b) Define strictly binary tree, complete binary tree and fully complete binary tree. Suppose the height of a fully complete binary tree is h. Find out the following: [4

    i)   Total number of nodes present

    ii)   Total number of leaf nodes present

8. Write Short Notes on <u>any two</u>. [4 × 2

    a) Priority Queue

    b) Heap Sort

    c) Polynomial addition through linked list

<div align="center">x x x x x</div>

SUPPLEMENTARY EXAMINATION-2016

3rd Semester B.Tech & B.Tech Dual Degree

DATA STRUCTURE AND ALGORITHM

CS-2001

Time: 3 Hours   **Full Marks: 60**

Answer any SIX questions including Question No.1 which is compulsory.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable and <u>all parts of a question should be answered at one place only</u>.

1. a) Write a pseudo code to check a given binary tree is a binary search tree or not. [2 × 10

    b) Construct a binary tree with the following sequence of traversal given. The English alphabets represent the node information.

        Preorder: ABCDFHJMKEGILN

        Inorder : ADJMHKFCINLGEB

    c) "Graph is an ADT." (True/False) Justify.

    d) Write example pseudo codes having the following time complexity.

        $O(1)$, $O(log2n)$, $O(n^2)$, $O(nlog_2n)$

    e) Construct a two-way inorder threaded binary search tree with the following set of elements.

        15,31,40,11,8,21,67,8,57,28,39

    f) What is an expression tree? Construct an expression tree for the given expression. Show all the steps of construction.

        +, +, 2, 6, +, - ,1, 3, 24

<div align="center">(1)</div>

g) What do you mean by dynamic memory allocation? How to allocate memory for a 2D array dynamically?

h) How many numbers of queues will be required to implement the LIFO principle? Briefly write the steps for implementing insertion and deletion operations.

i) Define the terms Algorithm, Data Structures, Overflow Condition and Underflow Condition with example.

j) Under which situation the best case and worst case arises in case of insertion sort algorithm? Write down the respective time complexity.

2. a) Differentiate between a binary tree and a B-tree. Discuss the technique used to minimize the access time in both the cases. Construct a B-tree of order 3 with the following elements(show all steps): [4

    31,35,26,35,15,6,19,47,59,73,64,10,93,85,8

   b) What is hashing? How is it advantageous over sequential searching? Discuss about various collision resolution techniques available in hashing. [4

3. a) Write an algorithm to delete a node from a binary search tree. Find out time complexity of the algorithm. [4

   b) Why should we prefer to represent a graph data structure using linked list? Explain the representation with a suitable example. [4

4. a) What is polish notation? Write an algorithm to convert an infix expression into a postfix expression using stack ADT. Explain the algorithm with the given infix expression: [4

    a*b+c*(d/e^f)-g+h^j/k

b) What is a queue data structure? Write an algorithm to implement insertion and deletion operation in case of an input-restricted deque and output-restricted deque. [4

5. a) Suppose V1, V2, V3, V4, V5 represent the vertices of a directed graph. The adjacent matrix is given below: [4

	V1	V2	V3	V4	V5
V1	0	0	1	0	1
V2	0	0	1	1	1
V3	1	0	0	1	1
V4	1	1	0	0	0
V5	0	1	1	1	0

Construct a reachability matrix using breadth-first-search algorithm.

[Note: A reachability matrix contains value 1 if there exists a path between u and v otherwise 0; where u and v are any two vertices in the graph.]

b) What is a sparse matrix? How to represent a sparse matrix in 3-tuple format? Write a pseudo code to add two sparse matrices. [4

6. a) What is an AVL tree? What is the property of it? Construct an AVL tree with the following set of numbers. [4

    21, 35, 77, 45, 38, 80, 41, 21, 10, 37, 30, 25, 8, 15, 49

   b) List the differences between array ADT and linked list ADT. Write a pseudo code to check whether a given single linked list contains a loop or not. [4

7. a) What is a divide and conquer algorithms? Explain the concept of divide and conquer through the pseudo code quick sort algorithm. Write down its time complexity. [4