

N.B. Answer six questions, taking three from each section.

The questions are of equal value.

Use separate answer script for each section.

SECTION-A

Q1. Suppose S is the following list of 10 alphabetic characters 04

B A N G L A D E S H

Use the Quick Sort algorithm to find the final position of N. How many interchanges are needed?

Q2. Consider the following pseudo code:

scan the string from left to right

if(character==vowel)

pop from the stack and print them until it is empty

else

push on stack

Now use the string i) Stack ii) recursion as input and find out the output using pseudo code.

(c) Consider the following arrangements. Suppose there are ten students in a class. But initially they take seat as follows. Here are their roll numbers. 04

Block 1	Block 2
123003	123010
123001	123008
123009	123002
123005	123006
123007	123004

But your teacher orders you to take seat according to Roll (Block 2 starts after Block 1).

Now write down the pseudo code by which you can find out the total number of moves by all students.

Q2. Draw a series of heap tree diagram for the following operations 04

i) Add 100, 40, 60, 80, 20

ii) Remove 2 elements

iii) Add 30, 50

Q3. Consider the following first pass table of RadixSort technique. Now sort the data using Radix Sort algorithm. 04

Input	0	1	2	3	4	5	6	7	8	9
348										348
143				143						
361		361								
321		321								
543				543						
366							366			

Q4. Consider the parentheses combination : [] () [] ([()]) [([])]. Is it balanced? Justify your answer using Stack. What is the maximum value of TOP for this? 04

Q5. Consider the postfix expression: 9 4 3 2 1 5 + * / * +. Now evaluate the expression using Stack. 04

Q6. Suppose you are a manager of an MLM company. Here is the employee database. 04

Name	Left Hand	Right Hand	Media
John	Berly	Max	None
Berly	Kevin	Scott	John
Max	Pepe	Ford	John
Kevin	Roy	Smith	Berly
Scott	Steve	Mack	Berly

i) Store the information of the employee at an Array.

ii) Write down a pseudo code by which you can find out the name of all employees which are failed to include their left hand and right hand.

Q7. Draw the all possible Extended binary trees with 3 external nodes. 02

Q8. (a) Suppose you have 9 friends. One day you with your friends go for dinner. Here given the individual amounts of your group. F1, F2, ..., F9 are your friend. 07

you	F1	F2	F3	F4	F5	F6	F7	F8	F9
100	60	120	210	40	45	80	70	180	30

Unfortunately the lowest package of the dinner is 330 tk. You decide to merge the money. But there are 2 conditions.

Condition 1: At a time two person can merge their money. (suppose X and Y merge their money). If the total amount is less than 330 then they can merge with another (pair of X and Y can then merge with Z).

Condition 2: You have to merge money with the lower values. If X and Y are the lowest and 2nd lowest then they can merge. After merging X and Y they can merge with the next lowest.

- Now find out the persons list which can have dinner package first.
- Write down the pseudo code by which you can find this.
- Is there other lucky persons exist after the first? If yes then give their name.

(b) Consider the data: 20 40 10 53 33 25

- Draw the Binary Search Tree.
- Insert 28 and 82 after that
- After inserting delete 10 from the tree.

SECTION-B

Q5. (a) Give an example of each of the following hash functions to demonstrate how they work. i) 03
Midsquare method ii) Division method

(b) Write a pseudo code to insert an item into a Hash Table where collision is resolved using open addressing technique.

(c) Suppose a Queue is maintained by a circular array Queue with N=12 memory cells. Find the 04 number of elements in Queue if i) FRONT=4, REAR=8 ii) REAR=3, FRONT=10 iii) FRONT=5, REAR=6 and then two elements are deleted.

Q6. In a 'tic tac toe' game each player fills up a cell of the board with his symbol ('X' or 'O') in turn. Consider the directed graph where vertices are reachable 'tic tac toe' board positions and edges represent valid moves. Figure (a) & (b) shows a valid and invalid edge (u,v) respectively, where it is turn of 'O'. Considering possible adjacent nodes find indegree & outdegree of vertex u (Figure (c)) if it is turn of 'O' now

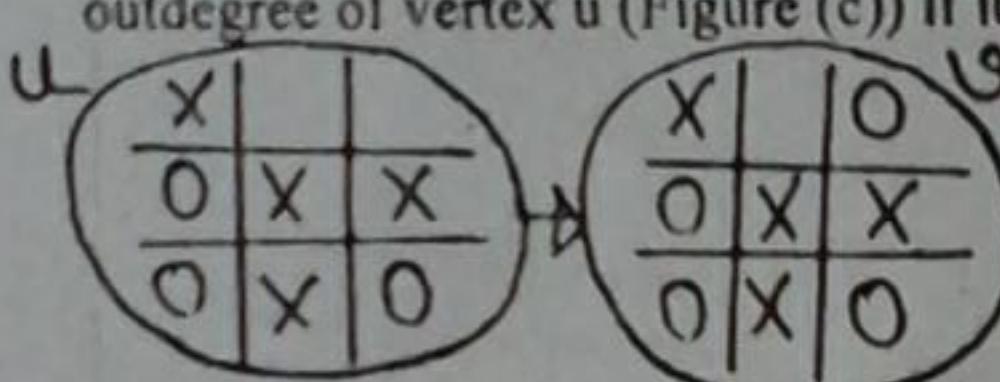


Fig. a : Valid edge

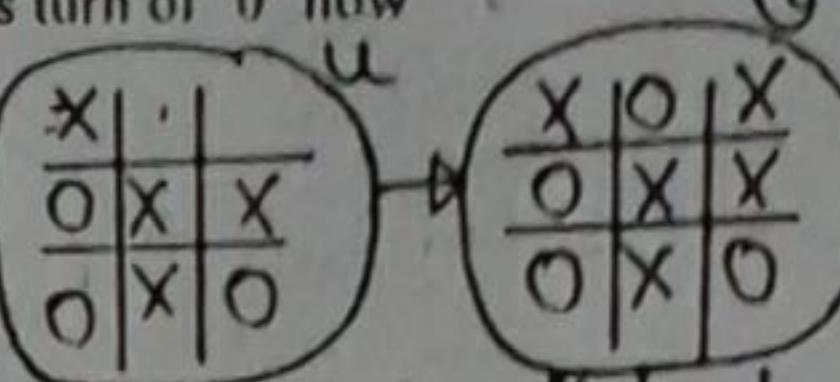


Fig. b : Invalid edge

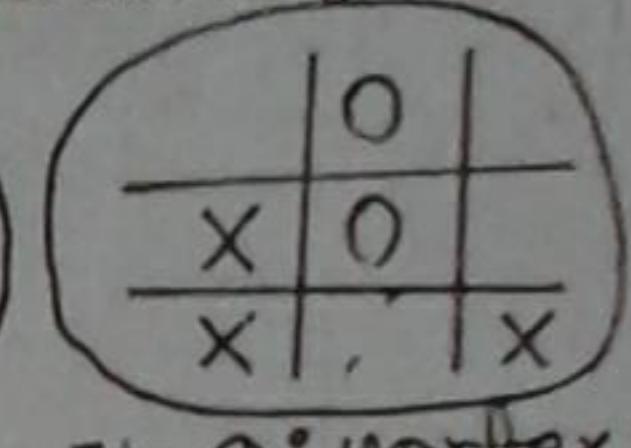


Fig. c : vertex u

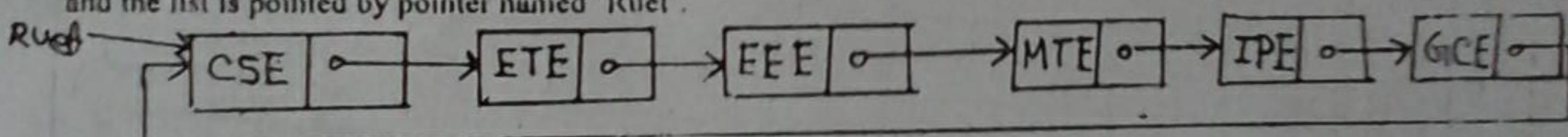
Given an adjacent matrix named 'Adj' of size 4x4, for an undirected graph, write necessary 05 C programming statements to find the degree of each vertex and print the degree.

What is a path matrix of a graph? Explain with example. 03

Q7. Write necessary C program statements to traverse the following circular list and print all its 03 elements, when each node has following structure:

```
struct node{
    char dept[10];
    struct node *next;};
```

and the list is pointed by pointer named 'Ruef'.



Insert the numbers (26,37,59,76,65) into a hash table of size m=11, using following linear probing technique, when initially the array is empty,
 $h(k,i)=(h(k)+i)\bmod m$ for $i=0$ to $m-1$ and $h(k)=k \bmod m$

Draw the state of the array after insertion.

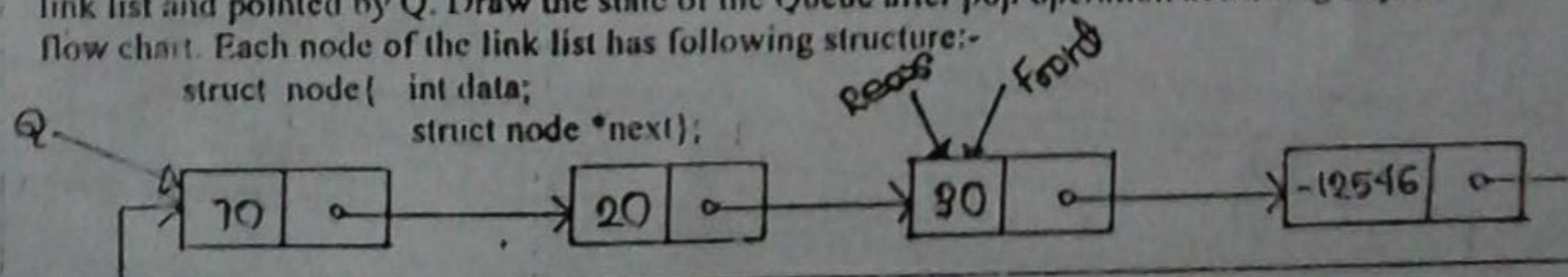
Write a flow chart to check, either a two way link list where each node contains a single 03 letter from range 'a' to 'z' is a palindrome or not. Each node has following structure and the list is pointed by pointer 'Head':

```
struct node{
    char data;
    struct node *next, *prev;};
```

Q8. (a) Consider the directed acyclic graph $G=(V,E,W)$, where edges that leave the source vertex s, 04 may be negative weights and all other edges has non-negative weights. Does Dijkstra algorithm compute the shortest path weight $\delta(s,t)$ from source s to target t correctly in this graph? Justify your answer.

(b) Draw a flow chart to pop an element from the following Queue represented using circular 05 link list and pointed by Q. Draw the state of the Queue after pop operation according to your flow chart. Each node of the link list has following structure:-

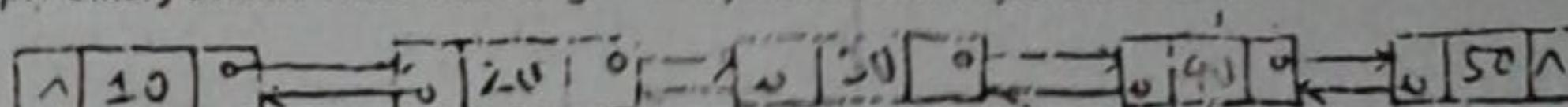
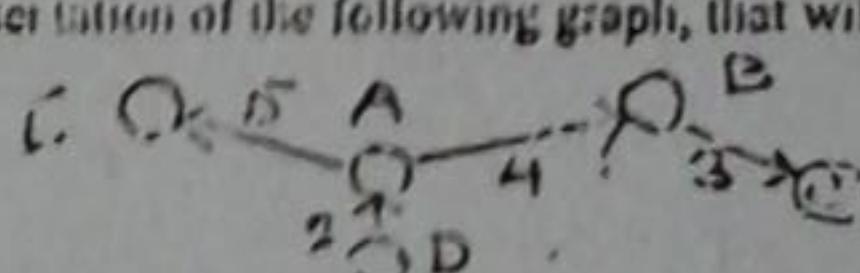
```
struct node{ int data;
    struct node *next};
```



What are the drawbacks and benefits of adjacency list representation of a graph? What is the 03 difference between Stack and Queue?

N.B. Answer six questions, taking three from each section.
 The questions are of equal value.
 Use separate answer script for each section.

SECTION-A

- | Q1. | <p>(a) Suppose STACK is allocated $N = 6$ memory cells and initially STACK is empty, TOP = 0. Find out the output of the following module:</p> <ol style="list-style-type: none"> 1. Set A = 2 and B = 5. 2. call PUSH(STACK, A) call PUSH(STACK, 4) call PUSH(STACK, B+2) call PUSH(STACK, 9) call PUSH(STACK, A+B). 3. Repeat while TOP ≠ 0 : call POP(STACK, ITEM). Print ITEM. 4. Exit. <p><i>(Ans)</i></p> <p>Consider the following arithmetic expression P, written in postfix notation:
 $P: 12, 7, 3, \cdot, /, 2, 1, 5, +, *, +$. Now evaluate the expression.</p> <p>Look carefully the parenthesis combination: (()) () (()) (). Is it right combination? Explain your answer.</p> <p>(b) Suppose S is the following list of 14 alphabetic characters: DATASTRUCTURES. Suppose the characters in S are to be stored alphabetically. Use the quicksort algorithm to find the final position of S. How many comparisons and interchanges are needed for it.</p> <p>Consider the following deque of characters where DEQUE is a circular array which is allocated six memory cells. LEFT = 2, RIGHT = 4, DEQUE = {A,C,D,E,F}. Describe the deque while the following operations take place.</p> <ol style="list-style-type: none"> i) E is added to the right of the deque. ii) Two letters on the right are deleted. iii) K,L and M are added to the left of the deque. iv) One letter on the left is deleted. v) S is added to the right of the deque. <p>(c) Suppose a queue is maintained by a circular array QUEUE with $N = 12$ memory cells. Find the number of elements in QUEUE if i) FRONT = 4, REAR = 8 ii) FRONT = 10, REAR = 3 and then two elements are deleted.</p> <p>Consider the priority queue in following figure, which is maintained by a two dimensional array queue. Describe the structure after (RKK,3), (SSS,4), (TTT,1), (UUU,4) and (VVV,2) are added to the queue.</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <tr> <td style="padding: 5px;">1</td> <td style="padding: 5px;">2</td> <td style="padding: 5px;">3</td> <td style="padding: 5px;">4</td> <td style="padding: 5px;">5</td> <td style="padding: 5px;">6</td> </tr> <tr> <td style="padding: 5px;">AAB</td> <td style="padding: 5px;">BBB</td> <td style="padding: 5px;">CCC</td> <td style="padding: 5px;">KKK</td> <td style="padding: 5px;">SSS</td> <td style="padding: 5px;">TTT</td> </tr> <tr> <td style="padding: 5px;">FFF</td> <td style="padding: 5px;">GGG</td> <td style="padding: 5px;">HHH</td> <td style="padding: 5px;">UUU</td> <td style="padding: 5px;">VVV</td> <td style="padding: 5px;">AAA</td> </tr> </table> <p>(d) Sort the following data in ascending order using insertion sort technique: 44, 33, 11, 55, 77, 90, 40, 60, 99, 22, 88, 66.</p> <p>Suppose there are three words, READ, REAL and REAL. Order them using Radix sort technique.</p> <p>(e) Can we apply binary search to the following two way linked list? If yes then how, and if not then why?</p>  <p>(f) Draw the corresponding linked list representation of the following graph, that will store the node name as well as the weight of the edges.</p>  <p>(g) Write a function to return the number of nodes in a linked list. A simple prototype for the function may be: int fnl_nodes(struct nodes *head).</p> <th style="width: 10%; text-align: right;">Marks</th> | 1 | 2 | 3 | 4 | 5 | 6 | AAB | BBB | CCC | KKK | SSS | TTT | FFF | GGG | HHH | UUU | VVV | AAA | Marks |
|-----|--|------------------|-----|-----|-----|---|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | | | | | | | | |
| AAB | BBB | CCC | KKK | SSS | TTT | | | | | | | | | | | | | | | |
| FFF | GGG | HHH | UUU | VVV | AAA | | | | | | | | | | | | | | | |
| Q1. | (a) | 03 <u>2</u>
3 | | | | | | | | | | | | | | | | | | |
| Q2. | (a) | 04 | | | | | | | | | | | | | | | | | | |
| Q2. | (b) | 04 | | | | | | | | | | | | | | | | | | |
| Q2. | (c) | 05 | | | | | | | | | | | | | | | | | | |
| Q3. | (a) | 04 | | | | | | | | | | | | | | | | | | |
| Q3. | (b) | 04 | | | | | | | | | | | | | | | | | | |
| Q3. | (c) | 04 | | | | | | | | | | | | | | | | | | |
| Q4. | (a) | 04 | | | | | | | | | | | | | | | | | | |
| Q4. | (b) | 04 | | | | | | | | | | | | | | | | | | |
| Q4. | (c) | 04 | | | | | | | | | | | | | | | | | | |
| Q4. | (d) | 04 | | | | | | | | | | | | | | | | | | |
| Q4. | (e) | 04 | | | | | | | | | | | | | | | | | | |
| Q4. | (f) | 04 | | | | | | | | | | | | | | | | | | |
| Q4. | (g) | 04 | | | | | | | | | | | | | | | | | | |

