

GURU NANAK INSTITUTE OF TECHNOLOGY

An Autonomous Institute under MAKAUT

2020-2021

DATA STRUCTURE

EE504A

TIME ALLOTTED: 3 HOURS

FULL MARKS: 70

*The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

Answer any *ten* from the following, choosing the correct alternative of each question: **10×1=10**

		Marks	CO No
1(i)	Sparse matrices have a) many zeros entries b) many non-numeric entries c) higher dimension d) none of the mentioned	1	CO2
1(ii)	The minimum number of stacks needed to implement a queue is a) 1 b) 2 c) 3 d) 4	1	CO3
1(iii)	A data structure where elements can be added or removed at either end but not in the middle a) Linked list b) Stack c) Queue d) none of the mentioned	1	CO3
1(iv)	What is the result of the following operation Top (Push (S, X)) a) S b) Null c) X d) none of the mentioned	1	CO3

1(v)	The postfix expression for $* + a b - c d$ is a) $ab + cd - *$ b) $ab cd + - *$ c) $ab + cd * -$ d) $ab + - cd *$	1	CO3
1(vi)	The searching technique that takes $O(1)$ time to find a data is a) Binary Search b) Linear Search c) Interpolation Search d) Hashing	1	CO5
1(vii)	A single array $A [1.....MAXSIZE]$ is used to implement two stacks. The two stacks grow from opposite ends of the array. Variables $top1$ and $top2$ ($top1 < top2$) point to the location of the topmost element in each of the stacks. If the space is to be used efficiently, the condition for “stack full” is a) $(top1=MAXSIZE/2)$ and $(top2=MAXSIZE/2+1)$ b) $top1+top2=MAXSIZE$ c) $(top1=MAXSIZE/2)$ or $(top2=MAXSIZE)$ d) $top1=top2-1$	1	CO3
1(viii)	The following numbers are inserted into an empty binary search tree in the given order: 10, 1, 3, 5, 15, 12, 16. What is the height of the binary search tree (tree height is the maximum distance of a leaf node from the root)? a) 2 b) 3 c) 4 d) 6	1	CO4
1(ix)	Suppose the numbers 7, 5, 1, 8, 3, 6, 0, 9, 4, 2 are inserted in that order into an initially empty binary search tree. The binary search tree uses the usual ordering on natural numbers. What is the inorder transversal sequence of the resultant tree? a) 7 5 1 0 3 2 4 6 8 9 b) 0 2 4 3 1 6 5 9 8 7 c) 0 1 2 3 4 5 6 7 8 9 d) 9 8 6 4 2 3 0 1 5 7	1	CO4
1(x)	Postorder traversal of a given binary search tree, T produces the following sequence of keys 10, 9, 23, 22, 27, 25, 15, 50, 95, 60, 40, 29 Which one of the following sequences of keys can be the result of an inorder traversal of the tree T? a) 9, 10, 15, 22, 23, 25, 27, 29, 40, 50, 60, 95 b) 9, 10, 15, 22, 40, 50, 60, 95, 23, 25, 27, 29	1	CO4

- c) 29, 15, 9, 10, 25, 22, 23, 27, 40, 60, 50, 95
 d) 95, 50, 60, 40, 27, 23, 22, 25, 10, 0, 15, 29

1(xi)	Number of nodes in a complete binary tree of depth k is a) $2k$ b) 2^k c) 2^{k-1} d) k	1	CO4
1(xii)	The result evaluating the postfix expression 10 5 + 60 6 / * 8 - is a) 284 b) 213 c) 142 d) 71	1	CO3

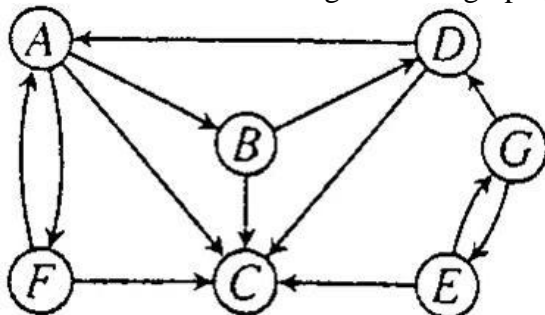
GROUP – B

(Short Answer Type Questions)

