Roll No: | | | | | | | | | | | | | |

BTECH
(SEM III) THEORY EXAMINATION 2021-22
DATA STRUCTURE

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If you require any missing data, then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2X10 = 20

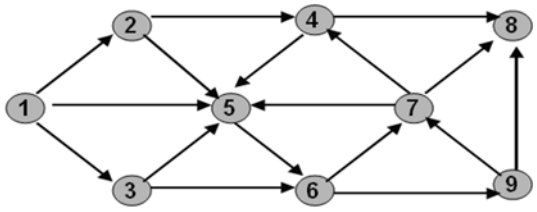
Q No	Questions	CO
(a)	Convert the infix expression (A+B) *(C-D) $E*F to postfix. Give the answer without any spaces.	1
(b)	Rank the following typical bounds in increasing order of growth rate: $O(\log n)$, $O(n^4)$, $O(1)$, $O(n^2 \log n)$	2
(c)	Draw the binary search tree that results from inserting the following numbers in sequence starting with 11: 11, 47, 81, 9, 61, 10, 12,	3

(d)	What does the following recursive function do for a given Linked List with first node as head?
	void fun1(struct node* head)
	{
	if(head == NULL)
	return;
	fun1(head->next);
	printf("%d ", head->data);
	}
		4

(e)	Define a sparse matrix. Suggest a space efficient representation for space matrices.	5
(f)	List the advantages of doubly linked list over single linked list.	1
(g)	Give example of one each stable and unstable sorting techniques.	2
(h)	Write advantages of AVL tree over Binary Search Tree (BST)	3
(i)	What is tail recursion? Explain with a suitable example.	4
(j)	Write different representations of graphs in the memory.	5

SECTION B

2. Attempt any *three* of the following: 10X3 = 30

Q No	Questions	CO
(a)	Write advantages and disadvantages of linked list over arrays. Write a 'C' function creating new linear linked list by selecting alternate elements of a linear linked list.	**1**
(b)	Write algorithms of insertion sort. Implement the same on the following numbers; also calculate its time complexity. 13, 16, 10, 11, 4, 12, 6, 7	**2**
(c)	Differentiate between DFS and BFS. Draw the breadth First Tree for the above graph. 	**3**
(d)	Differentiate between liner and binary search algorithm. Write a recursive function to implement binary search.	**4**
(e)	What is the significance of maintaining threads in Binary Search Tree? Write an algorithm to insert a node in thread binary tree.	**5**

SECTION C

3. Attempt any *one* part of the following: 10X1 = 10

Q No	Questions	CO
(a)	Suppose a three dimensional array A is declared using A[1:10, -5:5, -10:5) (i) Find the length of each dimension and the number of elements in A (ii) Explain Row major order and Column Major Order in detail with explanation formula expression.	1

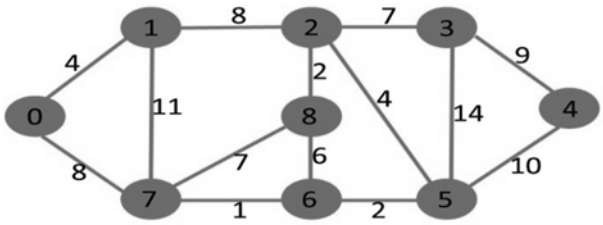
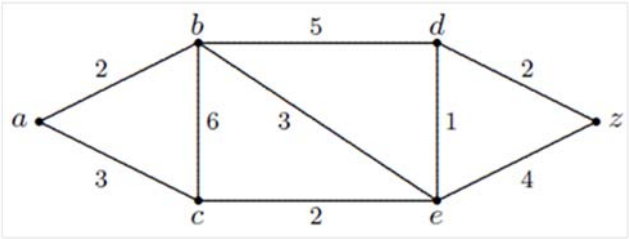
BTECH
(SEM III) THEORY EXAMINATION 2021-22
DATA STRUCTURE

(b)	Discuss the representation of polynomial of single variable using linked list. Write 'C' functions to add two such polynomials represented by linked list.	1

