

International Islamic University Chittagong

Department of Computer Science and Engineering

B. Sc. in CSE Final Examination, Autumn 2022

Course Code: CSE 2421 Course Title: Computer Algorithms

Total marks: 50

Time: 2 hours 30 minutes

[The figures in the right hand margin indicate full marks.

Course Outcomes and Bloom's Taxonomy Levels are mentioned in additional columns]

Group A

CO DL

1.

a) Greedy strategy does not give the optimal solution for 0/1 knapsack. Do you agree with this statement? Justify your answer with example.

5 CO2 An

b) You have been asked to encode a paragraph with Huffman coding scheme. This paragraph contains the following symbols along with their associate frequency in the paragraph.

5 CO5 App

			A	B	C	D	E	F	G	H	I	J	
			3	3	26	5	3	8	13	2	16	9	

Draw the corresponding Huffman tree and utilizing that tree tell the binary encoding for each letter.

OR

Suppose we have a knapsack that has a weight limit w . There are items $i_1, i_2, \dots$, in each having weight $w_1, w_2, \dots, w_n$ and some benefit associated with it $v_1, v_2, \dots, v_n$. We need to maximize the benefit such that the total weight inside the knapsack is at most w . Demonstrate an algorithm to solve this problem

2.

a) Draw the following undirected graph

3 CO1 A

$G = \{a, b, c, d, e, f, g, h, i\}$

$E = \{(a,b), (a,d), (b,c), (c,d), (c,e), (d,e), (d,g), (f,e), (g,f), (g,i), (h,d), (h,g), (i,f)\}$

Traverse the graph using Breadth First Search starting from vertex h . Visit the nodes in lexicographic order ($a, b, c \dots$). Show only the final breadth first tree along with d and π values. You don't need to show the intermediate steps.

OR

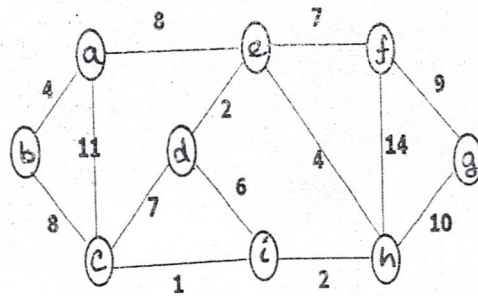
Traverse the graph using Depth First Search and show the discover time d and finish time f . You don't need to show the intermediate steps.

b) Write an algorithm for finding the in-degree of each vertex a graph G . G is represented with an adjacency list. What will be the running time of your algorithm?

3 CO2 C

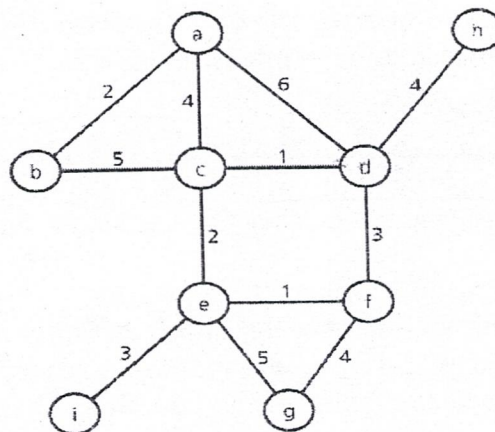
- c) Write the definition of minimum spanning tree. Consider the following graph. What minimum spanning tree would Prim's algorithm produce? Write the edges in the order that the algorithm would add them to its result.

4 CO1 A



OR

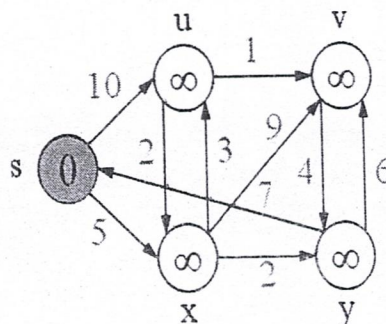
Write the definition of minimum spanning tree. Consider the following graph. What minimum spanning tree would Kruskal's algorithm produce? Write the edges in the order that the algorithm would add them to its result.



Group B

3. a) Run the Dijkstra's algorithm to find single source shortest path on the weighted directed graph in following figure.

5 CO2 U



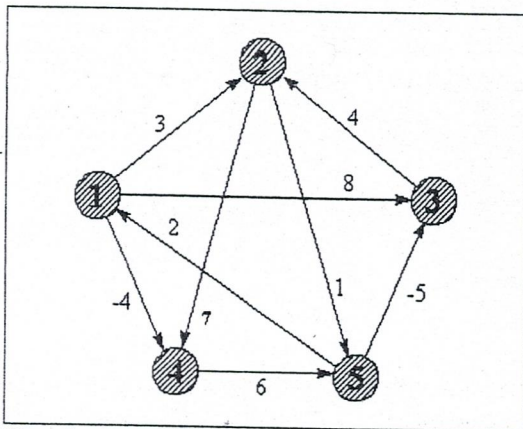
- b) Describe the Bellman-Ford algorithm with necessary figure.

5 CO1 R

OR

Consider the following graph for finding all pair shortest path using Floyd-Warshall algorithm.

C05 E



	0	3	8	7	-4
	inf	0	Inf	1	7
D(3) =	inf	4	0	5	11
	2	-1	-5	0	-2
	inf	inf	Inf	6	0

What is the value of matrix D(4) calculated from matrix D(3) given above.

4.

- a) Let $P_1(x_1, y_1)$, $P_2(x_2, y_2)$ and $P_3(x_3, y_3)$ are three points. Show using the concept of that if going through P_1 , P_2 , P_3 has a left turn at P_2 then going through P_3 , P_2 , P_1 has a right turn at P_2 . You have to show it using the concept of cross product.

3 C01 A

OR

Suppose, you are given two points $P_1(3, 7)$ and $P_2(9, 2)$. Determine which one has greater polar angle with respect to

- Origin (0, 0)
- (20, 0)

- b) How can you determine whether two line segments are collinear or not? Describe the basic idea using figure.

3 C01 C

OR

Given three points on a 2D plane, how can you determine whether they form a triangle or not using the concept of cross product?

- c) Prove that the subpaths of shortest paths are also shortest paths.

4 C03 N

5.

- a) Consider the 4-queen problem. Your task is to place the 4 queens in 4X4 chessboard so that no two queens attack each other.

3 C02 A

- What is a dead node in N-queen problem?
- Design a state space tree which represents all possible arrangements for 4 non-attacking queens.

- b) Define the following classes: P, NP, NP-complete.

3 C04 U

- c) What is the basic principle of a Branch-and-Bound algorithm? Explain how you will apply it in solving travelling salesman problem.

4 C05 A