Search an element in a Linked List (Iterative and Recursive)

Write a function that searches a given key 'x' in a given singly linked list. The function should return true if x is present in linked list and false otherwise.

```
bool search(Node *head, int x)
```

For example, if the key to be searched is 15 and linked list is 14->21->11->30->10, then function should return false. If key to be searched is 14, then the function should return true.

Iterative Solution

```
2) Initialize a node pointer, current = head.
3) Do following while current is not NULL
    a) current->key is equal to the key being searched return true.
    b) current = current->next
4) Return false
```

Following is iterative implementation of above algorithm to search a given key.

C++

```
// Iterative C++ program to search
// an element in linked list
#include <bits/stdc++.h>
using namespace std;

/* Link list node */
class Node
{
    public:
    int key;
    Node* next;
};

/* Given a reference (pointer to pointer) to the head
of a list and an int, push a new node on the front
of the list. */
void push(Node** head_ref, int new_key)
{
    /* allocate node */
    Node* new_node = new Node();

    /* put in the key */
    new_node->key = new_key;

    /* link the old list off the new node */
    new_node->next = (*head_ref);

    /* move the head to point to the new node */
    (*head_ref) = new_node;
}

/* Checks whether the value x is present in linked list */
bool search(Node* head, int x)
{
    Node* current = head; // Initialize current
    while (current != NULL)
    {
        if (current->key == x)
            return true;
        current = current->next;
    }
    return false;
}

/* Driver program to test count function*/
int main()
{
    /* Start with the empty list */
    Node* head = NULL;
    int x = 21;

    /* Use push() to construct below list
    14->21->11->30->10 */
    push(&head, 10);
    push(&head, 30);
    push(&head, 11);
    push(&head, 21);
    push(&head, 14);

    search(head, 21)? cout<<"Yes" : cout<<"No";
    return 0;
}

// This is code is contributed by rathbhupendra
```

C

```
// Iterative C program to search an element in linked list
#include<stdio.h>
#include<stdlib.h>
#include<stdbool.h>

/* Link list node */
struct Node
{
    int key;
    struct Node* next;
};

/* Given a reference (pointer to pointer) to the head
  of a list and an int, push a new node on the front
  of the list. */
void push(struct Node** head_ref, int new_key)
{
    /* allocate node */
    struct Node* new_node =
            (struct Node*) malloc(sizeof(struct Node));

    /* put in the key  */
    new_node->key  = new_key;

    /* link the old list off the new node */
    new_node->next = (*head_ref);

    /* move the head to point to the new node */
    (*head_ref)    = new_node;
}

/* Checks whether the value x is present in linked list */
bool search(struct Node* head, int x)
{
    struct Node* current = head;  // Initialize current
    while (current != NULL)
    {
        if (current->key == x)
            return true;
        current = current->next;
    }
    return false;
}

/* Driver program to test count function*/
int main()
```

```
{
    /* Start with the empty list */
    struct Node* head = NULL;
    int x = 21;

    /* Use push() to construct below list
     14->21->11->30->10  */
    push(&head, 10);
    push(&head, 30);
    push(&head, 11);
    push(&head, 21);
    push(&head, 14);

    search(head, 21)? printf("Yes") : printf("No");
    return 0;
}
```

Java

```
// Iterative Java program to search an element
// in linked list

//Node class
class Node
{
    int data;
    Node next;
    Node(int d)
    {
        data = d;
        next = null;
    }
}

//Linked list class
class LinkedList
{
    Node head;    //Head of list

    //Inserts a new node at the front of the list
    public void push(int new_data)
    {
        //Allocate new node and putting data
        Node new_node = new Node(new_data);

        //Make next of new node as head
        new_node.next = head;

        //Move the head to point to new Node
        head = new_node;
    }

    //Checks whether the value x is present in linked list
    public boolean search(Node head, int x)
    {
        Node current = head;    //Initialize current
        while (current != null)
        {
            if (current.data == x)
                return true;    //data found
            current = current.next;
        }
        return false;    //data not found
    }

    //Driver function to test the above functions
    public static void main(String args[])
    {

        //Start with the empty list
        LinkedList llist = new LinkedList();

        /*Use push() to construct below list
        14->21->11->30->10  */
        llist.push(10);
        llist.push(30);
        llist.push(11);
        llist.push(21);
        llist.push(14);
        if (llist.search(llist.head, 21))
            System.out.println("Yes");
        else
            System.out.println("No");
    }
}
// This code is contributed by Pratik Agarwal
```