4. **Attempt any *one* part of the following:** **10 X1 = 10**

Q No	Questions	CO
(a)	(i) Use the merge sort algorithm to sort the following elements in ascending order. 13, 16, 10, 11, 4, 12, 6, 7. What is the time and space complexity of merge sort? (ii) Use quick sort algorithm to sort 15,22,30,10,15,64,1,3,9,2. Is it a stable sorting algorithm? Justify.	2
(b)	(i) The keys 12, 17, 13, 2, 5, 43, 5 and 15 are inserted into an initially empty hash table of length 15 using open addressing with hash function h(k) = k mod 10 and linear probing. What is the resultant hash table? (ii) Differentiae between linear and quadratic probing techniques.	2

5. **Attempt any *one* part of the following:** **10X1 = 10**

Q No	**Questions**	**CO**
(a)	Use Dijkstra's algorithm to find the shortest paths from source to all other vertices in the following graph. 	**3**
(b)	Apply Prim's algorithm to find a minimum spanning tree in the following weighted graph as shown below. 	**3**

6. **Attempt any *one* part of the following:** **10X1 = 10**

Q No	**Questions**	**CO**
(a)	(i) Write an iterative function to search a key in Binary Search Tree (BST). (ii) Discuss disadvantages of recursion with some suitable example.	4
(b)	(i) What is Recursion? (ii)Write a C program to calculate factorial of number using recursive and non-recursive functions.	4

7. **Attempt any *one* part of the following:** **10X1 = 10**

Q No	Questions	CO
(a)	(i) Why does time complexity of search operation in B-Tree is better than Binary Search Tree (BST)? (ii) Insert the following keys into an initially empty B-tree of order 5 a, g, f, b, k, d, h, m, j, e, s, i, r, x, c, l, n, t, u, p (iii) What will be the resultant B-Tree after deleting keys j, t and d in sequence?	5
(b)	(i) Design a method for keeping two stacks within a single linear array so that neither stack overflow until all the memory is used. (ii) Write a C program to reverse a string using stack.	5

Printed Pages: 2 **Sub Code: KCS- 301**

Paper Id: 233380 **Roll No.** | | | | | | | | | | |

B. TECH.
(SEM III) THEORY EXAMINATION 2022-23
DATA STRUCTURE

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

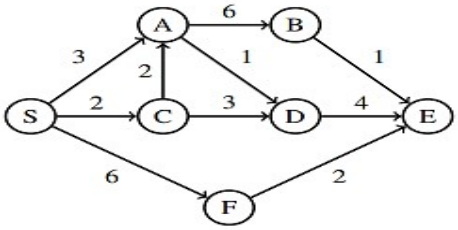
(a) Define best case, average case and worst case for analyzing the complexity of a program.
(b) Differentiate between binary search tree and a heap.
(c) Write the condition for empty and full circular queue.
(d) What do you understand by tail recursion?
(e) Construct an expression tree for the following algebraic expression:
(a - b) / ((c * d) + e)
(f) Differentiate between internal sorting and external sorting.
(g) What are the advantages and disadvantages of array over linked list?
(h) Write an algorithm for Breadth First Search (BFS) traversal of a graph.
(i) In a complete binary tree if the number of nodes is 1000000. What will be the height of complete binary tree.
(j) Which data structure is used to perform recursion and why?

SECTION B

2. Attempt any *three* of the following: 10x3=30

(a) Assume that the declaration of multi-dimensional arrays X and Y to be,
X (-2:2, 2:22) and Y (1:8, -5:5, -10:5)
(i) Find the length of each dimension and number of elements in X and Y.
(ii) Find the address of element Y (2, 2, 3), assuming Base address of Y = 400 and each element occupies 4 memory locations.

(b) What is Stack? Write a C program for linked list implementation of stack.
(c) Write an algorithm for Quick sort. Use Quick sort algorithm to sort the following elements: **2, 8, 7, 1, 3, 5, 6, 4**
(d) Write the Dijkstra algorithm for shortest path in a graph and also find the shortest path from 'S' to all remaining vertices of graph in the following graph:



(e) The order of nodes of a binary tree in inorder and postorder traversal are as follows:

In order : **B, I, D, A, C, G, E, H, F.**

Post order: **I, D, B, G, C, H, F, E, A.**

(i) Draw the corresponding binary tree.
(ii) Write the pre order traversal of the same tree.

