

**FUNDAMENTALS OF DATA STRUCTURE & ALGORITHMS
(INFO 2101)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

Candidates are required to give answer in their own words as far as practicable.

**Group – A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) The number of disk movements required to solve tower of Hanoi problem with 5 number of disks is
(a) 20 (b) 31
(c) 30 (d) None of the above
 - (ii) The application of heap tree is to efficiently
(a) Find largest element (b) Implement Priority Queue
(c) Perform Heap sort (d) All
 - (iii) If a graph has n nodes then the adjacency matrix used to represent it has size _____.
(a) $n * n$ (b) $n + n$
(c) $2*n$ (d) None
 - (iv) The inorder and preorder traversal of a tree are (D,B,A,E,C) and (A,B,D,C,E) respectively. Then the leaf nodes of the tree are _____.
(a) C, D, and E (b) C and E
(c) D and E (d) E
 - (v) A sparse graph is efficiently represented using
(a) Adjacency matrix (b) Adjacency list
(c) Adjoint data (d) None of the above
 - (vi) Pre-order traversal is also called _____.
(a) Depth first (b) Breadth first
(c) Level order (d) In-order
 - (vii) In array representation of a binary tree if index number of a node is 7 then index number of its right child is
(a) 12 (b) 13
(c) 14 (d) 15

- (viii) The following sequence of operations is performed on stack. push(1),push(2), pop(),push(1),push(2),pop(),pop(),pop(),push(2),pop(). The sequence of popped out values are_____
- (a) 2,2,1,1,2 (b) 2,2,1,2,2
(c) 2,1,2,2,1 (d) 2,1,2,2,2
- (ix) The postfix expression of $A+C/B*D-E$ is _____.
(a) $ACD/B*+E-$ (b) $A+C/B*D-E$
(c) $A+B/C*DE-$ (d) $ACB/D*+E-$
- (x) If a set of sorted integers is inserted in a Binary Search Tree then to search a certain item it's time complexity will be _____.
(a) $O(n)$. (b) $O(\log(\log n))$
(c) $O(\log n)$. (d) $O(n^2)$

Group – B

2. (a) Compare between array and linked list.
(b) Define abstract data type with an example.
(c) Write a program in C to count the number of nodes in a singly linked list.
3 + 4 + 5 = 12
3. (a) Explain an efficient way of storing a sparse matrix in memory. Write an algorithm to find the transpose of a sparse matrix.
(b) Write a C function to insert a node in an already created linked list.
(2 + 4) + 6 = 12

Group – C

4. (a) Write a C function to perform enqueue an element in a circular queue.
(b) Convert the following infix expression to its corresponding prefix and also its postfix expression. Show all the steps.
 $((X+Q*D)-(A-B*F)-(P/C*L))$
4 + (4 + 4) = 12
5. (a) Evaluate the following postfix expression using stack. Show all the steps.
 $(23+)4*7$
(b) Write an algorithm to implement a queue using stack.
6 + 6 = 12

Group – D

6. (a) The inorder and preorder traversals of a binary tree T yield the following sequence of nodes. Draw the tree.

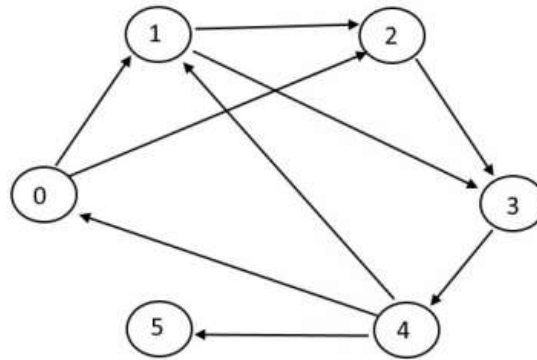
Inorder : D B H E A I F J C G

Preorder : A B D E H C F I J G

- (b) What is an AVL tree. Create an AVL search tree with the following elements. Show all the steps explicitly
59, 5, 19, 27, 15, 115, 94, 88.

$$6 + (2 + 4) = 12$$

7. (a) What is an expression tree? Represent the following expression using a tree.
 $E = (a+b) / ((c*d)+(e/f)).$
- (b) Find the breadth first search traversal and the depth first search traversal for the following graph, starting from node 0. Explain the steps.



$$(1 + 3) + (4 + 4) = 12$$

Group - E

8. (a) Using the Insertion Sort algorithm, find the number of key comparisons(C) and the number of swaps (D) in the 8 letter word HERITAGE. Show every step in the process.
- (b) Deduce worst case time complexity of Bubble sort and discuss how to improve.
9. (a) What are the properties of a heap. Transform the element of an array 2, 8, 6, 1, 10, 15, 5, 14, 13 into a max heap. Show each step.
- (b) What is collision in the context of hashing. Explain the various techniques to resolve a collision.

$$(2 + 4) + (2 + 4) = 12$$

Department & Section	Submission Link
IT	https://classroom.google.com/c/MTI2NTM3NTAzNzY3/a/Mjc0NTUwMjc4NzUw/details