SECTION-B

- | Q5. | <p>(a) What is time space trade off in case of complexity of algorithms?</p> <p>(b) Write a recursive function that will print the first N Fibonacci numbers.</p> <p>Suppose you are given with the following two way linked list, where each node has 3 meaningful fields: Left-link, Data, Right-link. Write the necessary statements to insert new node in between the nodes.</p> | Marks |
|-----|--|------------------|
| Q5. | (a) | 02 <u>2</u>
3 |
| Q5. | (b) | 04 |
| Q5. | (c) | 05 |
| Q6. | (a) | 02 <u>2</u>
3 |
| Q6. | (b) | 04 |

Possible Exam and Dates

06/01/2013
11/01/2013
01/02/2013
02/02/2013
03/02/2013

Output Format:

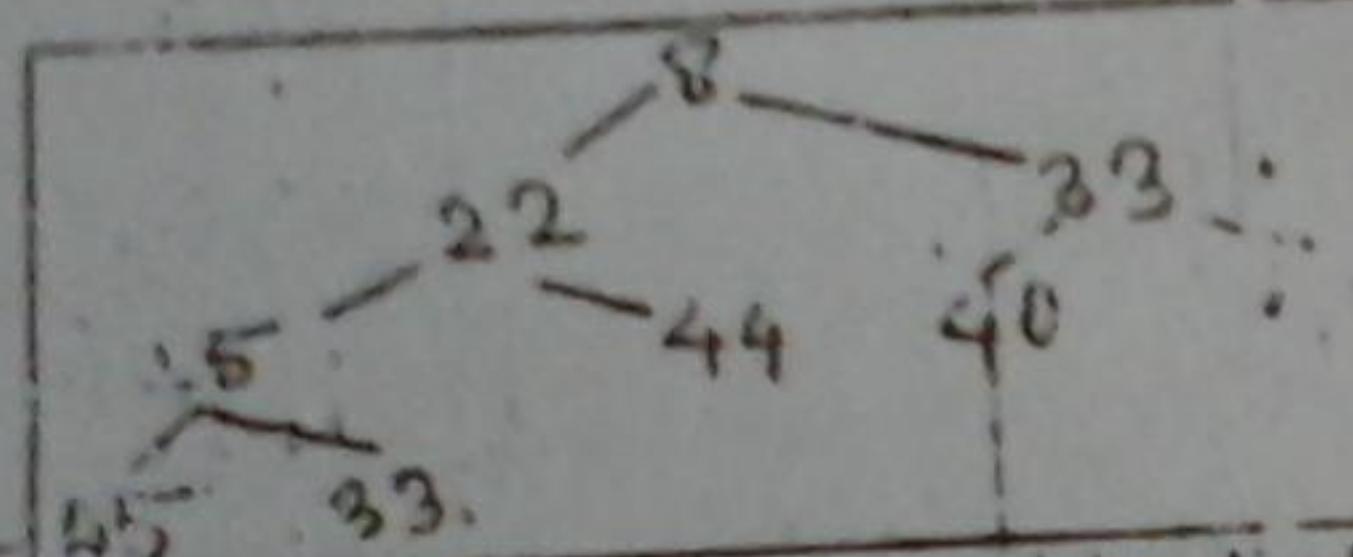
Course	Examination Date
--------	------------------

Course	Candidate
CSE 507	01301, 013079, 013001
CSE 303	013013, 013011
CSE 207	013039
CSE 201	01300, 013033
CSE 501	013001, 013059
CSE 107	013005, 013033, 013034

Using graph coloring make an examination schedule which will complete the exams in minimum number of days. Also, draw the corresponding graph to be colored.

Consider the following heap. Now answer the questions.

05



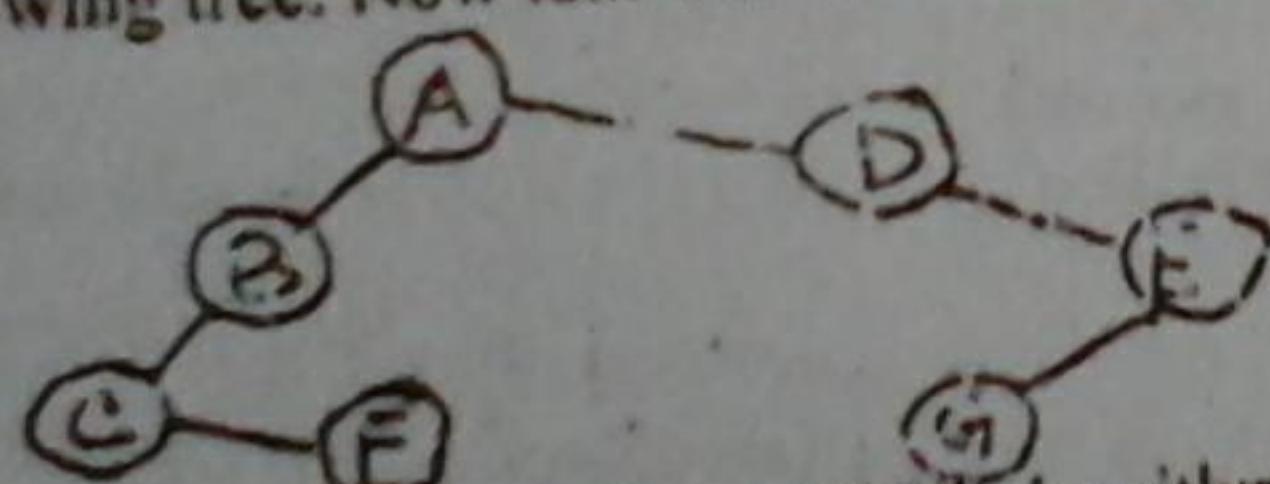
- i) Is it maxheap or min heap? Why?
- ii) Describe the heap after insertion of 2.
- iii) Is heap a 2-tree or complete binary tree? Why?
- iv) Delete 33 from heap.
- v) Delete 8 from heap.

(a) Consider the following six weights. Find a 2-tree with the given weights. 4, 15, 25, 5, 8, 16.

04

(b) Consider the following tree. Now loss this tree in a sequential representation system.

02 2/3

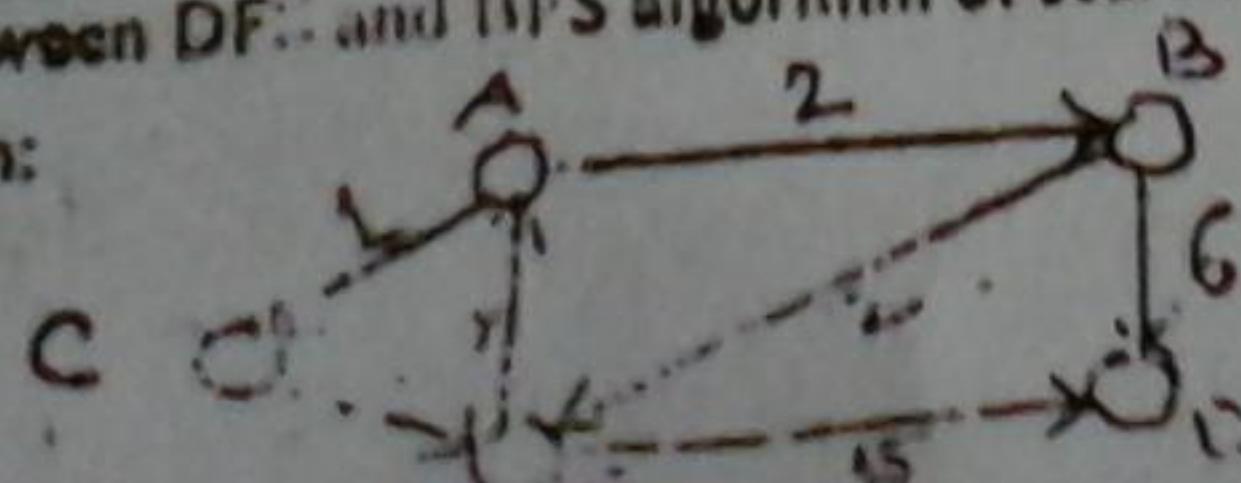


Q5. (a) What are the differences between DFS and BFS algorithm of searching a node from a graph?

04

(b) Consider the following graph:

05



Let v1 = A, v2 = C, v3 = D, v4 = B, v5 = E, v6 = F. Using Floyd warshall shortest path algorithm to calculate the matrix Q1, Q2.

02 2/3

(c) What is chromatic number?

Let v1 = A, v2 = C, v3 = D, v4 = B, v5 = E, v6 = F. Using Floyd warshall shortest path algorithm to calculate the matrix Q1, Q2.

02 2/3

Course No: CSE 201

Full Marks: 70

Course Title: Data Structure

Time: 3 Hours

N.B.

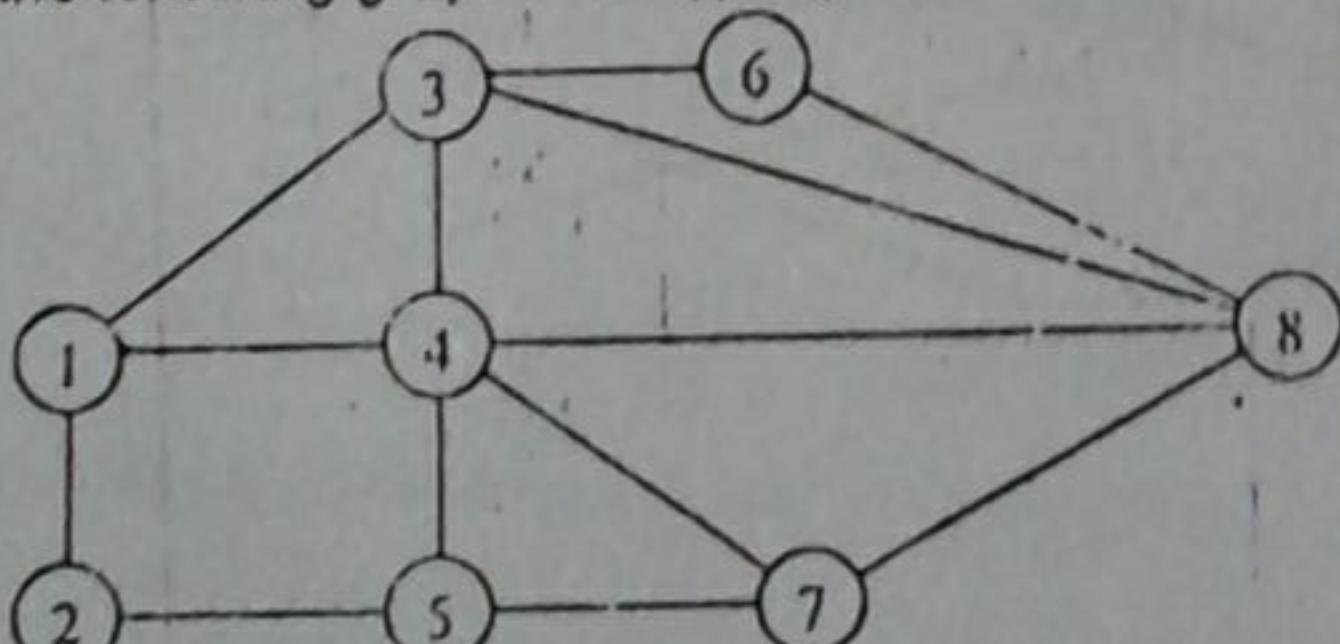
1. Answer any SIX questions, taking THREE from each section.
2. Figures in the margin indicate full marks.
3. Use separate answer script for each section.