SECTION C

3. Attempt any *one* part of the following: 10x1=10

(a) How to represent the polynomial using linked list ? Write a C program to add two polynomials using linked list.

(b) Discuss doubly linked list. Write an algorithm to insert a node after a given node in singly linked list.

4. Attempt any *one* part of the following: 10x1=10

(a) Write an algorithm for converting infix expression into postfix expression. Trace your algorithm for infix expression Q into its equivalent postfix expression P,

Q: A + (B * C – (D / E ^ F) * G) * H

(b) What is circular Queue? Write a C code to insert an element in circular queue?

5. Attempt any *one* part of the following: 10x1=10

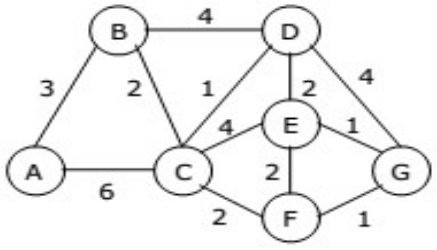
(a) What is Hashing? Explain division method to compute the hash function and also explain the collision resolution strategies used in hashing.

(b) Write an algorithm for Heap Sort. Use Heap sort algorithm, sort the following sequence:

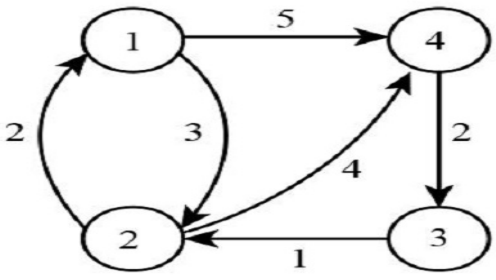
18, 25, 45, 34, 36, 51, 43, and 24.

6. Attempt any *one* part of the following: 10x1=10

(a) What is spanning tree? Write down the Prim's algorithm to obtain minimum cost spanning tree. Use Prim's algorithm to find the minimum cost spanning tree in the following graph:



(b) Write and explain the Floyd Warshall algorithm to find the all pair shortest path. Use the Floyd Warshall algorithm to find shortest path among all the vertices in the given graph:



7. Attempt any *one* part of the following: 10x1=10

(a) Discuss left skewed and right skewed binary tree. Construct an AVL tree by inserting the following elements in the order of their occurrence:

60, 2, 14, 22, 13, 111, 92, 86.

(b) What is B-Tree? Write the various properties of B- Tree. Show the results of inserting the keys **F, S, Q, K ,C, L, H, T, V, W, M, R, N, P, A, B** in order into a empty B-Tree of order **5.**

Paper Id: 110321 Roll No: | | | | | | | | | | | | | |

B. TECH.
(SEM III) THEORY EXAMINATION 2019-20
DATA STRUCTURES

Time: 3 Hours *Total Marks: 100*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

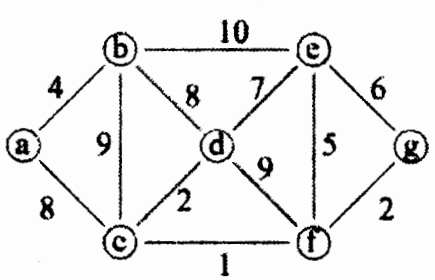
SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Qno.	Question	Marks	CO
a.	How can you represent a sparse matrix in memory?	2	CO1
b.	List the various operations on linked list.	2	CO1
c.	Give some applications of stack.	2	CO2
d.	Explain Tail recursion.	2	CO2
e.	Define priority queue. Given one application of priority queue.	2	CO3
f.	How does bubble sort work? Explain.	2	CO3
g.	What is Minimum cost spanning tree? Give its applications.	2	CO4
h.	Compare adjacency matrix and adjacency list representations of graph.	2	CO4
i.	Define extended binary tree, full binary tree, strictly binary tree and complete binary tree.	2	CO5
j.	Explain threaded binary tree.	2	CO5

