Department of Computer Science and Engineering
Course Name: Data Structures
Question Bank for the Preparation Mid Test – 2

Topic: Trees

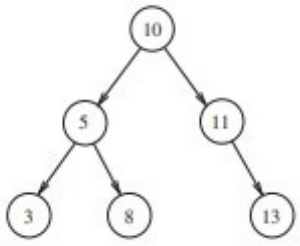
1. List any four applications of Tree Data Structure

2. Explain how you could use a tree data structure to represent the hierarchical structure Provide an example of how this tree would look for a simple file system with multipl imagining you are building a file system for a computer operating system.

Topic: Binary Tree

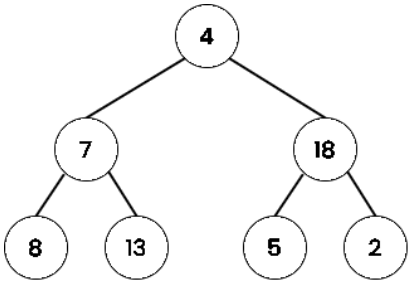
1. Define Binary Tree. What is the maximum and minimum number of nodes in a binary tree of height 5 ?

2. Consider the C function print and the binary tree shown.




```
struct node {
int val;
struct node *left, right;
};
int print(node *p)
{
int retval;
if (p = = NULL)
return 0;
else {
retval = p->val+ print(p->left) +print(p->right);
printf("%d", retval);
return retval; }
```

3. Illustrate the inorder, preorder and postorder tree traversal for the following binary tree without recursion using stack.



4. Infer the output, when the function print is called with a pointer to the root node of the given binary tree.

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5. Write the routine for tree traversals explain with an example

Topic: Expression Tree

1. Construct an expression tree from a given postfix notation
   a b + c d e + * * .

Topic: Binary Search Trees

1. Construct Binary Search trees Tree A and Tree B. Tree A has the following nodes:6,3,8,1,5,10 and Tree B has the following nodes in tree of same order: 7,2,9,1,10.

a) Perform an inorder traversal on both Tree A and Tree B and write down the sequences of visited nodes for each.
b) Compare the structures of Tree A and Tree B. Are they mirror images Explain your answer.
c) Describe a process to merge Tree B into Tree A, resulting in a single binary search tree that contains all the nodes from both trees.

2. Show the inorder, preorder and postorder traversal sequence of the resultant tree with following scenario. 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.

3. Interpret a binary search tree by inserting in the following order of integers
   50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24.
   The number of nodes in the left subtree and right subtree of the root respectively is _____.

4. Construct BST tree for the given preorder: 50,30,20,40,70,60,80 and delete 20,60,50

5. The preorder traversal of a binary search tree is 15, 10, 12, 11, 20, 18, 16, 19. Find out the postorder traversal of the tree?

6. Show the result of inserting 3,1,4,6,9,2,5,7 into an initially empty binary search tree and explain pseudocode of BST insertion.
   Show the result of deleting the root.

7. Construct a tree for the given distinct sequence of keys which represents preorder traversal of a binary search tree(BST) . And find the In-Order and Postorder for the same tree.
   Pre-order = 50,30,23,11,25,35,31,42,70,80,73,85

Topic: Binary Heap

1. Sort the following elements by using Heap Sort.81,89,9,11,14,76,54,22

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2. Given a binary-max heap. The elements are stored in an arrays as 25,14,16,13,10,8,12. What is the content of the array after two delete operations?

3. Develop a binary min-heap to keep track of the earliest books based on their publication years with following scenario.
   You're managing the inventory of an online bookstore. The books are organized based on their publication years. Each book is represented by a tuple (title, publication_year). When a new book is added, it needs to be inserted into the heap.
   Explain how you would represent the books in the binary min-heap, considering the publication years.
   Describe the steps you would take to add a new book to the heap.
   Provide an example scenario with at least four books, each with a title and publication year. Show the state of the binary min-heap after each book is added.

4. Interpret the heap sort processes for the input 82,90,10,12,15,77,55,23.
5. Show the routine for the function getmin() in a binary heap.

Topic: AVL Tree

1. Show the result of inserting 235, 115, 454, 5534, 999, 3879, 666, and 7562 into an initially empty AVL tree. Also write the routine for required rotations.

2. Show the result of inserting 50,20,60,10,8,15,32,46,11,48 into an initially empty AVL tree.

3. Construct an AVL tree having the following elements H, I, J, B, A, E, C, F, D, G, K, If there are n nodes in AVL tree, find the minimum height and maximum height of AVL tree

4. Why does an AVL tree give better worst case performance than an ordinary binary search tree?
5. Define Balance factor with an example.

6. Illustrate an AVL tree with nodes: 10, 5, 15, 2, 7, 12, 20, 1. Calculate the balance factor for each node in this AVL tree.

Topic: Trie

1. Extend a Trie data structure for the following input [App, Maria, Mario, Mariana, Apple, Parent, Application, Paragraph, Purple].

2. Build the trie data structure for the following keys {and,ant.dad,do}
3. Outline a Trie for the insertion of following strings
   Ball, Bat, Stack, Struct, Stock, Structure

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Topic: Hashing

1. The keys are 42,16,91,33,18,27,36,62 are inserted into empty hash table of size 10 by using quadratic hash function. Show the resultant hash table and how many attempts are needed to insert the key value 62.
2. State the advantage and disadvantage of quadratic hash function.
3. Given input (4371, 1323, 6173, 4199, 4344, 9679, 1989) and a hash function b(X) = X (mod 10), construct the resulting:
   Separate chaining hash table.
   Open addressing hash table using linear probing.
4. Extend a hash table using the hash function 'key mod 7' , insert the following sequence of keys in the hash table 50,700,76,85,92,73 and 101. Use separate chaining technique for collision resolution.

5. Apply the keys 12, 18, 13, 2, 3, 23, 5 and 15 into an initially empty hash table of length 10 using open addressing with hash function h(k) = k mod 10 and linear probing. Show all the required steps clearly. What is the resultant hash table?