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Given a pointer to the node in a binary tree, write code to find its inorder successor? You may assume each node to also have a pointer to the parent node (along with pointer to right and left sub-trees). Hence, the structure of Node will be

```
struct Node
{
    int data;
    Node* lptr;    // pointer to the left subtree
    Node* rptr;    // pointer to the right subtree
    Node* parent;  // Pointer to the parent Node (null for root of
tree)
};
```

For example: if we have the below binary tree, then

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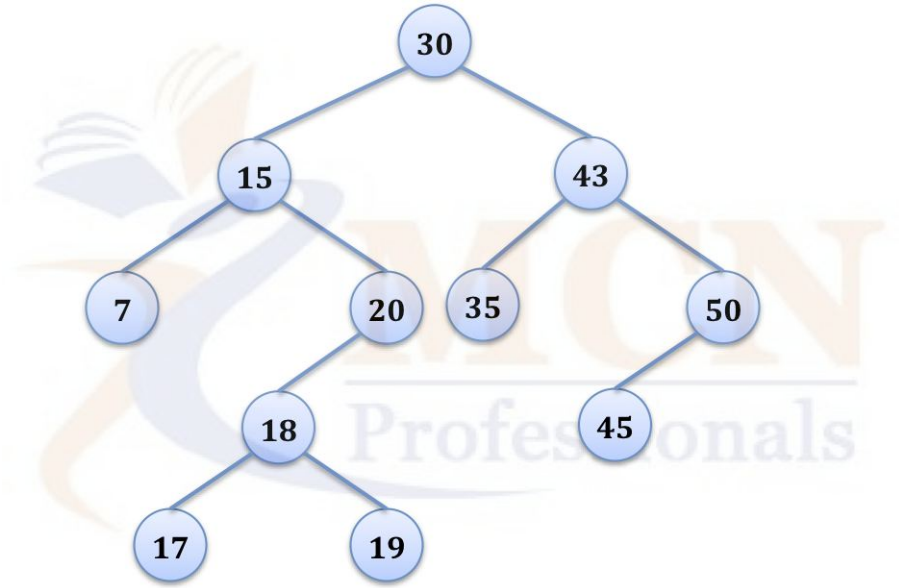


```
Node         Inorder Successor
-------        ---------------------
15               17
18               19
50              NULL
20              30
7                15
```

Solution:

If the Node has right child, then the in-order successor of the node ca be found by

- Move to the right child
- keep moving to the left child untill the left child becomes NULL. When we get a node for which the left child is null, return that node.

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```
For example:
1. To find the in-order successor of 18
   - Move to the right child, i.e 19
   - Since the left child of 19 is NULL, return 19
2. To find the in-order successor of 15
   - Move to the Right child, i.e 20
   - Move to the left child, i.e 18 and keep moving to left child
till we get a NULL pointer as left child, i.e 17. Return 17.
```

If the Right child is NULL, then in-order successor can be found using the parent Node,

- Move to the parent Node, untill the Node becomes the left child of the parent.
- If Parent becomes NULL then return NULL, else return the parent

```
For Example:
1. In-order successor of 35 is 40 because 35 is itself the left
child
2. In-order successor of 20 will be 30.
   - Parent of 20 is 15, but 20 is the right child of 15 so move
to the parent (i.e 15).
   - Parent of 15 is 30 and 15 is the left child of 30 so return
30.
3. In-order successor of 50 will be NULL.
   - Parent of 50 is 43 and 50 is the right child of 43. So move
to the parent
   - Parent of 43 is 30 and 43 is also the right child of 30. So
move to the parent
   - Parent of 30 is NULL, so return NULL. (i.e 50, does not have
an in-order successor)
```

Code:

```
// Returns the in-order successor of node pointed to by d
Node* successor(Node * d)
{
   if(d == NULL)
       return NULL;
   // If d has a Right Child
   if(d->rptr != NULL)
   {
      // Move to Right Node
      d = d->rptr;
      // Move to the extreme left
      while(d->lptr != NULL)
         d = d->lptr;
      return d;
   }
   while(d)
   {
      Node* p = d->parent;
      if(p == NULL)
         break;
      if(p->lptr == d)
         return p;
      else
         d = p;
   }
   return NULL;
}
```

Let me know your Comments / Feedback / suggestions.

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