SECTION-A

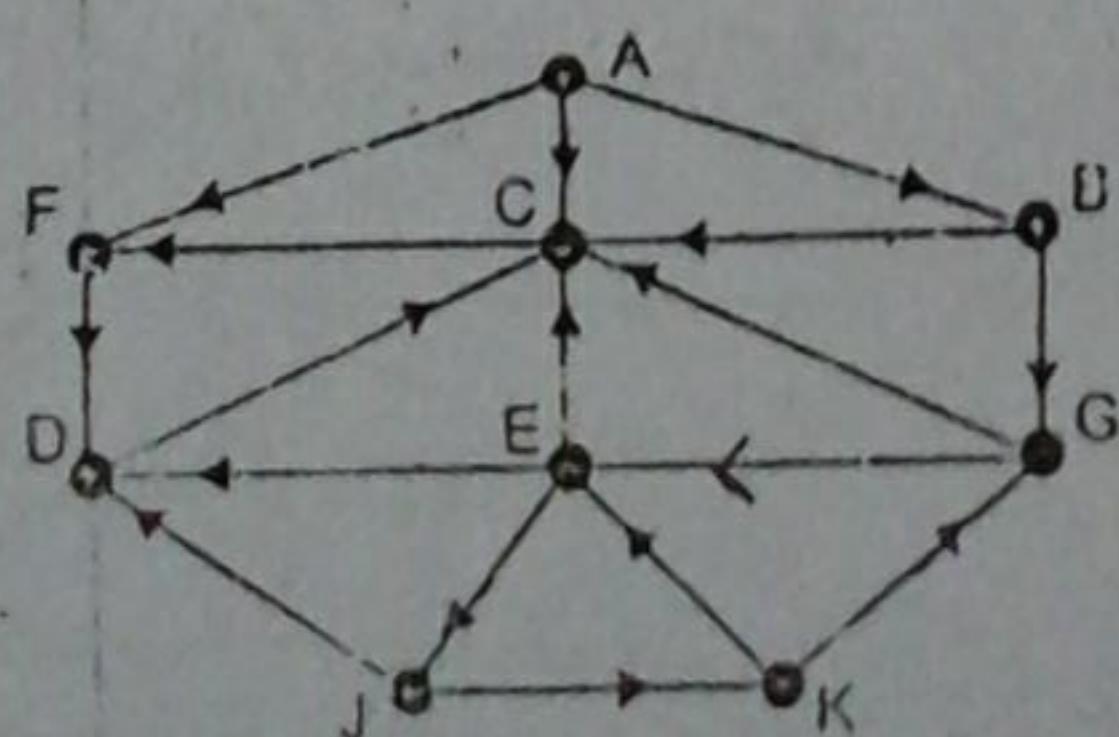
- Q1(a)** Distinguish between data and data structure. 03
- (b)** Describe relative merits and demerits of array processing over link list. 03%
- (c)** Explain how an array can be used to implement a queue. 05
- Q2(a)** Write an algorithm to store two n-order polynomials and then add them using link lists. 05%
- (b)** Let f and r are the front and rear pointers of a circular queue, Q. Then write an algorithm to copy all the elements of Q to a stack S. 06
- Q3(a)** Write the statements to insert a node pointed by p between node pointed by q and node pointed by r in a double link list. How do we insert a new node before the first node in a double link list headed by pointer head? 05
- (b)** Suppose you have a link list called LIST where all nodes contain the numerical values. Write a procedure to find the maximum value MAX among the nodes of LIST. 02%
- (c)** How do we add a given value ITEM at the end of a circular link list? 04
- Q4(a)** "All complete trees are full tree but all full binary trees aren't complete binary tree". Do you agree with this statement? Justify your answer with example. 02%
- (b)** The preorder traversing of a tree is: +a-bc-/d/-+fg/h. Now find out the level, depth, leaves, and branches of that tree by designing that tree. Is the tree complete binary tree? 05
- (c)** The post order traversal of a tree is:
E, D, C, H, G, Q, P, N, M, L, K, J, F, B, A
Now find out the preorder and inorder traversal. 04

SECTION-B

- Q5(a)** Construct a Huffman tree using the following node-weights: 05%
- 12, 5, 4, 7, 8, 10, 17
- (b)** Write an algorithm to construct a binary search tree using 50 elements. 06
- Q6(a)** Define spanning tree. 01%
- (b)** Draw and explain Krusal's algorithm regarding minimal spanning tree. 06
- (c)** Prove that a graph with n connected nodes having $(n-1)$ links can be treated as tree. 04
- Q7(a)** Write down the procedure by which we can find out the summation of node-values of a binary tree that are divisible by 5. 05%
- (b)** Write down the steps to sort the following data using
(i) Insertion sort technique
(ii) Merge sort technique
(iii) Radix sort technique. 06
- 21, 55, 30, 9, 51, 985, 33, 285
- Q8(a)** For the following graph write (i) adjacent matrix (ii) adjacent list. 05%



- (b)** Consider the following directed graph. Find out and print all the nodes reachable from the node J (including J itself) using the Depth-First Search. 06



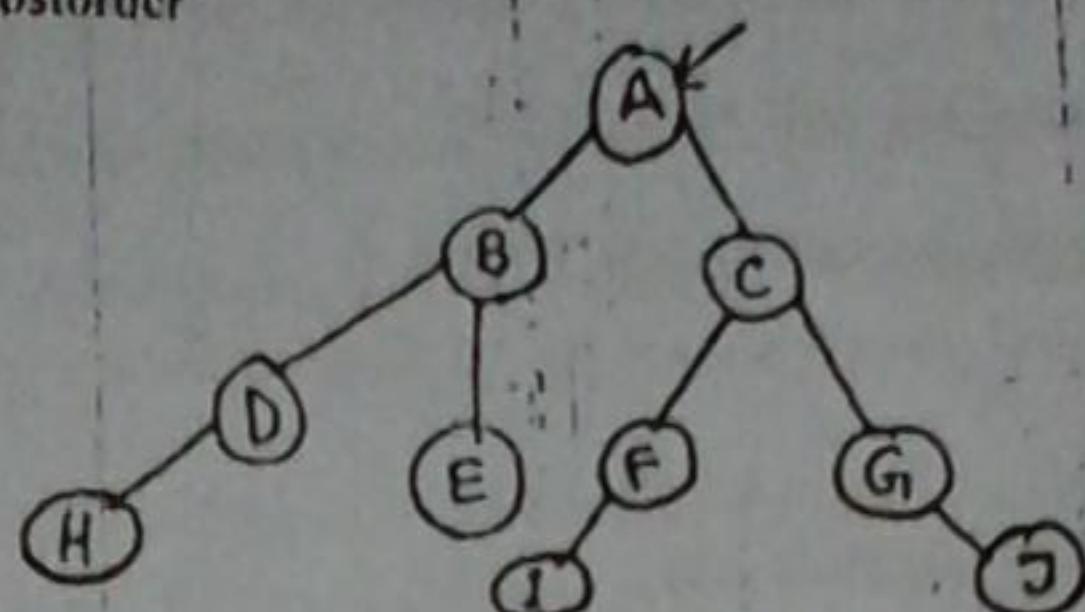
D - C
C - F
F - D
J - K
K - G
G - E
E - J

A - C
C - F
F - D
A - B
B - G
G - E
E - J

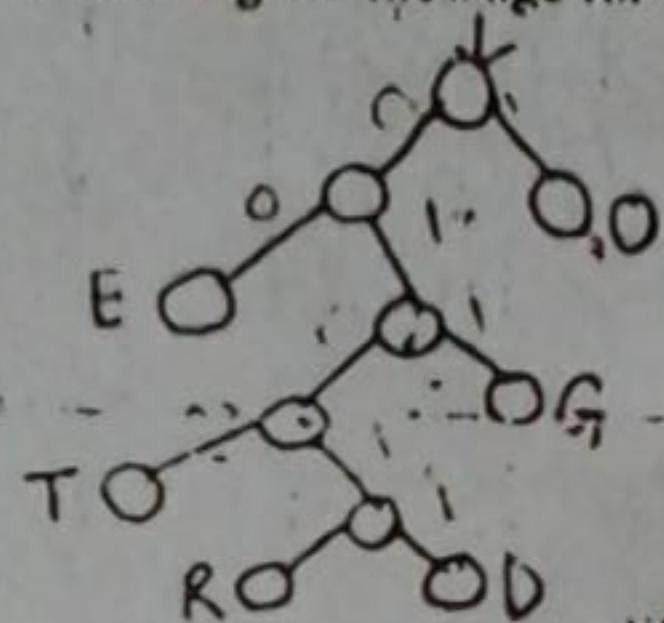
N.B. Answer six questions, taking three from each section.
 The questions are of equal value.
 Use separate answer script for each section.

SECTION A

- Q1. (a) Write an algorithm to merge two sorted lists. 4
 (b) Discuss the merits of link list over sequential list. 3
 (c) What is data structure? Name different kinds of data structure. 3
- Q2. (a) How an array can be used as a stack. Explain. 3
 (b) Write an algorithm to insert a new element in a circular queue. 6
 Q3. (i) Define (i) Full binary tree (ii) Complete binary tree. 3
 (ii) Discuss a method to store a binary tree in a linear list. 3
 (c) For the following binary tree, find the sequence nodes when traversing in (i) inorder (ii) Preorder
 (iii) Postorder 5



- Q4. (a) Write an algorithm to construct Huffman tree. 6
 (b) The leaf nodes of the following binary tree represent a set of characters. Find
 (i) Bit-Stream for the message "GOOD TRIP".
 (ii) Decode the original message for the bits stream "10101111011100100".

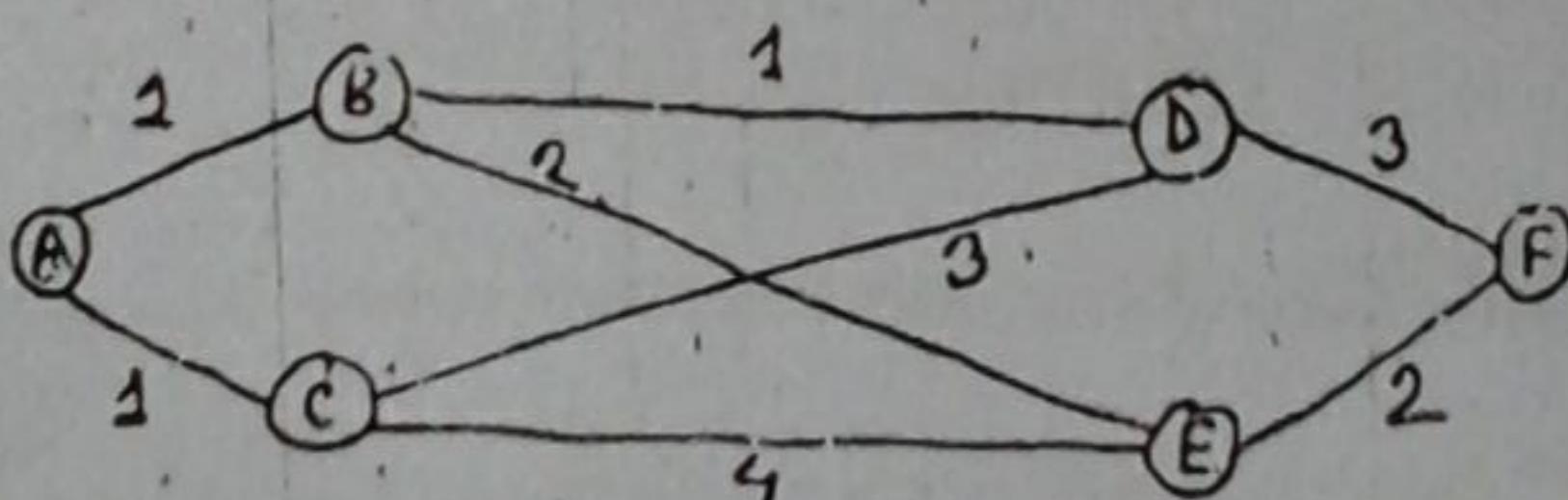


SECTION-B

- Q5. (a) Write an algorithm to insert a new node as a child whose parent is known. 5
 (b) Construct a binary sort tree using the following data entries sequentially. 6
 45, 75, 95, 25, 65, 55, 15, 85

- Q6. (a) Write the real-life applications of Dijkstra's algorithm. 2

- (b) For the following graph, find out the shortest path from A to D using Dijkstra's algorithm. 4

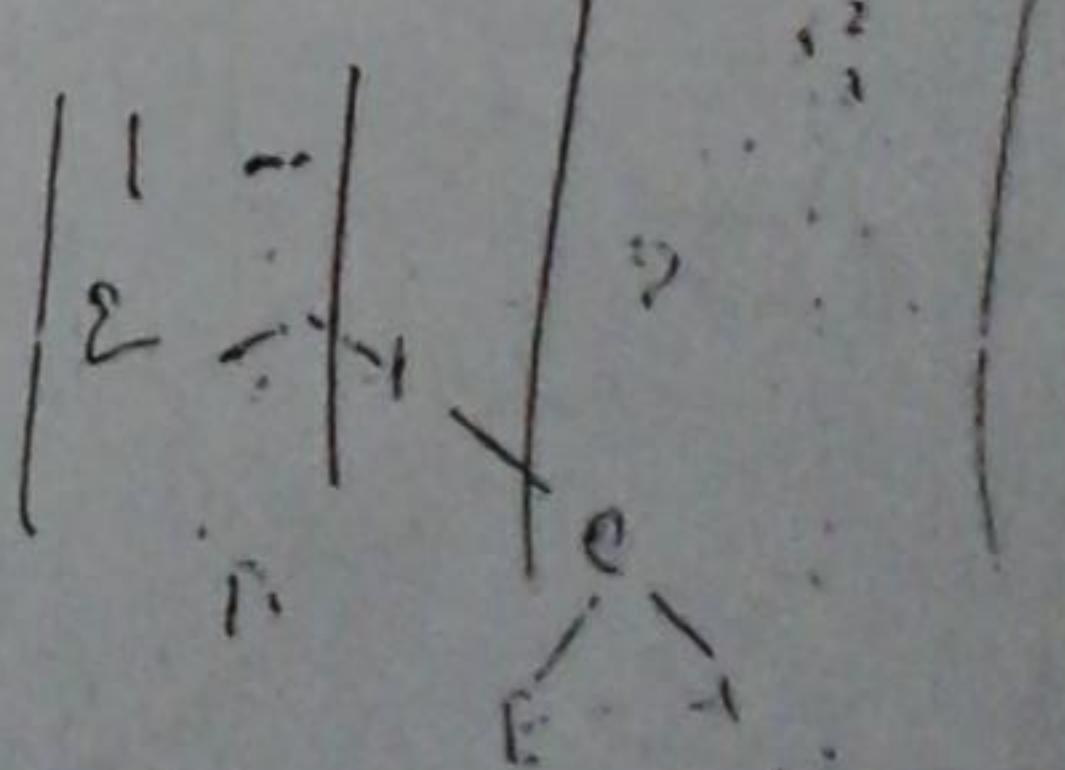
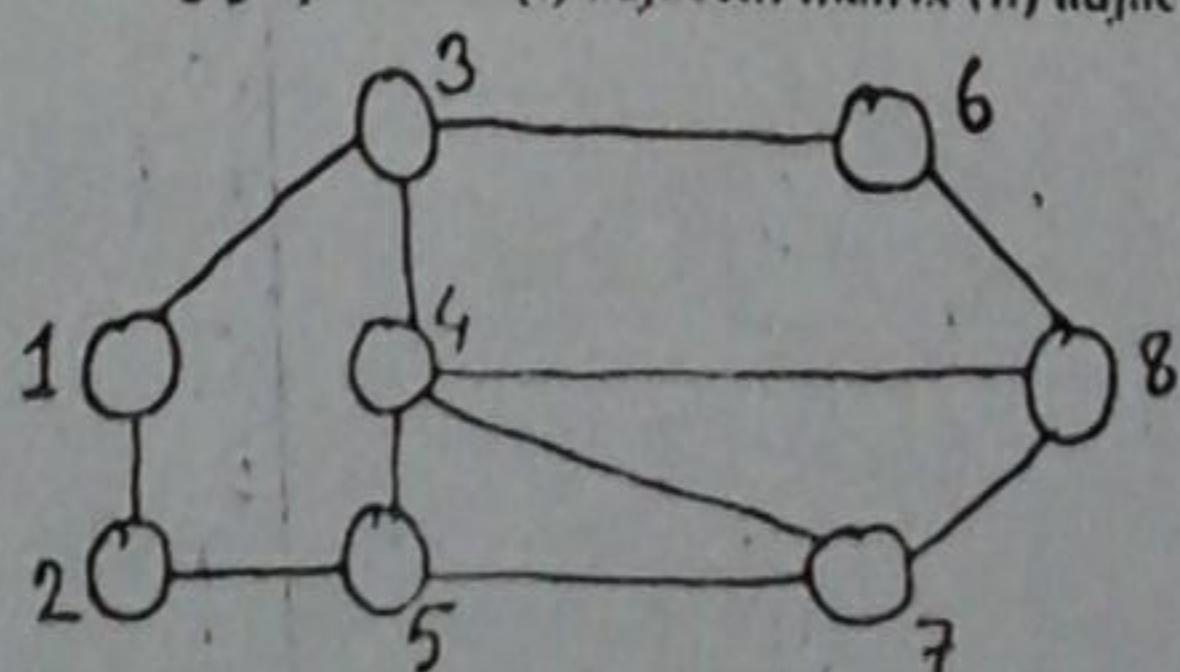