SECTION B

2. Attempt any *three* of the following: **3 x 10 = 30**

Qno.	Question	Marks	CO
a.	What are the merits and demerits of array? Given two arrays of integers in ascending order, develop an algorithm to merge these arrays to form a third array sorted in ascending order.	10	CO1
b.	Write algorithm for Push and Pop operations in stack. Transform the following expression into its equivalent postfix expression using stack: A + (B * C – (D / E ↑ F) * G) * H	10	CO2
c.	How binary search is different from linear search? Apply binary search to find item 40 in the sorted array: 11, 22, 30, 33, 40, 44, 55, 60, 66, 77, 80, 88, 99. Also discuss the complexity of binary search.	10	CO3
d.	Find the minimum spanning tree in the following graph using Kruskal's algorithm: 	10	CO4
e.	What is the difference between a binary search tree (BST) and heap? For a given sequence of numbers, construct a heap and a BST. 34, 23, 67, 45, 12, 54, 87, 43, 98, 75, 84, 93, 31	10	CO5

Paper Id: 110321 Roll No: | | | | | | | | | | | | | |

SECTION C

3. Attempt any *one* part of the following: 1 x 10 = 10

Qno.	Question	Marks	CO
a.	What is doubly linked list? What are its applications? Explain how an element can be deleted from doubly linked list using C program.	10	CO1
b.	Define the following terms in brief: (i) Time complexity (iii) Space complexity (ii) Asymptotic Notation (iv) Big O Notation	10	CO1

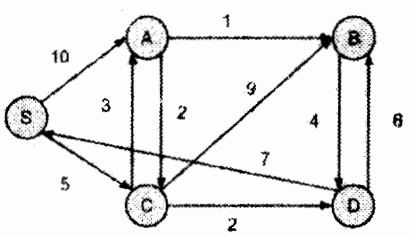
4. Attempt any *one* part of the following: 1 x 10 = 10

Qno.	Question	Marks	CO
a.	(i) Differentiate between iteration and recursion. (ii) Write the recursive solution for Tower of Hanoi problem.	10	CO2
b.	Discuss array and linked representation of queue data structure. What is dequeue?	10	CO2

5. Attempt any *one* part of the following: 1 x 10 = 10

Qno.	Question	Marks	CO
a.	Why is quick sort named as quick? Show the steps of quick sort on the following set of elements:25, 57, 48, 37, 12, 92, 86, 33 Assume the first element of the list to be the pivot element.	10	CO3
b.	What is hashing? Give the characteristics of hash function. Explain collision resolution technique in hashing.	10	CO3

6. Attempt any *one* part of the following: 1 x 10 = 10

Qno.	Question	Marks	CO
a.	Explain warshall's algorithm with the help of an example.	10	CO4
b.	Describe the Dijkstra algorithm to find the shortest path. Find the shortest path in the following graph with vertex 'S" as source vertex.  	10	CO4

7. Attempt any *one* part of the following: 1 x 10 = 10

Qno.	Question	Marks	CO
a.	Can you find a unique tree when any two traversals are given? Using the following traversals construct the corresponding binary tree: INORDER: H K D B I L E A F C M J G PREORDER: A B D H K E I L C F G J M Also find the Post Order traversal of obtained tree.	10	CO5
b.	What is a B-Tree? Generate a B-Tree of order 4 with the alphabets (letters) arrive in the sequence as follows: a g f b k d h m j e s i r x c l n t u p	10	CO5