(Answer any *three* of the following)

3 × 5 = 15

		Marks	CO No
2.	What is Tail recursion give example	5	CO1
3 (a)	How can a polynomial such as $5x^4 - 8x^3 + 2x^2 + 4x^1 + 9x^0$ be represented by a linked list?	2	CO2
3 (b)	Let the size of the elements stored in a 10×10 matrix be 4 bytes each. If the base address (i.e. address of the first element $A[0][0]$) of the matrix is 2000, then find the address of A [5, 7] for both row major & column major cases.	3	CO2
4 (a)	Show that $3n^2+4n+1 = O(n^2)$.	2	CO1
4 (b)	Compare and contrast between array and a single linked list.	3	CO2
5	Show the result of running DFS the graph given below.	5	CO5



6 (a)	What do you mean by AVL tree? Explain with example.	1	CO4
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- 6 (b) Given the preorder and inorder sequence, draw the resultant binary tree and write its postorder traversal. 4 CO4

Pre-order: A B D G H E I C F J K

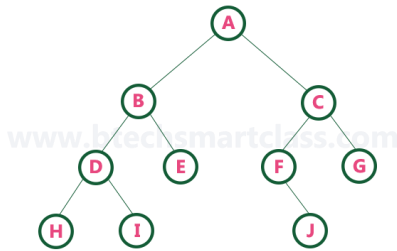
In-order: G D H B E I A C J F K

GROUP – C

(Long Answer Type Questions)

(Answer any *three* of the following) **3 × 15 = 45**

		Marks	CO No
7 (a)	Convert the following Infix expression to Postfix form using a stack: $x + y * z + (p * q + r) * s$, Follow usual precedence rule and assume that the expression is legal	6	CO3
7 (b)	Write down the algorithm for push and pop operation in the stack.	4	CO3
7 (c)	Write down a tail-recursive function to calculate factorial of a number.	5	CO3
8 (a)	What is Threaded Binary Tree	3	CO3
8 (b)	Build a Threaded Tree on given Tree	5	CO3



- 8 (c) What is Expression Tree 2 CO3

- 8 (d) Build a Expression Tree on given Tree $3 + ((5+9)*2)$ 5 CO2

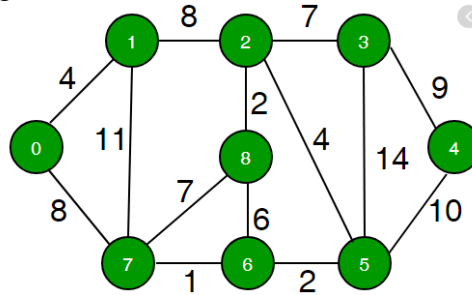
- 9 (a) Write down the algorithm of Selection Sort. 5 CO5

- 9 (b) Sort the following array **in ascending order** using **quick Sort** technique. Show the intermediate orientation of the array after each and every inner loop, i.e. show the array after each and every step. Take the last element as a pivot.
19,14,16,7,17,10,13,8

- 10 (a) What do you mean by binary search tree? 2 CO4

- 10 (b) Insert the following list of elements one by one to build them into an Binary Search Tree:
13, 10, 3, 5, 18, 15, 14

- 10 (c) Write a C function algorithm to delete end node in a circular linked list. 5 CO2
- 10 (d) Apply Prim's algorithm on the graph in following figure to find minimum spanning tree: 5 CO4



- 11 (a) Sort the following array (of characters) in descending order (in lexicographic descending order) using bubble Sort technique. Show the intermediate orientation of the array after each and every inner loop, i.e. show the array after each and every step.
E, A, I, O, U 5 CO5
- 11 (b) Write a C program where two arrays of integers are input and generate output the largest number in the first array not present in the second one. 5 CO2
- 11 (c) Insert the characters of the string K R P C S N Y T J M into a hash table of size 10. Use the hash function

$$h(x) = (\text{ord}(x) - \text{ord}("A") + 1) \bmod 10$$
 where, $\text{ord}("A") = 1$
 $\text{ord}("B") = 2$
 $\text{ord}("C") = 3$
 and so on
 Use linear probing resolve collisions.
 Design the resultant hash table. 5 CO5