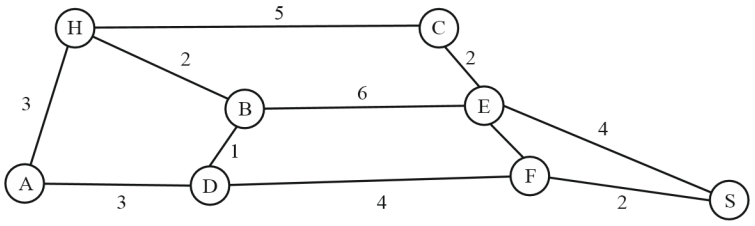
10. Describe the advantages of dynamic programming approach methods. Apply the dynamic programming approach to solve the 0/1 knapsack problem for the following items with weights [2, 3, 4, 5] and values [3, 4, 5, 6] and a knapsack capacity of 5.

11. Explain the significance of the SAT problem in the theory of NP-Completeness. Discuss, why the SAT problem is considered a fundamental NP-complete problem and its applications in various areas of computer science ?

12. Explain the concept of asymptotic notations and why we use it ? Explain different asymptotic notations.

13. Apply Dijkstra's algorithm to find the shortest path from node A to all other nodes in the graph shown below. Show each step of the algorithm including the initialization, the updates of distance and the final shortest paths.



MSCCS-07/MSCCS-201/ MSCCSC-201/MCA-201

June – Examination 2024

MSCCS (Final)/MCA (IInd Year) Examination

DATA STRUCTURE AND ALGORITHM

Paper : MSCCS-07/MSCCS-201/MSCCSC-201/MCA-201

*Time : **3** Hours*] [*Maximum Marks : **80***

Note :– The question paper is divided into three Sections A, B and C. Write answers as per the given instructions.

Section–A **8×2=16**

(Very Short Answer Type Questions)

Note :– Answer all questions. As per the nature of the question delimit your answer in one word, one sentence or maximum up to **30** words. Each question carries 2 marks.

1. (i) What do you mean by Data Structure ? List any *four* Data Structures.

(ii) If a stack is implemented using an array of size n, what is the time complexity of the push operation when the stack is full ?

(iii) How the doubly linked list can be represented ? Give an example.

(iv) Give an example of AVL Tree.

(v) Define the term 'Cycle' and 'Self-loop' in graph theory. Give an example.

(vi) Explain the concept of contiguous memory allocation in arrays. Give an example.

(vii) What do you mean by height, degree and depth of a tree ? Give an example.

(viii) List any *four* applications of Graph.

Section–B 4×8=32

(Short Answer Type Questions)

Note :– Answer any *four* questions. Each answer should not exceed **200** words. Each question carries 8 marks.

2. Explain the concept of a circular linked list. How does it differ from a regular linked list ?

3. Consider a linked list with the elements [3, 1, 4, 1, 5, 9, 2, 6, 5, 3, 5]. Write an algorithm to find the maximum element in the list. What is the time complexity of your algorithm ?

4. Consider a singly linked list that represents a sequence of integers. Write an algorithm to find the sum of all the even integers in the linked list. Also, give the time complexity of the different cases considered.

5. Explain the concept of representing a sparse matrix using a linked list. Discuss the advantages of using a linked list representation for sparse matrices compared to other methods.

6. Implement a queue data structure using an array. Perform the following operations :

   (a) Enqueues the elements 3, 4, 7 and 2 into the queue.

   (b) Dequeues an element from the queue.

   (c) Enqueues the element 9 into the queue.

   (d) Dequeues all elements from the queue and prints them.

7. Given an array [3, 7, 2, 9, 5] apply bubble sort algorithm and show all the steps for sorting.

8. Explain, how a two-dimensional array is represented in memory using row-major and column-major orders ? Provide examples for each representation.

9. Construct a tree for given inorder and post-order traversal of a tree.

   Inorder : D B E A F C G

   Pre Order : D E B F G C A

Section–C 2×16=32

(Long Answer Type Questions)

Note :– Answer any *two* questions. You have to delimit your each answer maximum up to **500** words. Each question carries 16 marks.