PAPER ID-311107

Roll No: | | | | | | | | | | | | | |

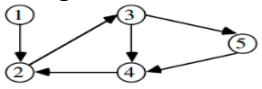
B. TECH
(SEM III) THEORY EXAMINATION 2020-21
DATA STRUCTURES

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Q no.	Question	Marks	CO
a.	Define Time-Space trade-off.	2	1
b.	Differentiate Array and Linked list.	2	1
c.	Explain Tail Recursion with suitable example.	2	2
d.	Write the full and empty condition for a circular queue data structure.	2	2
e.	Examine the minimum number of interchanges needed to convert the array 90, 20, 41,18, 13, 11, 3, 6, 8,12, 7, 71, 99 into a maximum heap.	2	3
f.	Differentiate sequential search and binary search.	2	3
g.	Compute the Transitive closure of following graph. 	2	4
h.	Write short notes on adjacency multi list representation a Graph.	2	4
i.	What is the importance of threaded binary tree?	2	5
j.	Write short notes on min heap.	2	5

SECTION B

2. Attempt any *three* of the following:

Q no.	Question	Marks	CO
a.	Consider a multi-dimensional Array *A*[90] [30] [40] with base address starts at 1000. Calculate the address of A[10] [20] [30] in row major order and column major order. Assume the first element is stored at *A*[2][2][2] and each element take 2 byte.	10	1
b.	Evaluate the following postfix expression using stack. **2 3 9 * + 2 3 ^ - 6 2 / +** , show the contents of each and every steps. also find the equivalent prefix form of above expression. Where ^ is an exponent operator.	10	2
c.	Explain any three commonly used hash function with the suitable example? A hash function H defined as H(key) =key%7, with linear probing, is used to insert the key 37,38,72,48,98,11,66 into a table indexed from 0 to 6. what will be the location of key 11? Justify your answer, also count the total number of collisions in this probing.	10	3
d.	Write an algorithm for Breadth First search (BFS) and explain with the help of suitable example.	10	4
e.	If the in order of a binary tree is B,I,D,A,C,G,E,H,F and its post order is I,D,B,G,C H,F,E,A then draw a corresponding binary tree with neat and clear steps from above assumption.	10	5

Roll No: | | | | | | | | | | | | | |

SECTION C

3. Attempt any *one* part of the following:

Q no.	Question	Marks	CO
a.	Consider the two dimensional lower triangular matrix (LTM) of order N ,Obtain the formula for address calculation in the address of row major and column major order for location LTM[j][k], if base address is BA and space occupied by each element is w byte.	10	1
b.	Write a C program to insert a node at k^{th} position in single linked list.	10	1

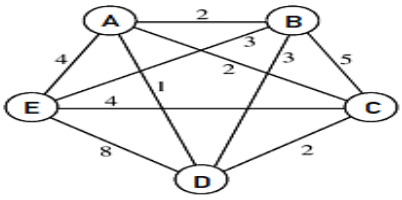
4. Attempt any *one* part of the following:

Q no.	Question	Marks	CO
a.	Convert the following infix expression to reverse polish notation expression using stack. $$x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$	10	2
b.	Write a C program to implement stack using single linked list.	10	2

5. Attempt any *one* part of the following:

Q no.	Question	Marks	CO
a.	Write an algorithm for merge sort and apply on following elements 45,32,65,76,23,12,54,67,22,87.	10	3
b.	Write a C program for Index Sequential Search.	10	3

6. Attempt any *one* part of the following:

Q no.	Question	Marks	CO
a.	Describe Prim`s algorithm and find the cost of minimum spanning tree using Prim`s Algorithm. 	10	4
b.	Apply the Floyd warshall's algorithm in above mentioned graph (i.e. in Q.no 6a)	10	4

7. Attempt any *one* part of the following:

Q no.	Question	Marks	CO
a.	Write Short notes of following (a) Extended Binary Trees (b) Complete Binary Tree (c) Threaded Binary Tree.	10	5
b.	Insert the following sequence of elements into an AVL tree, starting with empty tree 71,41,91,56,60,30,40,80,50,55 also find the minimum array size to represent this tree.	10	5

Printed Pages: 02 **Sub Code: RCS305**

Paper ID: | 1 | 0 | 0 | 4 | **Roll No.** | | | | | | | | | | |

B TECH
(SEM III) THEORY EXAMINATION 2017-18
DATA STRUCTURES

Time: 3Hours ***Max. Marks: 70***

Note: Attempt all Sections. Assume missing data, if any.