- (c) Write an algorithm of depth-first search with suitable example. 6

- Q7. (a) Differentiate between a graph and a tree. 2

- (b) Prove that a connected graph having n-nodes with (n-1) edges is a tree. 2

- (c) For the following graph write (i) adjacent matrix (ii) adjacent list. 4



- Q8. (a) Write the algorithm of binary search tree. 4

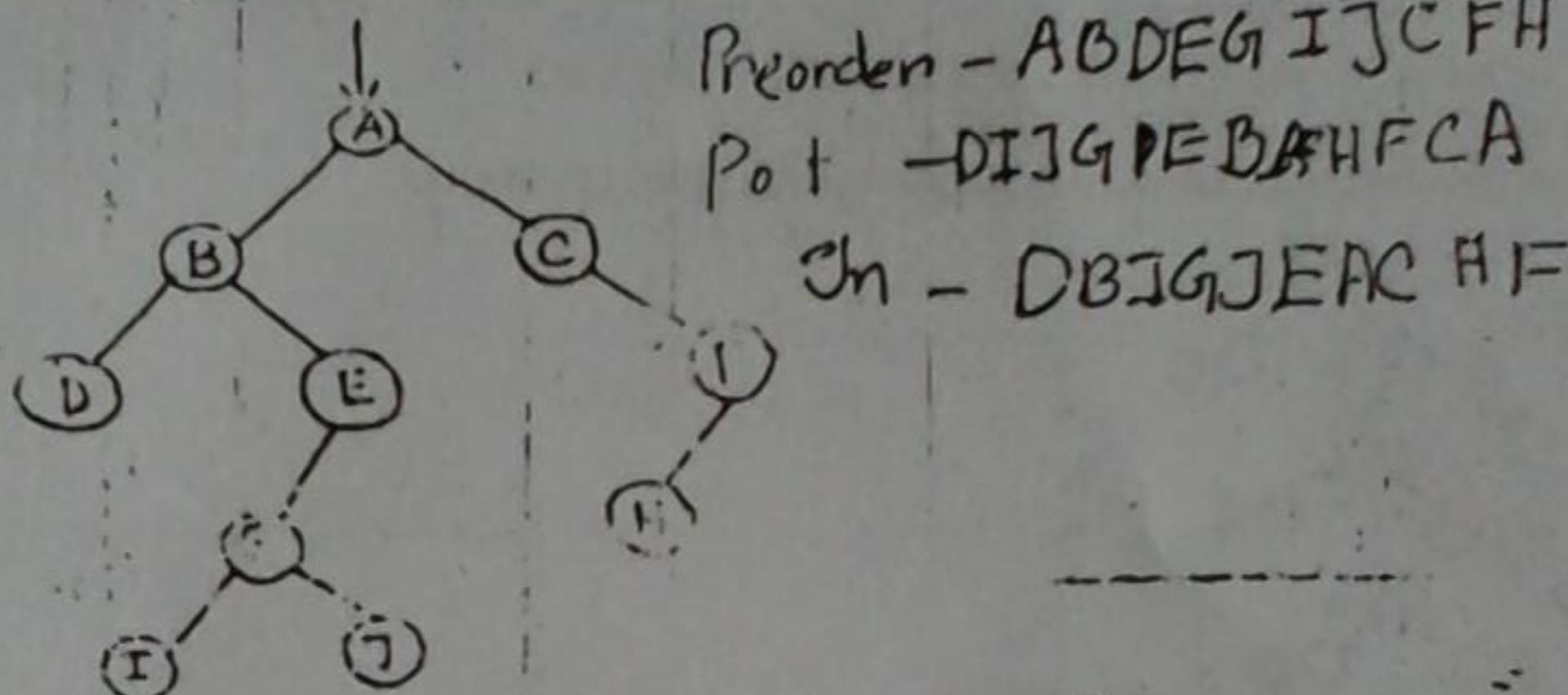
- (b) Draw the infix, prefix and postfix binary tree for the expression $A^* (B + C) / D$. 4

- (c) Using C/C++ code, write the bubble sort algorithm. 4

N.B. Answer six questions, taking three from each section.
 The questions are of equal value.
 Use separate answer script for each section.

SECTION-A

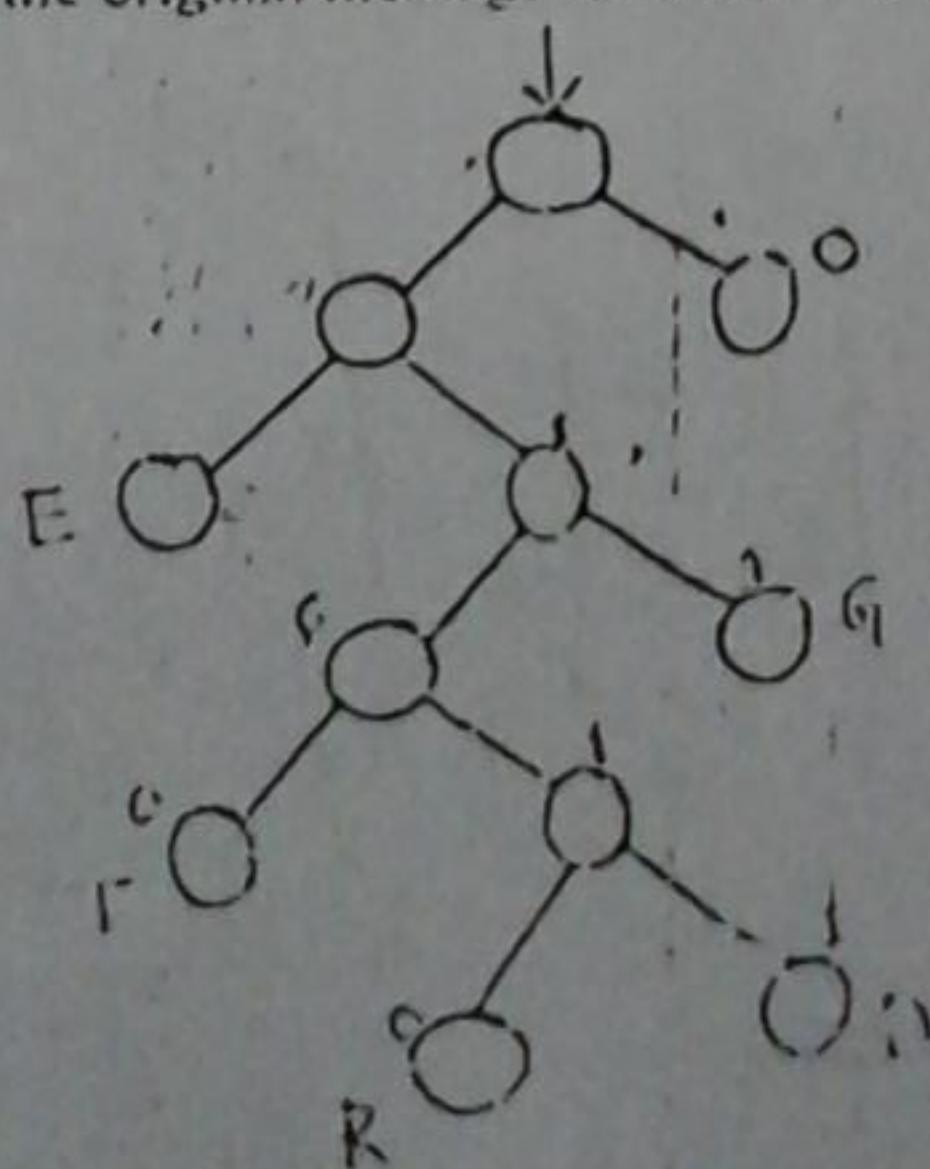
- Q1. (a) What is meant by 'Data Structure'? 1 2
 (b) Discuss complexity and time-space trade off of algorithm 1 3
 (c) Define Big O notation. Discuss the complexity of binary search algorithm. 2 2
 (d) What are the relative merits and demerits of link list over array? 5
- Q2. (a) Write an algorithm to merge two circular link lists headed by ' h_1 ' and ' h_2 ' into one circular link list. 2 2
 (b) Using C/C++ code, define a node for double link list. Also write the necessary statements to delete a node pointed by ' p ' from a double link list. 6
- Q3. (a) For a tree, define (i) Forest (ii) Child node (iii) Root and (iv) Leaf 4
 (b) Consider the following binary tree. Find the sequence of nodes when traversing in (i) Preorder (ii) Inorder and (iii) Postorder. 3



- (c) Write memory diagram to store the binary tree shown in the figure of Q.03(b) using array. 4 2
- Q4. (a) List three applications of binary tree. 3
 (b) Draw the infix, prefix and postfix binary tree for the expression $A * (B + C) / D$ 4
 (c) Construct a Huffman tree using the following node-weights 4,3,8,2,15,25,40. 4 2

SECTION-B

- Q5. (a) Write an algorithm to insert a new node in the appropriate location using binary sorted tree. 3 2
 (b) The leaf nodes of the following binary tree represent a set of characters. Find 6
 (i) Bit-stream for the message "GOOD TREE".
 (ii) Decode the original message for the bits-stream "1010111101111100100".



N.B. Answer six questions, taking three from each section.

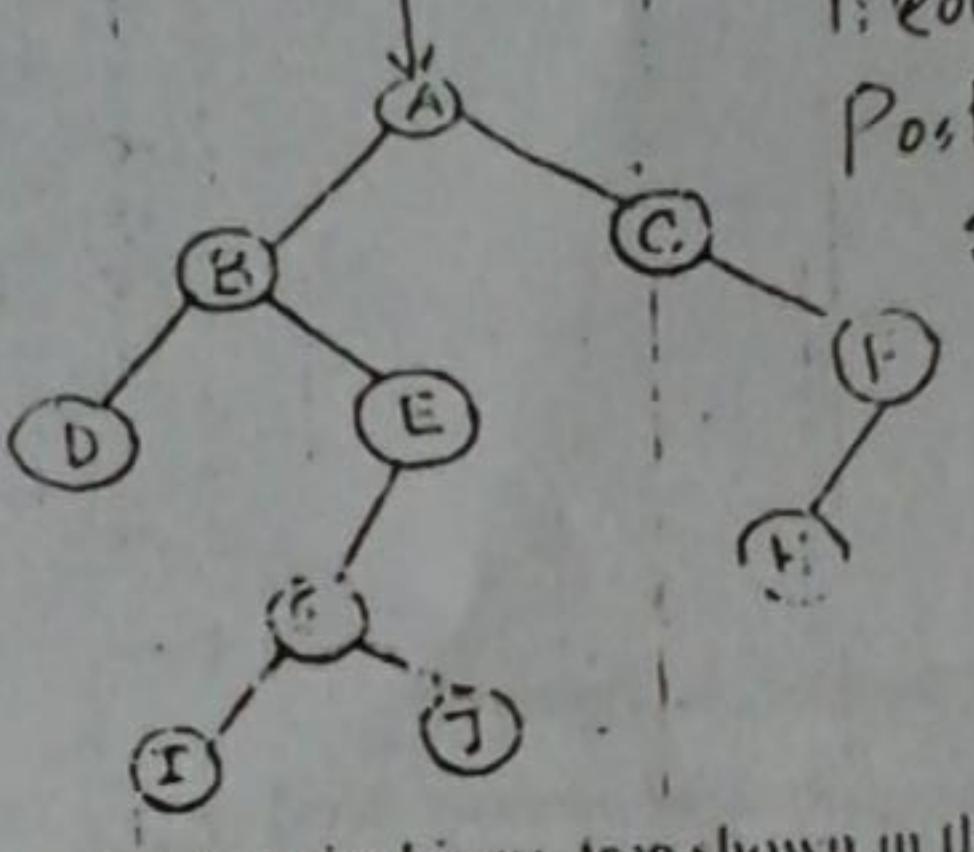
The questions are of equal value.

Use separate answer script for each section.

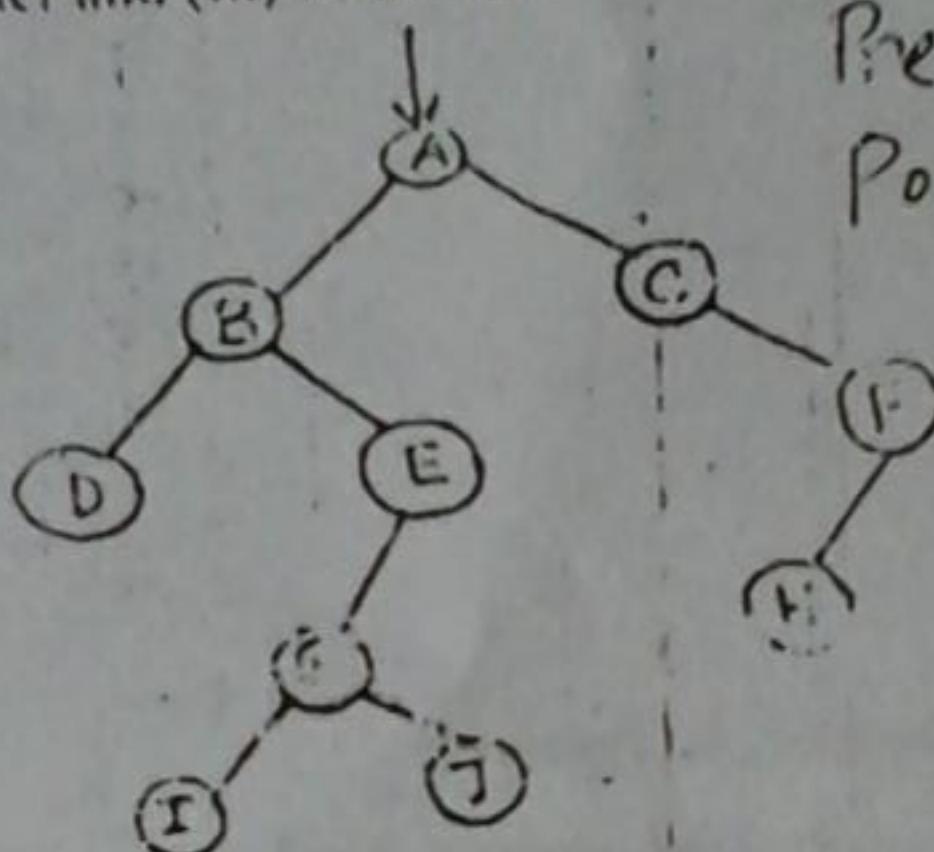
SECTION-A

- Q1.** (a) What is meant by 'Data Structure'? 2
 (b) Discuss complexity and time-space trade off of algorithm. 2
 (c) Define Big O notation. Discuss the complexity of binary search algorithm. 2
 (d) What are the relative merits and demerits of link list over array? 2

Q2. (a) Write an algorithm to merge two circular link lists headed by ' h_1 ' and ' h_2 ' into one circular link list. 6
 (b) Using C/C++ code, define a node for double link list. Also write the necessary statements to delete a node pointed by 'p' from a double link list. 4

Q3. (a) For a tree, define (i) Forest (ii) Child node (iii) Root and (iv) Leaf 3
 (b) Consider the following binary tree. Find the sequence of nodes when traversing in
 (i) Preorder (ii) Inorder and (iii) Postorder.

