Binary search tree

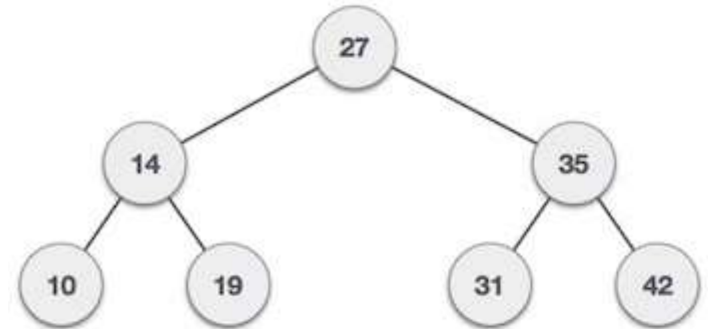
Binary Search Tree (BST)

- A Binary Search Tree (BST) is a tree in which all the nodes follow the below-mentioned properties :
- The left sub-tree of a node has a key less than or equal to its parent node's key.
- The right sub-tree of a node has a key greater than to its parent node's key.
- Thus, BST divides all its sub-trees into two segments; the left sub-tree and the right sub-tree and can be defined as –

➢ left_subtree (keys) ≤ node (key) ≤ right_subtree (keys)

Representation

- BST is a collection of nodes arranged in a way where they maintain BST properties.
- Each node has a key and an associated value.
- While searching, the desired key is compared to the keys in BST and if found, the associated value is retrieved.
- From the figure we identify that left subtree values are lesser than root
- The right subtree values are greater than the root node.



Basic Operations of Binary search tree:

Following are the basic operations of a tree −

- **Search** − Searches an element in a tree.
- **Insert** − Inserts an element in a tree.
- **Pre-order Traversal** − Traverses a tree in a pre-order manner.
- **In-order Traversal** − Traverses a tree in an in-order manner.
- **Post-order Traversal** − Traverses a tree in a post-order manner.

Node

Define a node having some data, references to its left and right child nodes.

```
struct node
{
int data;
struct node *leftChild;
struct node *rightChild;
};
```

Search Operation

- Whenever an element is to be searched, start searching from the root node.
- Then if the data is less than the key value, search for the element in the left subtree.
- Otherwise, search for the element in the right subtree.

Algorithm

```
struct node* search(int data)
{
struct node *current = root;
 printf("Visiting elements: ");
while(current->data != data)
{
 if(current != NULL)
 {
printf("%d ",current->data);
```

```
if(current->data > data)
{
current = current->leftChild;
}
else
{
current = current->rightChild;
}
if(current == NULL)
{
return NULL;
}
}
 }
return current;
 }
```

Insert Operation

- Whenever an element is to be inserted, first locate its proper location.
- Start searching from the root node.
- If the data is less than the key value, search for the empty location in the left subtree and insert the data.
- Otherwise, search for the empty location in the right subtree and insert the data.

Algorithm

```
void insert(int data)
 {
struct node *tempNode = (struct node*) malloc(sizeof(struct node));
struct node *current;
 struct node *parent;
```

```
tempNode->data = data;
tempNode->leftChild = NULL;
tempNode->rightChild = NULL;
if(root == NULL)
 { root = tempNode;
 }
else
{
current = root;
parent = NULL;
while(1)
 {
parent = current;
if(data < parent->data)
{
current = current->leftChild;
if(current == NULL)
{
parent->leftChild = tempNode;
return;
}
}
```

```
else
 {
 current = current->rightChild;
if(current == NULL)
{
 parent->rightChild = tempNode;
return;
 }
}
}
}
}
```