SECTION A

1. Attempt *all* questions in brief: 2 x 7 = 14

a. Define the term Data Structure. List some linear and non-linear data structures stating the application area where they will be used.

b. Discuss the concept of "successor" and “predecessor” in Binary Search Tree.

c. Convert the following arithmetic infix expression into its equivalent postfix expression.

Expression: A-B/C+D*E+F

d. Explain circular queue. What is the condition if circular queue is full?

e. Calculate total number of moves for Tower of Hanoi for n=10 disks.

f. List the different types of representation of graphs.

g. Explain height balanced tree. List general cases to maintain the height.

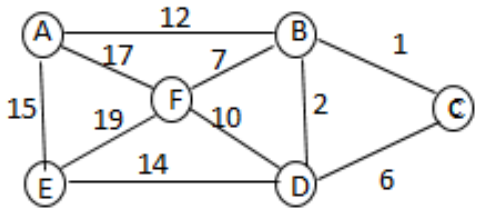
SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a. What do you understand by time space trade off? Explain best, worst and average case analysis in this respect with an example

b. Use quick sort algorithm to sort 15,22,30,10,15,64,1,3,9,2. Is it a stable sorting algorithm? – Justify.

c. Define spanning tree. Also construct minimum spanning tree using prim’s algorithm for the given graph.



d. Define tree, binary tree, complete binary tree and full binary tree. Write algorithms or function to obtain traversals of a binary tree in preorder, postorder and inorder.

e. Construct a B-tree on following sequence of inputs.

10, 20, 30, 40, 50, 60, 70, 80, 90

Assume that the order of the B-tree is 3.

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a) What are the various asymptotic notations? Explain Big O notation.

(b) Write an algorithm to insert a node at the end in a Circular linked list.

4. Attempt any *one* part of the following: 7 x 1 = 7

(a)What is a Stack .Write a C program to reverse a string using stack.

(b)Define the recursion. Write a recursive and non recursive program to calculate the factorial of the given number.

5. Attempt any *one* part of the following: 7 x 1 = 7

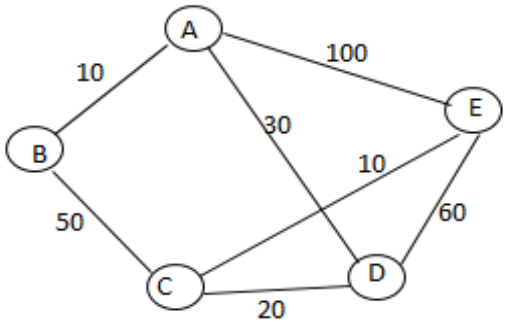
(a) Draw a binary tree with following traversals:
Inorder: B C A E G D H F I J
Preorder: A B C D E G F H I J

(b) Consider the following AVL Tree and insert 2, 12, 7and 10 as new node. Show proper rotation to maintain the tree as AVL.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a)What is a Threaded Binary Tree? Explain the advantages of using a threaded binary tree.

(b)Describe Dijkstra's algorithm for finding shortest path. Describe its working for the graph given below.



7. Attempt any *one* part of the following: 7 x 1 = 7

(a)Write short notes on:

i. Hashing Technique
ii. Garbage collection

(b)Explain the following:

i. Heap Sort
ii. Radix Sort.

Printed Pages: 02
Paper Id: 1 1 0 3 0 3

Sub Code: RCS305
Roll No.

B. TECH.
(SEM III) THEORY EXAMINATION 2018-19
DATA STRUCTURES

Time: 3 Hours *Total Marks: 70*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 7 = 14**

a. How the graph can be represented in memory? Explain with suitable example.

b. Write the syntax to check whether a given circular queue is full or empty?

c. Draw a binary Tree for the expression: A * B - (C + D) * (P /Q)

d. Differentiate between overflow and underflow condition in a linked list.

e. What do you understand by stable and in place sorting?

f. Number of nodes in a complete tree is 100000. Find its depth.

g. What is Recursion? Give disadvantages of recursion.