 Preorder - ABDEG IJCFH
 Post - DJIGPEB~~A~~HFC A
 In - DBIJGJEAC HF

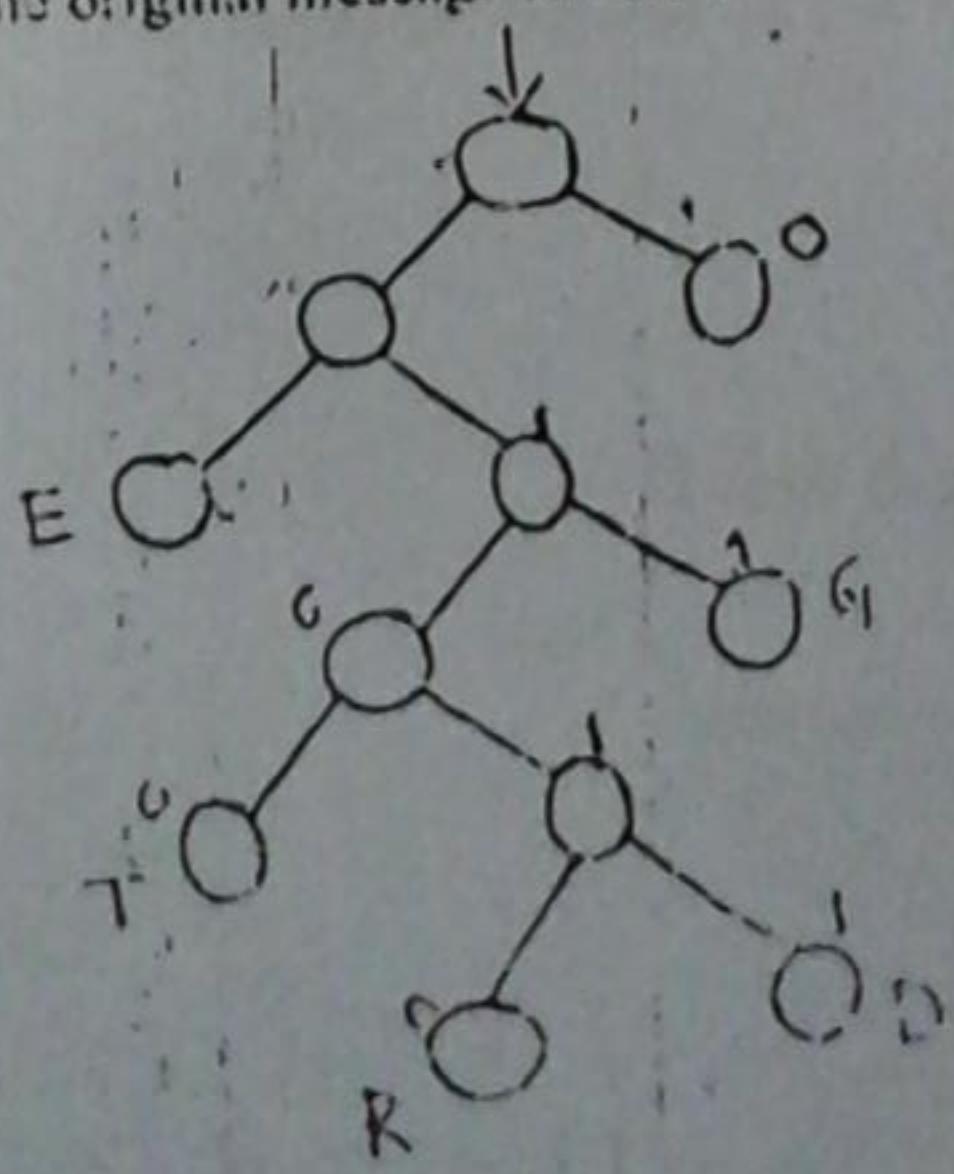
Q4. (a) List three applications of binary tree. 3
 (b) Draw the infix, prefix and postfix binary tree for the expression $A * (B + C) / D$. 4
 (c) Construct a Huffman tree using the following node-weights 1, 3, 8, 2, 15, 25, 40. 4



Preorder - ABDEG IJCFH
 Post - DJIGPEBAHFCA
 In - DBIJGEAC HF

SECTION-B

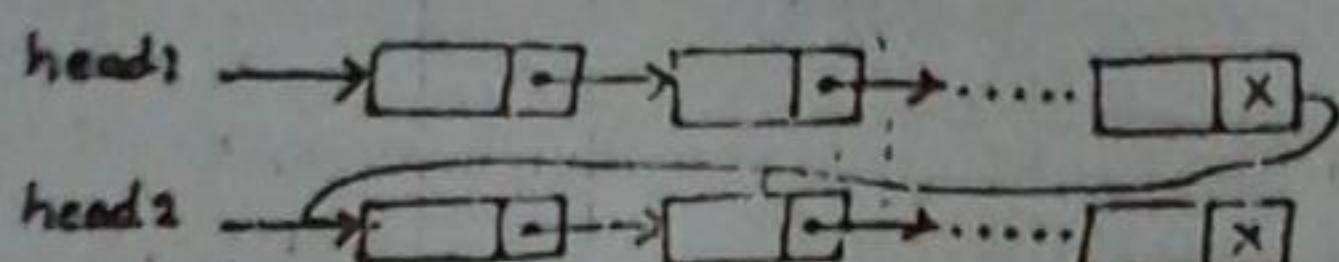
- Q5. (a) Write an algorithm to insert a new node in the appropriate location using binary sorted tree. 5
~~(a)~~ The leaf nodes of the following binary tree represent a set of characters. Find
(b) Bit-stream for the message "GOOD TREE".
(i) Decode the original message for the bits-stream "101011110111100100".
(ii)



N.B. Answer SIX questions, taking THREE from each section.
 The questions are of equal value.
 Use separate answer script for each section.

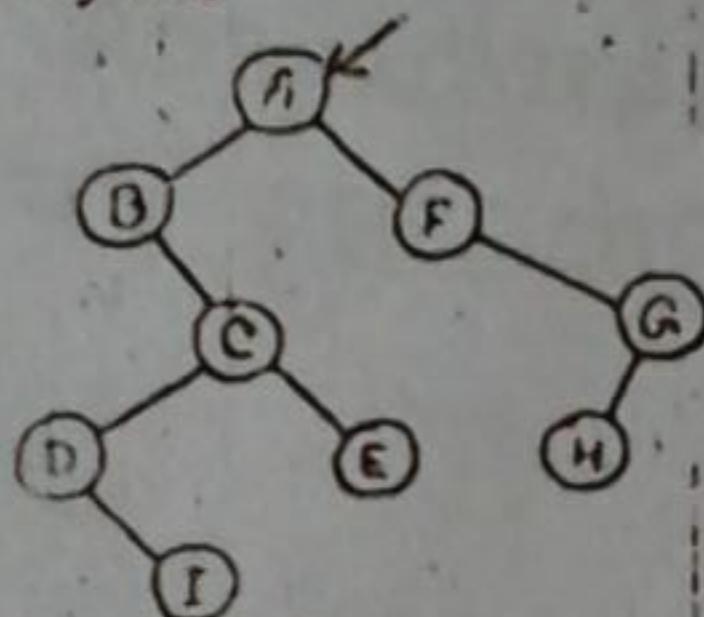
SECTION-A

- ~~Q1.~~ (a) What is data? What is data structure?
 (b) An array contains 100 elements. Draw a flowchart to find all pairs of elements whose sum is 30. 4%
- ~~Q2.~~ (c) An array contains 1000 elements. Find the time required to process the delete operation on 750th element of the array. Assume that the shifting of one elements requires $1/15$ sec. $1000 - 750 = 250$ sec 3
- ~~Q3.~~ (a) What is the difference between stack and queue?
 (b) Write an algorithm to transfer all odd numbered elements into an empty stack. 2
- ~~Q4.~~ (c) Following figure shows two header linked list. Write an algorithm to combine them into a single linked list. 3



- ~~Q5.~~ (a) Write an algorithm to split a circular link list such a way that all negative numbers should be stored in one circular list and all positive numbers should be stored in another circular list. 5
- (b) How can a node be declared for a double link list using C/C++ code. Also write the necessary C/C++ statements to insert a new node pointed by p after a node pointed by q in a double link list. 6%

- ~~Q6.~~ (a) What are the advantages of using linked list?
 (b) Consider the following binary tree 3

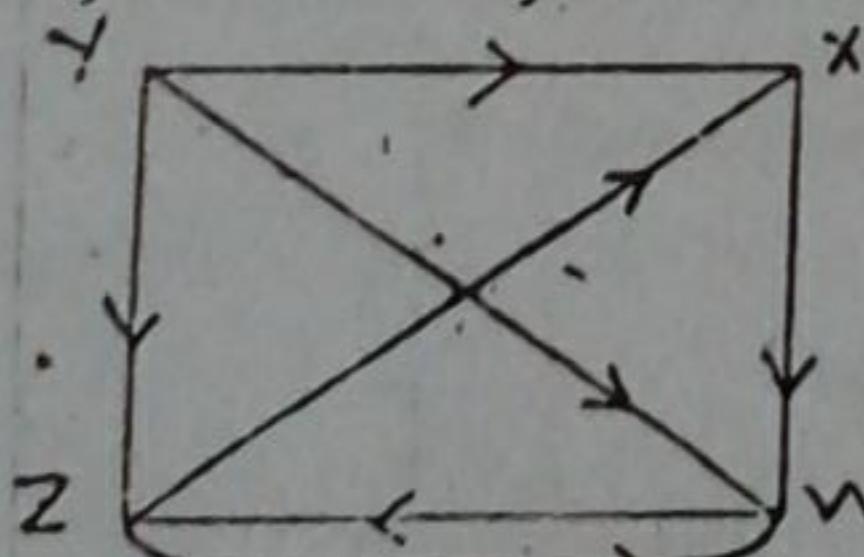


Then find the sequence of nodes when traversing in i) Preorder (ii) Inorder, (iii) Postorder

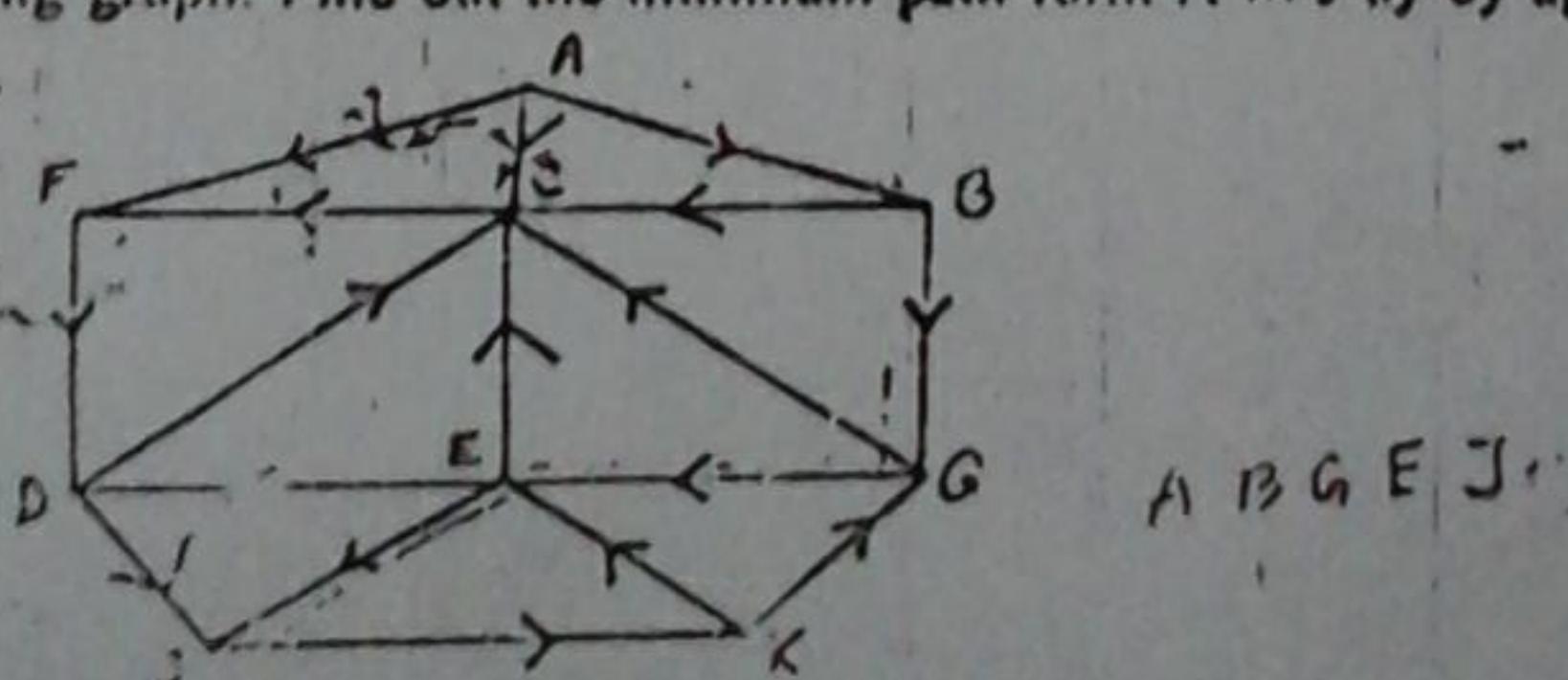
- (c) Write the memory diagram to store the binary tree of Q4(b) into computer's memory using array structure. 3%

SECTION-B

- ~~Q1.~~ (a) Write an algorithm to search a specific node of a undirected graph using depth-first searching technique. 5
- (b) What is a Huffman tree? Construct a Huffman tree using the following leaf weights, 4, 2, 10, 15, 22, 3, 30 6%
- Also calculate the total weight of the resultant tree.
- ~~Q2.~~ (a) Construct Adjacency matrix and Adjacent list for following graph. 4



- ~~Q3.~~ (b) Consider the following graph. Find out the minimum path from A to J by applying Depth First search. 4

