165