SECTION B

2. Attempt any *three* of the following: **7 x 3 = 21**

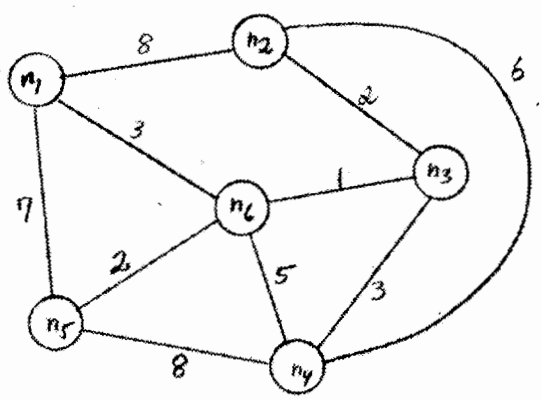
a. What do you understand by time and space trade off? Define the various asymptotic notations. Derive the O-notation for linear search.

b. Consider the following infix expression and convert into reverse polish notation using stack. A + (B * C – (D / E ^ F) * H)

c. Explain Huffman algorithm. Construct Huffman tree for MAHARASHTRA with its optimal code.

d. What is a height balanced Tree? Why height balancing of Tree is required? Create an AVL Tree for the following elements: a, z, b, y, c, x, d, w, e, v, f

e. Write the Floyd Warshall algorithm to compute the all pair shortest path. Apply the algorithm on following graph:



SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a) Write a program in c to delete a specific element in single linked list. Double linked list takes more space than single linked list for storing one extra address. Under what condition, could a double linked list more beneficial than single linked list.

(b) Suppose multidimensional arrays P and Q are declared as P (-2: 2, 2: 22) and Q (1: 8, -5: 5, -10: 5) stored in column major order

(i) Find the length of each dimension of P and Q

(ii) The number of elements in P and Q

(iii) Assuming Base address (Q) = 400, W=4, Find the effective indices E1, E2, E3 and address of the element Q [3, 3, 3].

4. Attempt any *one* part of the following: 7 x 1 = 7

(a) Explain Tower of Hanoi problem and write a recursive algorithm to solve it.

(b) Explain how a circular queue can be implemented using arrays. Write all functions for circular queue operations.

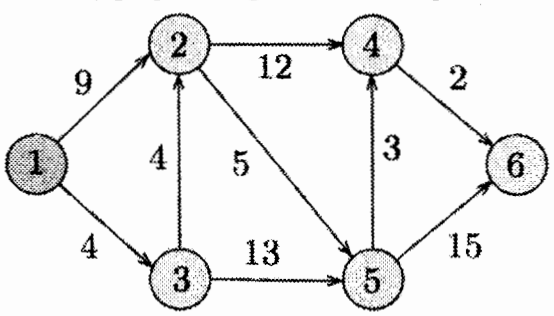
5. Attempt any *one* part of the following: 7 x 1 = 7

(a) Write the algorithm for deletion of an element in binary search tree.

(b) Construct the binary tree for the following.
In-order: Q, B, K, C, F, A, G, P, E, D, H, R
Preorder: G, B, Q, A, C, K, F, P, D, E, R, H
Find the Post Order of the Tree.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) By considering vertex '1' as source vertex, Find the shortest paths to all other vertices in the following graph using Dijkstra's algorithms. Show all the steps.



(b) Explain in detail about the graph traversal techniques with suitable examples.

7. Attempt any *one* part of the following: 7 x 1 = 7

(a) Write algorithm for Quick sort. Trace your algorithm on the following data to sort the list: 2, 13, 4, 21, 7, 56, 51, 85, 59, 1, 9, 10. How the choice of pivot element effects the efficiency of algorithm.

(b) Construct a B-tree of order 5 created by inserting the following elements
3, 14, 7, 1, 8, 5, 11, 17, 13, 6, 23, 12, 20, 26, 4, 16, 18, 24, 25, 19
Also delete elements 6, 23 and 3 from the constructed tree.