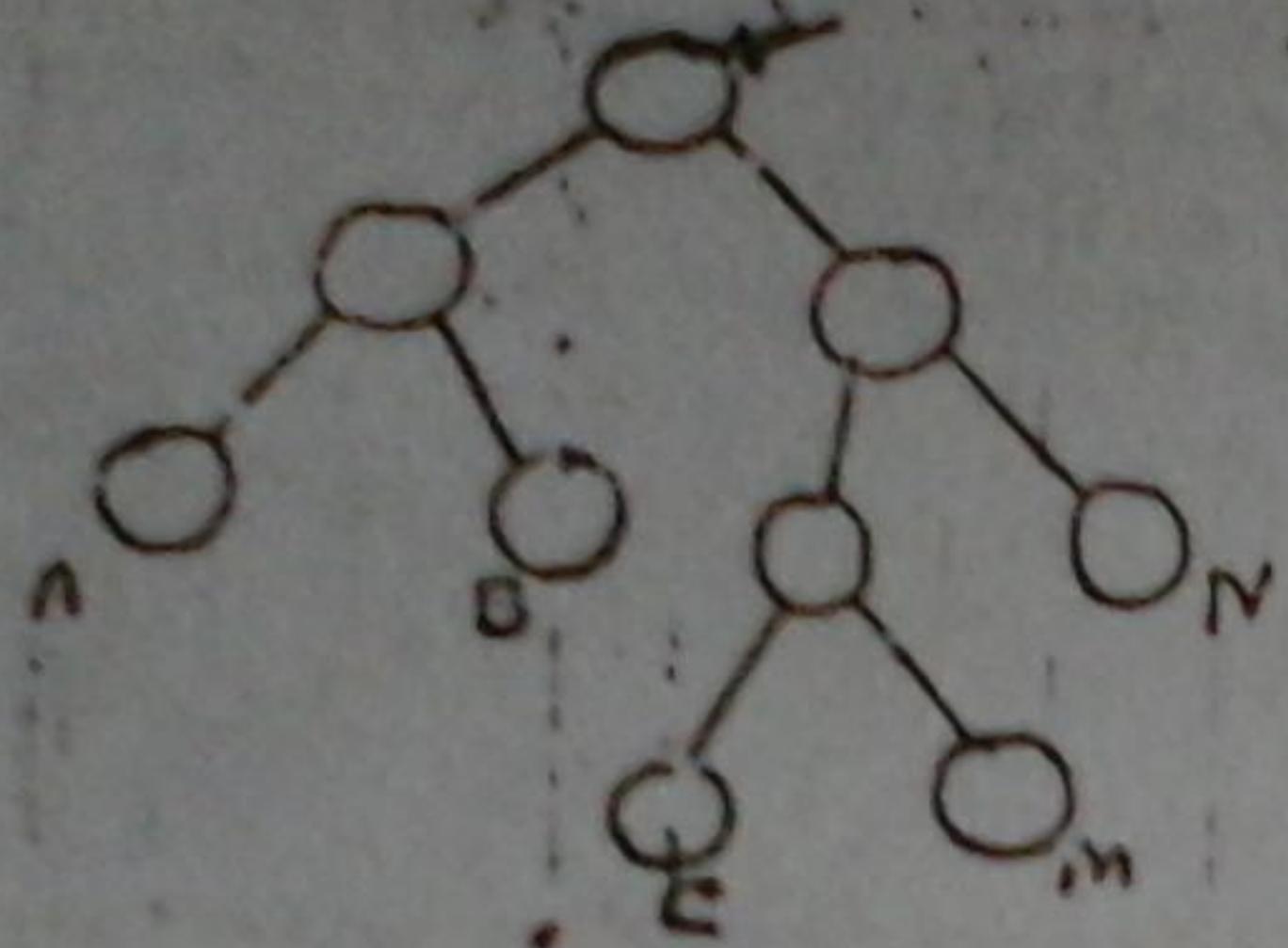


A B C D E F G H I J K

Front Queue
Rear

- ~~Q4.~~ Write an algorithm to insert a specific element as a leaf in a binary sorted tree. 3%

Q7. (a) The leaf nodes of the following binary tree represent a set of characters.

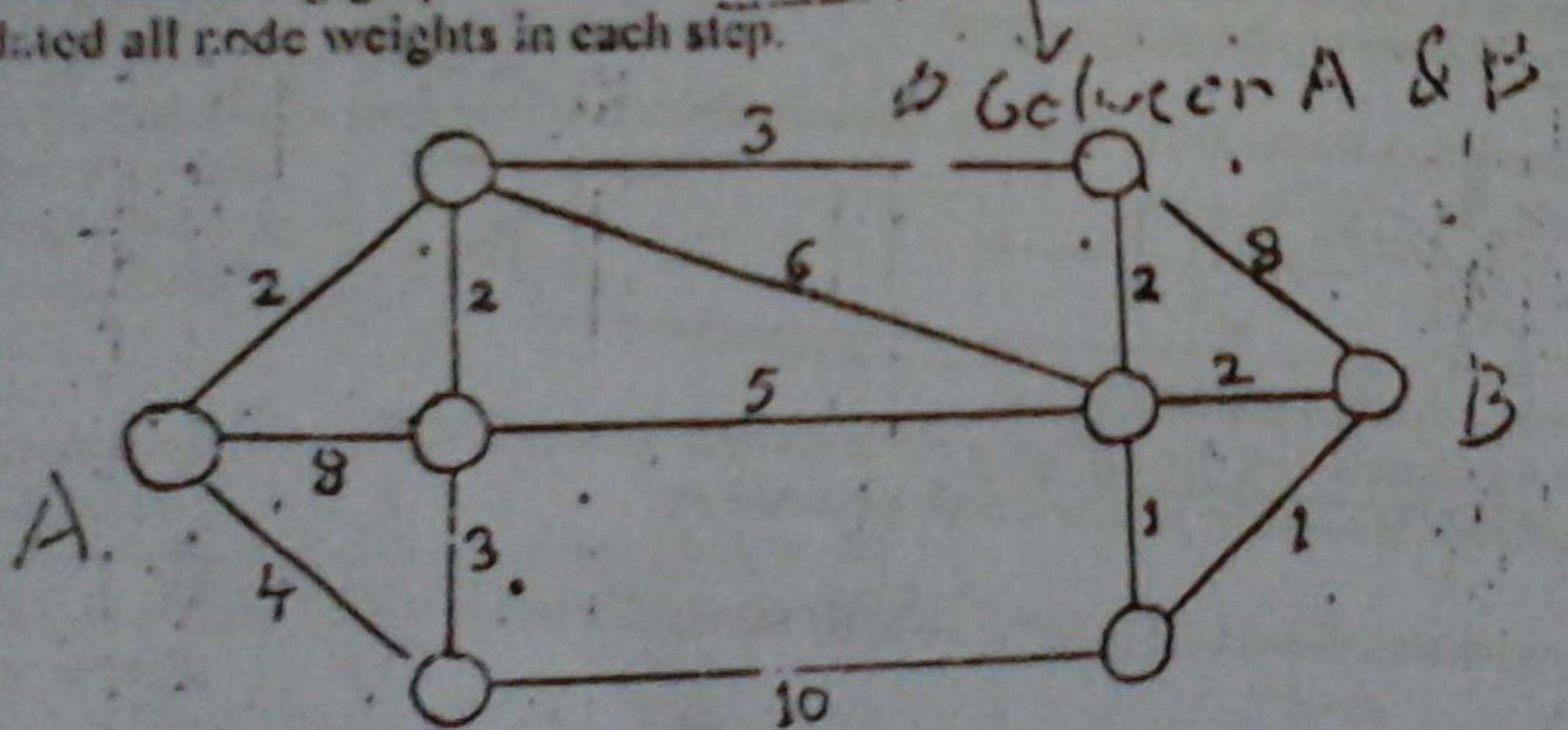


Then find

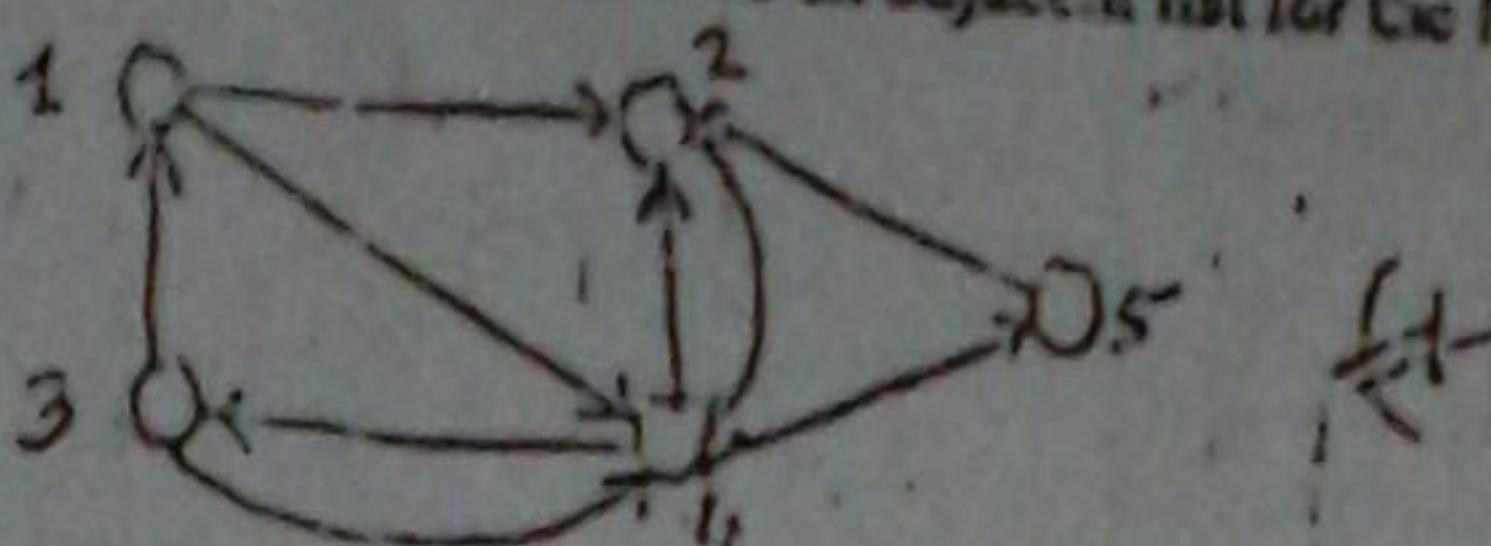
- (i) bitstream for the mess. "MAN CAN"
 - (ii) reconstruct the original message for bit stream 01001011100
- (b) Differentiate between a directed graph and an undirected graph. 2
- (c) What is a spanning tree? What is its importance in graph theory? 2½

Q8. (a) Write an algorithm to find the minimum weighted spanning tree of a connected undirected graph. 5½

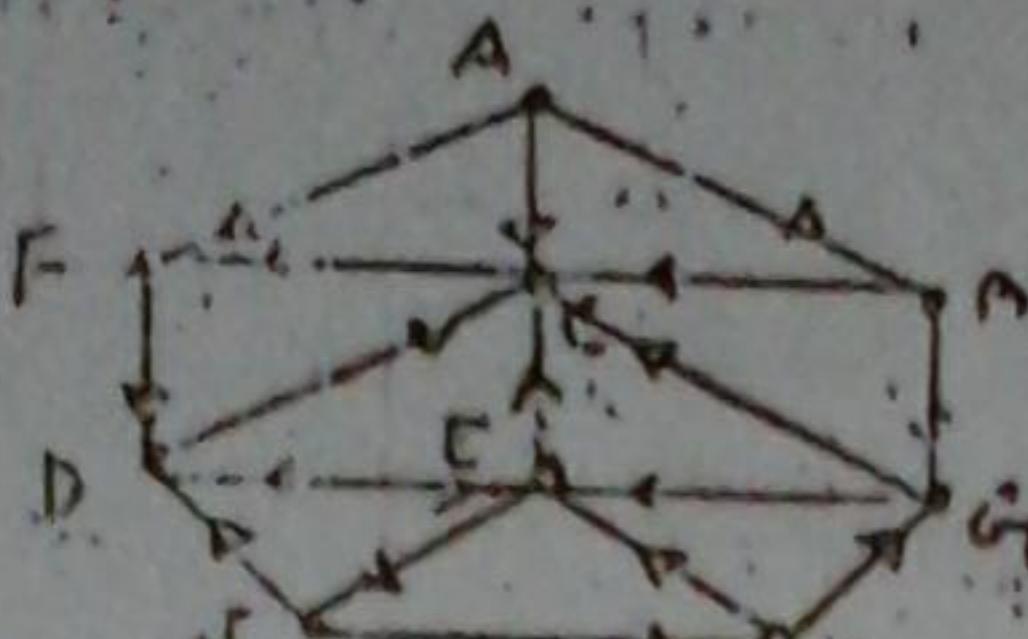
(b) For the following graph, find the shortest path using Dijkstra's algorithm. Redraw the graph with the updated all node weights in each step. 6



- Q6. (a) Prove that a connected graph contains n nodes and $(n-1)$ E's if it represents a tree.
 (b) A series of integer data are stored in a binary sorted tree with root, T. Then write an algorithm to search a specific element, m.
- (c) Construct an adjacent matrix and an adjacent list for the following directed graph.



Q7. (a) Consider the following graph. Find out the minimum path from A to J by applying Breadth-First search technique.



- (b) Briefly explain the techniques to minimize clustering.
 (c) Define the following terms:
 (i) weighted 2-tree
 (ii) Treed tree

Q8. (a) Show the different passes to sort the following data using insertion sort.

D, A, T, A, S, T, R, U, C, T, U, R, E, S

Find out the complexity of selection sort algorithm.

(b) Write down 3 popular linear functions and briefly describe them.

(c) What is linear probing?

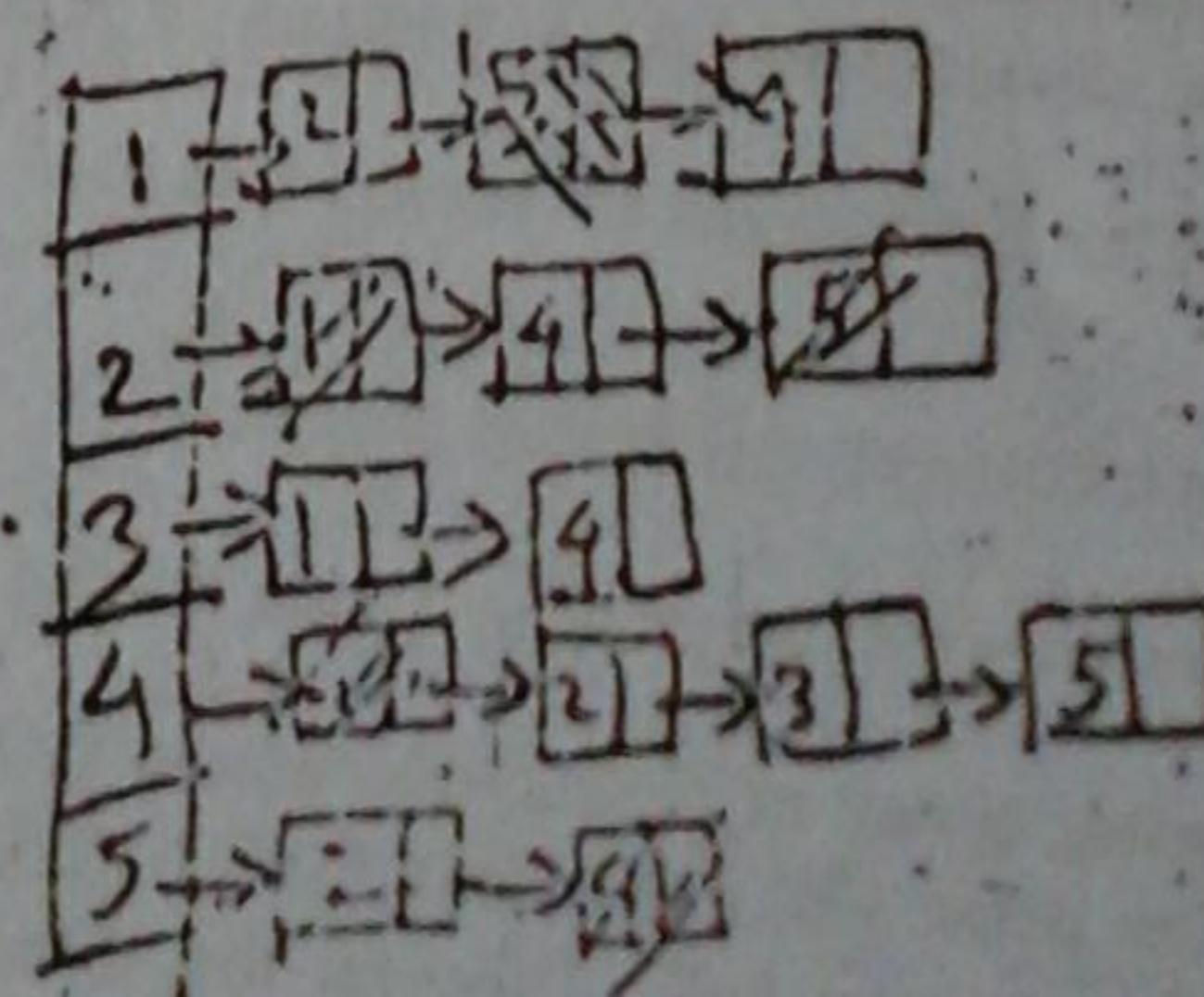
[9-7]

