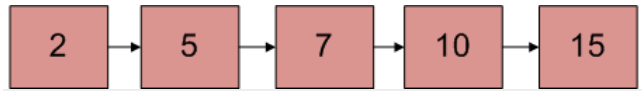
Given a linked list which is sorted, how will you insert in sorted way

Algorithm:

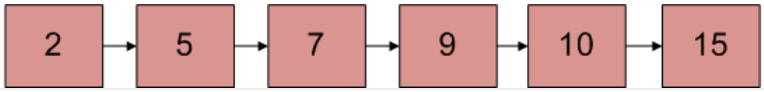
Let input linked list is sorted in increasing order.

```
1) If Linked list is empty then make the node as head and return it.
2) If value of the node to be inserted is smaller than value of head node
    then insert the node at start and make it head.
3) In a loop, find the appropriate node after which the input node (let 9) is
    to be inserted. To find the appropriate node start from head, keep moving
    until you reach a node GN (10 in the below diagram) who's value is
    greater than the input node. The node just before GN is the appropriate
    node (7).
4) Insert the node (9) after the appropriate node (7) found in step 3.
```

Initial Linked List



Linked List after insertion of 9



Implementation:

C/C++

```
/* Program to insert in a sorted list */
#include<stdio.h>
#include<stdlib.h>

/* Link list node */
struct node
{
    int data;
    struct node* next;
};

/* function to insert a new_node in a list. Note that this
  function expects a pointer to head_ref as this can modify the
  head of the input linked list (similar to push())*/
void sortedInsert(struct node** head_ref, struct node* new_node)
{
    struct node* current;
    /* Special case for the head end */
    if (*head_ref == NULL || (*head_ref)->data >= new_node->data)
    {
        new_node->next = *head_ref;
        *head_ref = new_node;
    }
    else
    {
        /* Locate the node before the point of insertion */
        current = *head_ref;
        while (current->next!=NULL &&
               current->next->data < new_node->data)
        {
            current = current->next;
```

```
        }
        new_node->next = current->next;
        current->next = new_node;
    }
}

/* BELOW FUNCTIONS ARE JUST UTILITY TO TEST sortedInsert */

/* A utility function to create a new node */
struct node *newNode(int new_data)
{
    /* allocate node */
    struct node* new_node =
        (struct node*) malloc(sizeof(struct node));

    /* put in the data  */
    new_node->data  = new_data;
    new_node->next =  NULL;

    return new_node;
}

/* Function to print linked list */
void printList(struct node *head)
{
    struct node *temp = head;
    while(temp != NULL)
    {
        printf("%d  ", temp->data);
        temp = temp->next;
    }
}

/* Drier program to test count function*/
int main()
{
    /* Start with the empty list */
    struct node* head = NULL;
    struct node *new_node = newNode(5);
    sortedInsert(&head, new_node);
    new_node = newNode(10);
    sortedInsert(&head, new_node);
    new_node = newNode(7);
    sortedInsert(&head, new_node);
    new_node = newNode(3);
    sortedInsert(&head, new_node);
    new_node = newNode(1);
    sortedInsert(&head, new_node);
    new_node = newNode(9);
    sortedInsert(&head, new_node);
    printf("\n Created Linked List\n");
    printList(head);

    return 0;
}
```

Java

```
// Java Program to insert in a sorted list
class LinkedList
{
    Node head;  // head of list

    /* Linked list Node*/
    class Node
    {
        int data;
        Node next;
        Node(int d) {data = d; next = null; }
    }
```

```
    /* function to insert a new_node in a list. */
    void sortedInsert(Node new_node)
    {
         Node current;

         /* Special case for head node */
         if (head == null || head.data >= new_node.data)
         {
            new_node.next = head;
            head = new_node;
         }
         else {

            /* Locate the node before point of insertion. */
            current = head;

            while (current.next != null &&
                   current.next.data < new_node.data)
                  current = current.next;

            new_node.next = current.next;
            current.next = new_node;
         }
     }

                  /*Utility functions*/

    /* Function to create a node */
    Node newNode(int data)
    {
       Node x = new Node(data);
       return x;
    }

     /* Function to print linked list */
     void printList()
     {
         Node temp = head;
         while (temp != null)
         {
            System.out.print(temp.data+" ");
            temp = temp.next;
         }
     }

     /* Drier function to test above methods */
     public static void main(String args[])
     {
         LinkedList llist = new LinkedList();
         Node new_node;
         new_node = llist.newNode(5);
         llist.sortedInsert(new_node);
         new_node = llist.newNode(10);
         llist.sortedInsert(new_node);
         new_node = llist.newNode(7);
         llist.sortedInsert(new_node);
         new_node = llist.newNode(3);
         llist.sortedInsert(new_node);
         new_node = llist.newNode(1);
         llist.sortedInsert(new_node);
         new_node = llist.newNode(9);
         llist.sortedInsert(new_node);
         System.out.println("Created Linked List");
         llist.printList();
     }
}
/* This code is contributed by Rajat Mishra */
```

Python

```
# Python program to insert in sorted list

# Node class
class Node:

    # Constructor to initialize the node object
    def __init__(self, data):
        self.data = data
        self.next = None

class LinkedList:

    # Function to initialize head
    def __init__(self):
        self.head = None

    def sortedInsert(self, new_node):

        # Special case for the empty linked list
        if self.head is None:
            new_node.next = self.head
            self.head = new_node

        # Special case for head at end
        elif self.head.data >= new_node.data:
            new_node.next = self.head
            self.head = new_node

        else :

            # Locate the node before the point of insertion
            current = self.head
            while(current.next is not None and
                 current.next.data < new_node.data):
                current = current.next

            new_node.next = current.next
            current.next = new_node

    # Function to insert a new node at the beginning
    def push(self, new_data):
        new_node = Node(new_data)
        new_node.next = self.head
        self.head = new_node

    # Utility function to prit the linked LinkedList
    def printList(self):
        temp = self.head
        while(temp):
            print temp.data,
            temp = temp.next


# Driver program
llist = LinkedList()
new_node = Node(5)
llist.sortedInsert(new_node)
new_node = Node(10)
llist.sortedInsert(new_node)
new_node = Node(7)
llist.sortedInsert(new_node)
new_node = Node(3)
llist.sortedInsert(new_node)
new_node = Node(1)
llist.sortedInsert(new_node)
new_node = Node(9)
llist.sortedInsert(new_node)
print "Create Linked List"
llist.printList()

# This code is contributed by Nikhil Kumar Singh(nickzuck_007)
```

Output:

```
Created Linked List
1 3 5 7 9 10
```

Shorter Implementation using double pointers

Thanks to Murat M Ozturk for providing this solution. Please see Murat M Ozturk's comment below for complete function. The code uses double pointer to keep track of the next pointer of the previous node (after which new node is being inserted).

Note that below line in code changes *current* to have address of next pointer in a node.

```
   current = &((*current)->next);
```

Also, note below comments.

```
    /* Copies the value-at-address current to
      new_node's next pointer*/
    new_node->next = *current;

    /* Fix next pointer of the node (using it's address)
       after which new_node is being inserted */
    *current = new_node;
```

Time Complexity: O(n)

References:

http://cslibrary.stanford.edu/105/LinkedListProblems.pdf