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7. (a) Explain the Radix Sort algorithm in detail and apply it to sort the given list :

[319, 212, 405, 123, 394, 209]

Show each pass and the final sorted output.

(7)

- (b) Solve the subset sum problem using dynamic programming for the set $A = [2, 3, 7, 8, 10]$ and intended sum = 11.

(8)

(1000)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6467

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Unique Paper Code : 2342572302

Name of the Paper : Design and Analysis of Algorithm

Name of the Course : NEP-UGCF-2022 DSC B.A.
(Prog. / B.Sc. (Prog.))

Semester : III

Duration : 3 Hours

Maximum Marks : 90

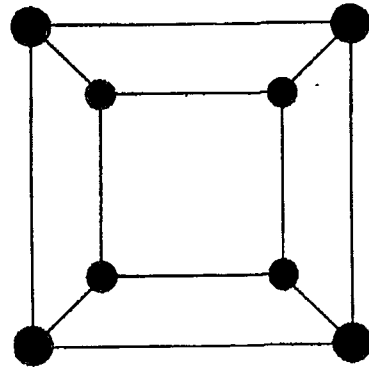
Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory contain 30 marks
3. Attempt any **four** questions from **Section B**.
4. Parts of a question must be answered together.

P.T.O.

Section A

1. (a) What are the two key factors that decide whether dynamic programming is applicable for an optimization problem or not? (3)
- (b) Consider the undirected graph $G(V, E)$: (3)



Check If the Graph is bipartite and give the two vertex sets.

- (c) Briefly Explain the Divide and Conquer technique with an example of algorithm that uses this approach. (3)
- (d) Show that at most $3 * \lceil n/2 \rceil$ comparisons are sufficient to find both the minimum and maximum number in a given array of size n . (3)

- (b) Consider Interval Scheduling problem where we are given a resource and a set of requests each having a start time and finish time. .

The goal is to maximize the number of requests scheduled.

Determine whether the following greedy strategy gives an optimal solution for the above problem or not:

“Select the requests with fewest number of incompatible requests.” (8)

6. (a) Sort the following list using Merge Sort and show all division and merging steps with diagrams:

[45, 23, 53, 12, 64, 2, 87, 31]

Give the best case and worst-case time complexity. (7)

- (b) A hash table has Size = 11 Use the division method $h(k) = k \bmod 11$

Insert keys in this order: 27, 18, 29, 28, 39, 13, 16

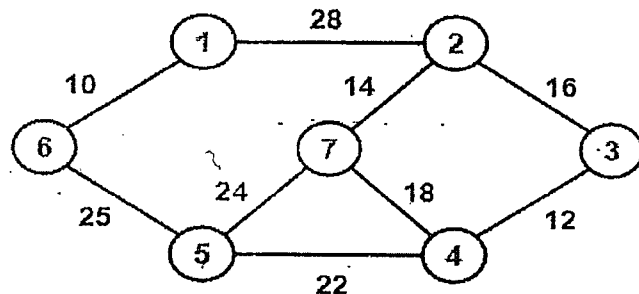
Resolve collision by Linear probing :

Show the final position of keys in hash table with index. (8)

- (b) A thief enters a house carrying a bag of maximum capacity of 60 Kg. There are 5 items in the house with the following weights and values. What items should he take in order to maximize the value (fractional weights are also allowed).

Item	Weight	Value
1	5	30
2	10	40
3	15	45
4	22	77
5	25	90

5. (a) Show the step by step execution of Prim's algorithm to find minimum spanning tree (MST) of the given graph :



What is the cost of MST generated?

(7)

- (e) Define the following terms in the context of graphs giving suitable examples of each:

(i) Acyclic graph

(ii) Weighted graph (3)

- (f) Prove: If a graph is bipartite then it cannot contain an odd cycle. (3)

- (g) Explain the concept of Primary Clustering and Secondary Clustering in hashing. (3)

- (h) What is the recurrence relation for the following algorithms :

(i) Insertion sort

(ii) Merge Sort

(iii) Counting sort (3)

- (i) Explain Randomized Quick Sort algorithm for sorting a list of numbers. How does the use of random pivot selection affect the time complexity compared to normal Quick Sort? (3)

- (j) What is collision in hashing? Name any two collision resolution techniques. (3)

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Section B

Attempt any 4 parts out of 6 questions :

2. (a) Use Strassen's Algorithm to multiply the following two matrices : (7)

$$A = \begin{bmatrix} 2 & 4 \\ 3 & 5 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

- (b) Consider the undirected graph $G(V, E)$ with vertices (8)

$V = \{A, B, C, D, E, F\}$ and edges

$E = \{(A, B), (A, C), (B, C), (C, D), (D, E), (E, F)\}$

- (i) Draw the graph G .
 - (ii) Determine whether the graph is connected or disconnected.
 - (iii) If it is disconnected, find all its connected components.
 - (iv) Generate Depth first traversal (DFS) for the graph taking A as source vertex.
3. (a) Analyse heap sort algorithm giving run time complexity of Max_heapify, build_Max_heap and heap Sort Procedure. (7)

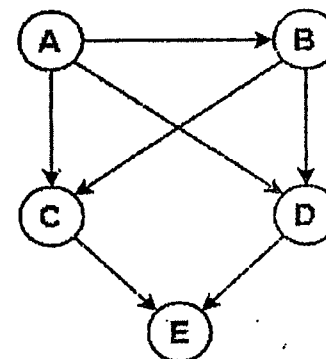
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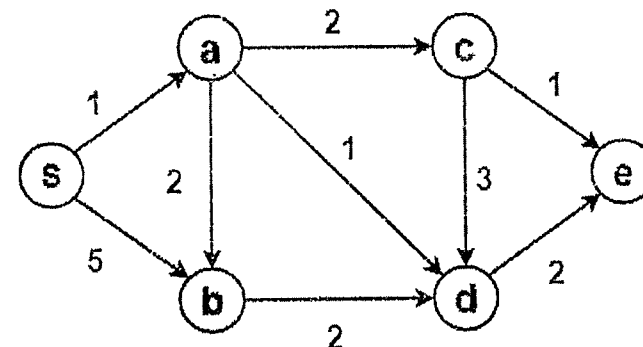
- (b) (i) Define the following terms : (8)

- Directed acyclic graph
- Topological ordering
- In degree of a vertex
- Out degree of a vertex

- (ii) List all possible topological orderings for the given graphs :



4. (a) Using Dijkstra's Algorithm, find the shortest distance from source vertex 'S' to remaining vertices in the following graph : (7)



P.T.O.