G. A. M.

3/ 6(c)

3	2	3	4	5	
0	1	0	1	0	1
0	0	0	1	0	2
1	0	0	1	0	3
0	1	1	0	1	4
0	1	0	0	0	5

G.A.L



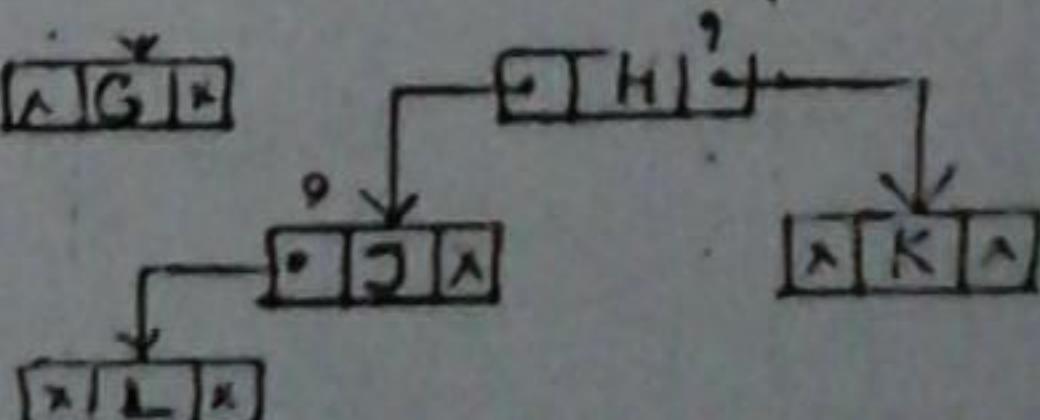
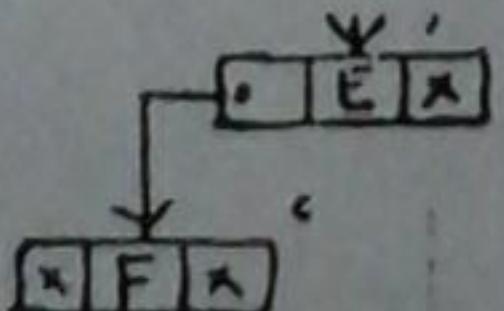
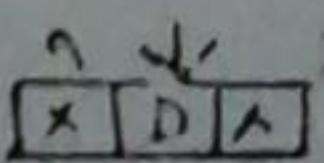
N.B. Answer six questions, taking three from each section.

The questions are of equal value.

Use separate answer script for each section.

SECTION - A

1. (a) Discuss all data structure operations in brief.
(b) What do you mean by (i) The Complexity of algorithm and (ii) The Space-time tradeoff of algorithm?
(c) What do you mean by linear search and binary search of data? Which and which one is better for data searching?
2. (a) What is header-linked list? Discuss the advantages of a two way list over a one way list for each of the following operations.
i) Deleting a node whose location is given.
ii) Searching a sorted list for a given element.
iii) Inserting a node before the node with a given location.
(b) Is there any difference between traversing and searching of data? If so, explain with example.
(c) "Quick sort is better than bubble sort" explain this statement with suitable example.
(d) Transform each of the following expression to prefix and postfix.
i) $A+B-C$
ii) $(A+B)^*(C-D) \& E^*F$
iii) $A+(((B-C)^*(D-E)+F)/G)\&(H-I)$
3. (a) Write down the "infix into postfix" algorithm.
(b) Using bubble sort algorithm, Find the number of comparison, C and the number of interchanges, D which alphabetize the $n = 7$ letters in "CSEDEPT".
(c) What is recursion? What advantages are there in its use?
4. (a) What is the difference between queue and dequeue?
(b) Describe briefly, how to work the priority queue during data processing?
(c) Consider the following queue of characters, where QUEUE is a linear array which is allocated six memory cells: FRONT = 2, REAR = 4, QUEUE: -, A,C,D, __, __. Where "—" denotes empty memory cell. Discuss the queue for each of the following operations take place.
i) F is added to queue.
ii) Two letters are deleted.
iii) K, L, M are added to the queue.
iv) R is added to the queue.



(d) Consider the following priority queue, which is maintained as a one-way list.

	INFO	PRN	LINK
1	BB	2	6
2	XX	3	7
3	DD	4	4
4	EE	5	9
5	AA	6	1
6	CC	7	2
7	XX	8	3
8	GG	9	0
9	FF	10	8
10	ZZ	11	7
11	WW	12	1
12			0

avail
Z 10
11 ✓

3, 7 10

- (i) Describe the structure after (XX,2), (YY,3), (ZZ,2) and (WW,1) are added to the queue.
- (ii) Describe the structure if, after the preceding insertions, three elements are deleted.

SECTION - B

5. (a) Discuss complete binary tree. How a node is deleted from a tree, when the node has two children? Explain with suitable example.

(b) The following list of letters is inserted into an empty binary search tree:

J, R, D, G, T, E, M, H, P, A, F, Q

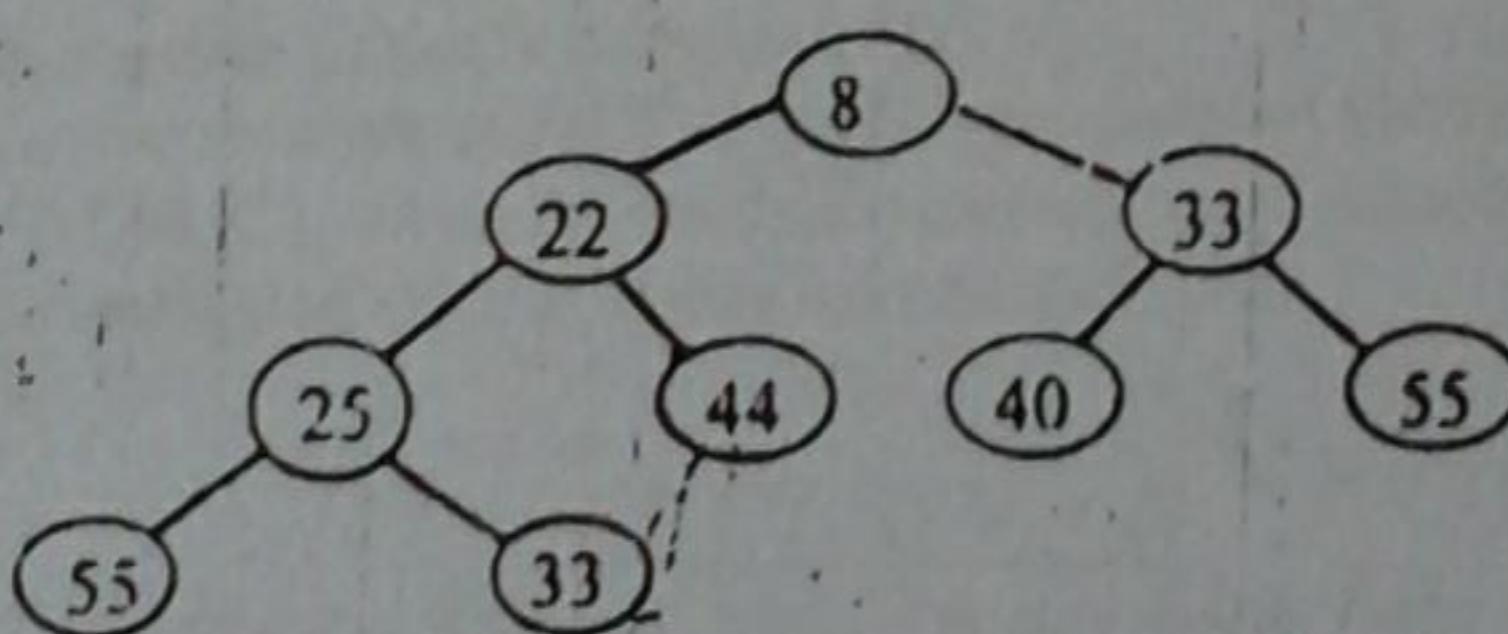
i) Find the final tree T.

ii) Find the preorder, inorder and postorder traversal of T.

(c) Find the recursive solution of Tower of Hanoi problem for n = 4 disks.

6. (a) What is heap? How this concept is applied to sort an array?

(b) Consider the minheap H of the following figure.



Discuss the heap of the following operations:

- i) 11 is inserted
- ii) 8 is deleted
- iii) 120 is inserted.

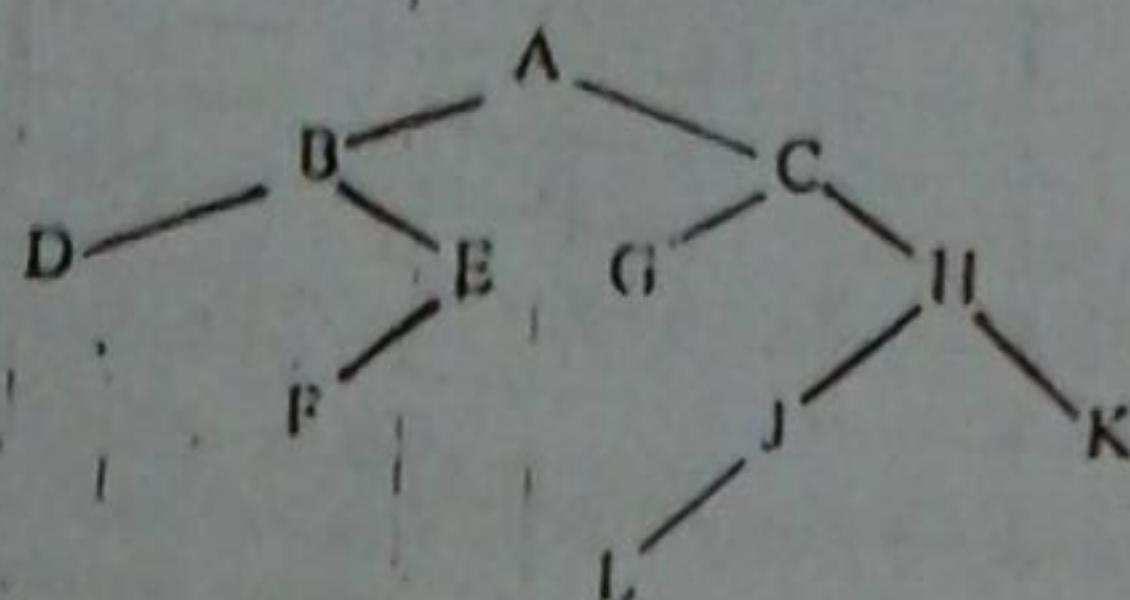
(g) Define Extended Binary Tree and External node. Build a tree from the following formation :

Inorder : 15 55 20 85 18 33 22 95 30 70 65

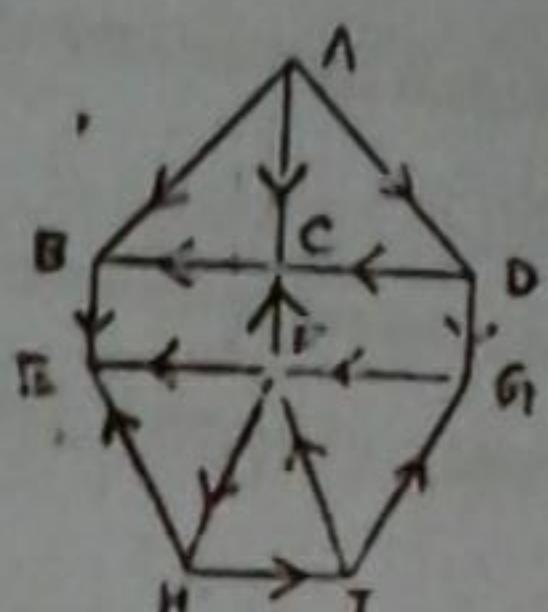
Preorder : 95 85 55 15 20 33 22 70 30 65

(d) What is the advantage of Circular queue over normal queue?

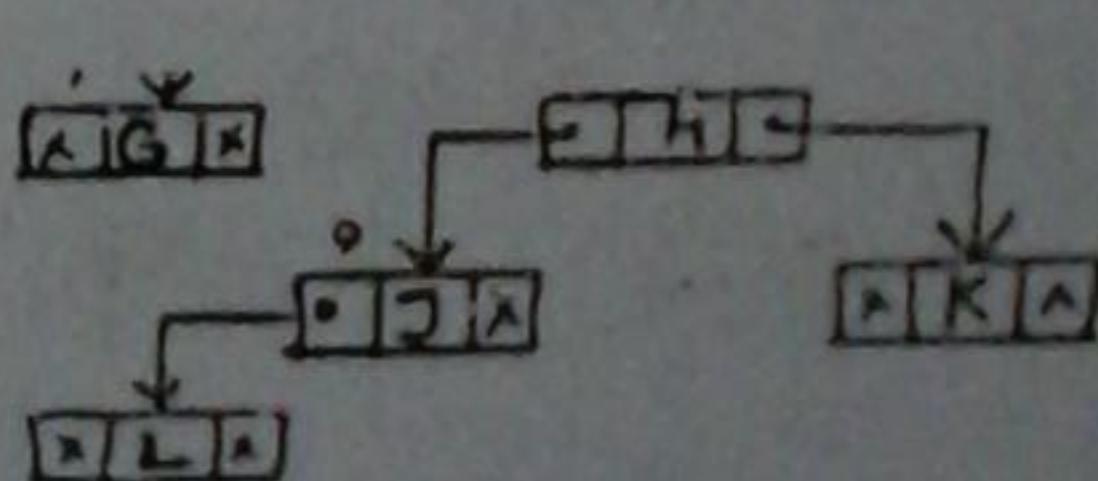
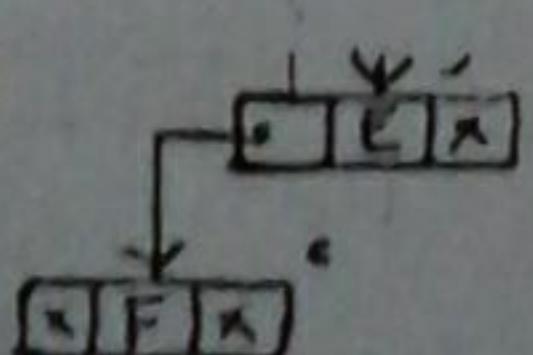
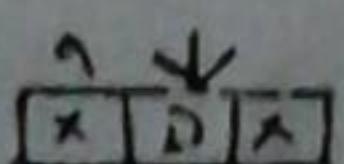
7. (a) Show the different passes to sort the following data using selection sort algorithm.
31, 12, 21, 13, 19, 18, 05, 10.
(b) Write down the algorithm of insertion sort. What is its complexity?
(c) What is a threaded tree? Find out the two way inorder threading for the following tree.



8. (a) Discuss the radix sort algorithm with example.
(b) What is hashing? Explain some popular hash functions.
(c) Traverse the following graph using Depth First Search Technique and display the output.



- (d) Write the Warshall's algorithm for determining shortest path.



N.B. i. Answer six questions, taking three from each section.
 ii. The questions are of equal value.
 iii. Use separate answer script for each section.

SECTION - A

Q. 1(a) What do you mean by linear search and binary search of data? When and which one is better for data searching?

(b) What is meant by complexity of an algorithm? Suppose you have n number of data. Now you want to find one data among them by applying binary search algorithm. If the time constant is six(6) seconds, find the value of n.

(c) Define data structure. Is there any difference between traversing and searching of data? If so, explain with example.

Q. 2(a) Define stack. Write down the practical example of stack of data structure.

(b) Suppose stack is allocated N=6 memory cells and initially stack is empty or in other words, TOP=0. Find the output of the following module:

1. Set AAA = 2 and BBB = 5, CCC = 6
2. Call PUSH (stack, AAA).
Call PUSH (stack, 4).
Call PUSH (stack, BBB+2).
Call PUSH (stack, 9).
Call PUSH (stack, AAA+BBB).
Call PUSH (stack, AAA+CCC).
3. Repeat while TOP ≠ 0:
Call POP (stack, ITEM).
Write : ITEM.
[End of loop]
4. Return.

(c) Write down the limitations of binary search and suggest possible solution.

(d) Evaluate the following arithmetic postfix (P) expression by using stack.

P: 5, 6, 2, +, *, 12, 4, /, -.

Q. 3(a) Quick sort is better than bubble sort" explain this statement with suitable example.

(b) Using the bubble sort algorithm, find the number of comparisons, C and the number of interchanges, D which alphabetize the n = 7 letters in "CSERUET".

(c) Draw the charts necessary for the following data using Radix Sort algorithm.

3256, 45, 217, 216, 49, 198, 3198, 437, 655, 192, 8, 1009, 229, 2.

Q. 4(a) Explain the Queue and Dequeue.

(b) Suppose S is the following list of 14 alphabetic characters:

D A T A S T R U C T U R E S.

Suppose the characters in S are to be sorted alphabetically. Use the quick sort algorithm to find the final position of the first character D.

(c) Find the recursive solution of the Tower of Hanoi problem for the following:

TOWER (4, A, B, C), where the symbols represent usual meanings.

(d) What is the advantage of circular queue over normal queue?

21

$$\frac{n^2 + 1}{2}$$

SECTION - B

Q. 5(a) Compare the efficiencies of Linked List, Tree and Array from the viewpoint of three basic operations -

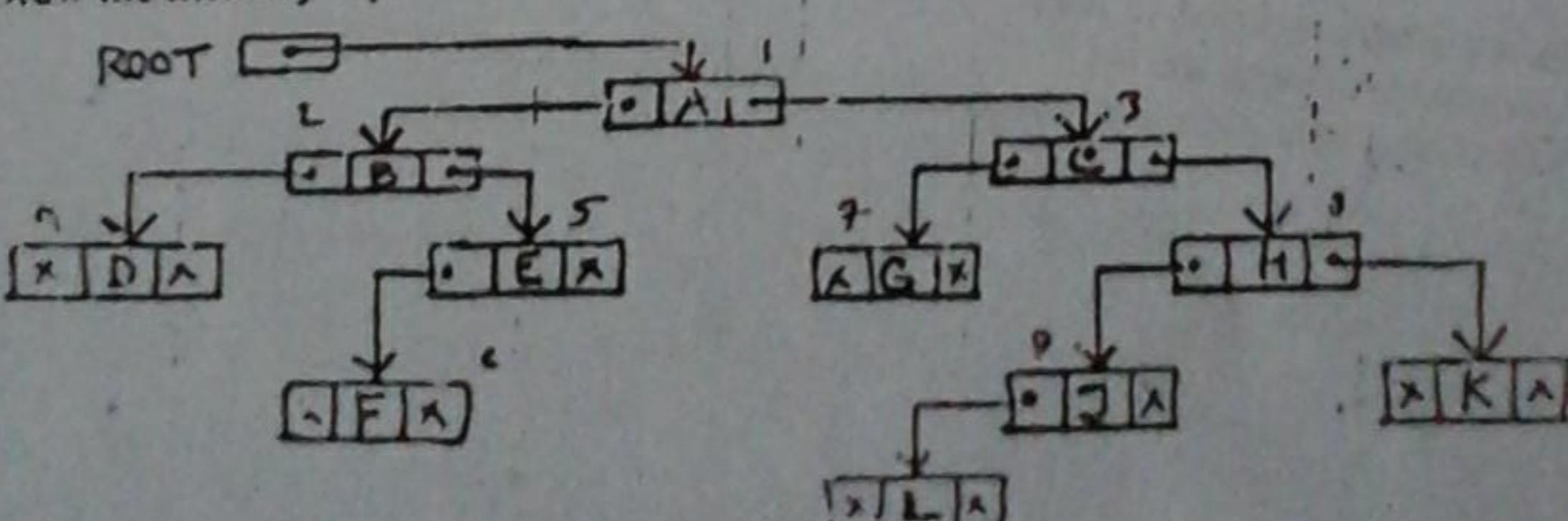
- i) Searching INFO
- ii) Inserting a node or data
- iii) Deleting a node or memory location

(b) Define Extended Binary Tree, External, Node. Build a tree from the following information given below -

Inorder : 15 55 20 85 18 33 22 95 30 70 65

Preorder : 95 85 55 15 20 33 18 22 70 30 65

(c) Draw the memory representation of the following linked representation of binary tree.



N.B. Answer six questions, taking three from each section.

The questions are of equal value.

Use separate answer script for each section.

SECTION-A

Q1. (a) Discuss all data structure operations in brief.

(b) Briefly describe the meaning of

- (i) The complexity of an algorithm and
- (ii) The space-time tradeoff of algorithms.

(c) Consider the alphabetized linear array NAME in Fig-1:

NAME	
1	Allen
2	Clark
3	Dickens
4	Edwards
5	Goodman
6	Hobbs
7	Irwin
8	Klein
9	Lewis
10	Morgan
11	Richards
12	Scott
13	Tucker
14	Walton

Fig-1

(i) Find the number of elements that must be moved if Brown, Johnson and Peters are inserted into NAME at three different times.

(ii) How many elements are moved if the three names are inserted at the same time?

(d) Compare the running time T_1 of the linear search algorithm with the running time T_2 of the binary search algorithm when

- (i) $n=1000$ and (ii) $n=10000$.

Q2. (a) Quick sort is better than bubble sort, explain with suitable example.

(b) Suppose the following numbers are stored in an array A:

32, 51, 27, 85, 66, 23, 13, 57.

Sort the array A by applying bubble sort technique.

(c) Suppose A be an $n \times n$ square matrix array. Write a module that

- (i) Finds the number NUM of nonzero elements in A.
- (ii) Finds the SUM of the elements above the diagonal, i.e. elements $A[i,j]$ where $i < j$.
- (iii) Finds the product PROD of the diagonal elements.

Q3. (a) What is the difference between queue and deque?

(b) Define

- (i) Input-restricted deque and
- (ii) Output-restricted deque.

(e) Describe briefly, how to work the priority queue during data processing.

N.B. Answer six questions, taking three from each section.

The questions are of equal value.

Use separate answer script for each section.

Section A

5 x 9 = 45

Q.1(a) Define following functions recursively:

$$(i) \sum_{k=0}^n a^k \quad (ii) x!$$

Transform each of the following expression to prefix and postfix:

$$(i) A+B-C \quad (ii) (A+B)^*(C-D) \quad (iii) (A-B)/((D+E)^F)$$

Using the bubble sort algorithm, find the number of C of comparisons and the number of D of interchanges which alphabetize the n=10 letters in CS1STUDENT. C D E E N S T T U

Q.2(a) Is there any disadvantage of linear array in comparison to linked-list?

(b) Suppose LIST be a linked-list in memory. Write a procedure which

(i) Finds the number NUM of time a given ITEM occurs in LIST.

(ii) Finds the number NUM of nonzero elements in LIST.

(iii) Adds a given value K to each elements in LIST.

(c) Suppose a 10-element array A contains the values a_1, a_2, \dots, a_{10} . Find the values in A after each loop.

(i) Repeat for K=1 to 9:

set $A[K+1]:=A[K]$.

[End of loop]

(ii) Repeat for K=9 to 1 by -1:

set $A[K+1]:=A[K]$.

[End of loop]

Q.3(b) Suppose S consists of the following n=12 numbers:

44,33,11,55,77,90,40,60,99,22,88,66 — 173

Find the final position of one of the numbers by using quicksort algorithm.

Consider the algebraic expression $E=(2x+y-z)(5a-b+c)$. Draw the tree T which corresponds to the expression E.

(e) Draw all the possible non-similar trees T, where

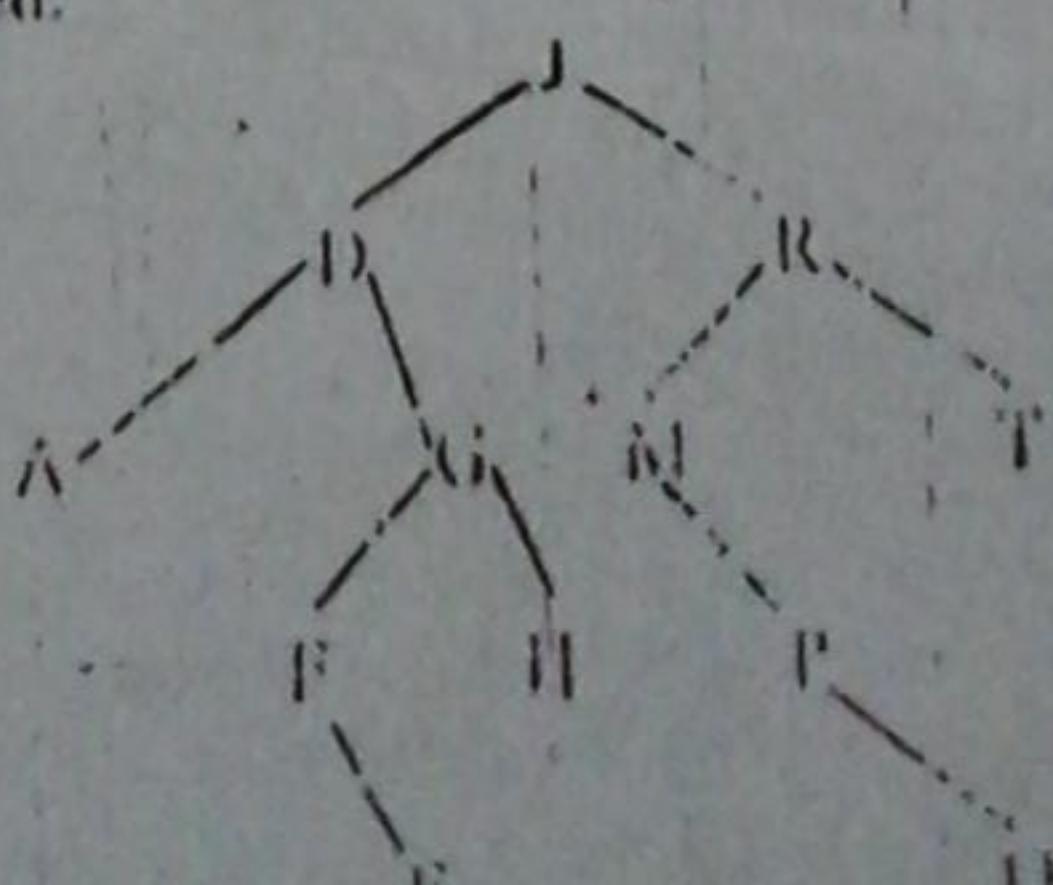
(i) T is a binary tree with 3 nodes.

(ii) T is a 2-tree with 4 external nodes

(f) Consider the binary search tree T of the following figure. Describe the tree after

(i) The node M is deleted and

(ii) The node D is also deleted.



~~Q. 5(a)~~ Suppose the six weights 4, 15, 25, 58, 16 are given. Find all possible 2-trees with the given weights and a minimum weighted path length 1.

(b) Sorting the following numbers by using RADIX SORT algorithm:

348, 142, 361, 423, 538, 128, 321, 543, 366.

(c) Explain the hash functions. What do you mean by collision in hash techniques?

Section II

~~Q. 5(b)~~ Consider the following STACK of characters where STACK is allocated $N=8$ memory cells:

STACK: A, C, D, E, K, ..., \dots (--- denotes empty memory locations).

Describe the STACK as the following operations take place: (i) POP (STACK, I, TEAM) (ii) POP (STACK, ITTEAM) (iii) PUSH (STACK, I) (iv) PUSH (STACK, P) (v) POP (STACK, ITTEAM) (vi) PUSH (STACK, R) (vii) PUSH (STACK, S) (viii) POP (STACK, ITTEAM).

~~Q. 5(c)~~ A queue is maintained by a circular binary QUEUE with $N=12$ memory cells. Find the number of elements in QUEUE if-

(i) FRONT=1, REAR=8.

(ii) FRONT=10, REAR=3.

(iii) FRONT=5, REAR=6 and then two elements are deleted.

~~Q. 6(a)~~ Write short notes on

(i) DEQUES and (ii) PRIORITY QUEUES.

~~Q. 6(b)~~ What is data structure? What are the major operations that are performed on data structure?

(b) Draw the schematic diagram using tree of the recursive procedure TOWER (A, B, C) for solving the problem "Tower of Hanoi".

(c) Consider the following queue where QUEUE is allocated 6 memory cells:

FRONT=2, REAR=5, QUEUE: ----, London, Berlin, Rome, Paris, ----.

(---- denotes empty memory locations).

Describe QUEUE including FRONT and REAR as the following operations take place.

(i) Athens is added (ii) Two cities are deleted (iii) Madrid is added (iv) Moscow is added

(v) Three cities are deleted.

~~Q. 7(a)~~ Represent the array A containing 13 elements as follows:

A: 20, -10, 7, 67, 53, 90, 10, -50, 99, 7, 105, 56, -70. Visualize each pass of 'merge sort' algorithm on this array.

(b) What is collision? How can it be resolved by chaining?

(c) Find 2-digits hash address for each of the following 4-digit numbers using division method with m=97: (i) 9614 (ii) 5882 (iii) 6713.

~~Q. 8(a)~~

Show all the steps for sorting the following array using insertion sort.

A: 10, -20, 7, 55, 25, 50, -20.

(b) The following figure is a list of the five hospital patients and their room number.

(i) Fill the values for NSTART and NLINK so that they form an alphabetical listing of names

(ii) Fill the values for RSTART and RLINK so that they form an ordering of room numbers.

NSTART

02

RSTART

402

	NAME	ROOM	NLINK	RLINK
1	Brown	650	5	709
2	Smith	422	9	162
3	Adams	104	1	0
4	Jones	462	2	637
5	Burns	632	4	650

~~Q. 8(b)~~ Traverse the following tree by using pre-order and in-order technique.