Python

```
# Iterative Python program to search an element
# in linked list

# Node class
class Node:

    # Function to initialise the node object
    def __init__(self, data):
        self.data = data # Assign data
        self.next = None # Initialize next as null

# Linked List class
class LinkedList:
    def __init__(self):
        self.head = None # Initialize head as None

    # This function insert a new node at the
    # beginning of the linked list
    def push(self, new_data):

        # Create a new Node
        new_node = Node(new_data)

        # 3. Make next of new Node as head
        new_node.next = self.head

        # 4. Move the head to point to new Node
        self.head = new_node

    # This Function checks whether the value
    # x present in the linked list
    def search(self, x):

        # Initialize current to head
        current = self.head

        # loop till current not equal to None
        while current != None:
            if current.data == x:
                return True # data found

            current = current.next

        return False # Data Not found


# Code execution starts here
if __name__ == '__main__':

    # Start with the empty list
    llist = LinkedList()

    ''' Use push() to construct below list
        14->21->11->30->10 '''
    llist.push(10);
    llist.push(30);
    llist.push(11);
    llist.push(21);
    llist.push(14);

    if llist.search(21):
        print("Yes")
    else:
        print("No")

# This code is contributed by Ravi Shankar
```

C#

```
// Iterative C# program to search an element
// in linked list
using System;

// Node class
public class Node
{
    public int data;
    public Node next;
    public Node(int d)
    {
        data = d;
        next = null;
    }
}

// Linked list class
public class LinkedList
{
    Node head; // Head of list

    // Inserts a new node at the front of the list
    public void push(int new_data)
    {
        // Allocate new node and putting data
        Node new_node = new Node(new_data);

        // Make next of new node as head
        new_node.next = head;

        // Move the head to point to new Node
        head = new_node;
    }

    // Checks whether the value x is present in linked list
    public bool search(Node head, int x)
    {
        Node current = head; // Initialize current
        while (current != null)
        {
            if (current.data == x)
                return true; // data found
            current = current.next;
        }
        return false; // data not found
    }

    // Driver code
    public static void Main(String []args)
    {

        // Start with the empty list
        LinkedList llist = new LinkedList();

        /*Use push() to construct below list
        14->21->11->30->10 */
        llist.push(10);
        llist.push(30);
        llist.push(11);
        llist.push(21);
        llist.push(14);

        if (llist.search(llist.head, 21))
            Console.WriteLine("Yes");
        else
            Console.WriteLine("No");
    }
}

// This code contributed by Rajput-Ji
```

Output:

```
Yes
```

Recursive Solution

```
bool search(head, x)
1) If head is NULL, return false.
2) If head's key is same as x, return true;
2) Else return search(head->next, x)
```

Following is recursive implementation of above algorithm to search a given key.

C

```c
// Recursive C program to search an element in linked list
#include<stdio.h>
#include<stdlib.h>
#include<stdbool.h>
/* Link list node */
struct Node
{
    int key;
    struct Node* next;
};

/* Given a reference (pointer to pointer) to the head
  of a list and an int, push a new node on the front
  of the list. */
void push(struct Node** head_ref, int new_key)
{
    /* allocate node */
    struct Node* new_node =
            (struct Node*) malloc(sizeof(struct Node));

    /* put in the key  */
    new_node->key  = new_key;

    /* link the old list off the new node */
    new_node->next = (*head_ref);

    /* move the head to point to the new node */
    (*head_ref)    = new_node;
}

/* Checks whether the value x is present in linked list */
bool search(struct Node* head, int x)
{
    // Base case
    if (head == NULL)
        return false;

    // If key is present in current node, return true
    if (head->key == x)
        return true;

    // Recur for remaining list
    return search(head->next, x);
}

/* Driver program to test count function*/
int main()
{
    /* Start with the empty list */
    struct Node* head = NULL;
    int x = 21;

    /* Use push() to construct below list
     14->21->11->30->10  */
    push(&head, 10);
    push(&head, 30);
    push(&head, 11);
    push(&head, 21);
    push(&head, 14);

    search(head, 21)? printf("Yes") : printf("No");
    return 0;
}
```

Java

```java
// Recursive Java program to search an element
// in linked list


// Node class
class Node
{
    int data;
    Node next;
    Node(int d)
    {
        data = d;
        next = null;
    }
}

// Linked list class
class LinkedList
{
    Node head;    //Head of list

    //Inserts a new node at the front of the list
    public void push(int new_data)
    {
        //Allocate new node and putting data
        Node new_node = new Node(new_data);

        //Make next of new node as head
        new_node.next = head;

        //Move the head to point to new Node
        head = new_node;
    }

    // Checks whether the value x is present
    // in linked list
    public boolean search(Node head, int x)
    {
        // Base case
        if (head == null)
            return false;

        // If key is present in current node,
        // return true
        if (head.data == x)
            return true;

        // Recur for remaining list
        return search(head.next, x);
    }

    // Driver function to test the above functions
    public static void main(String args[])
    {
        // Start with the empty list
        LinkedList llist = new LinkedList();

        /* Use push() to construct below list
           14->21->11->30->10  */
        llist.push(10);
        llist.push(30);
        llist.push(11);
        llist.push(21);
        llist.push(14);

        if (llist.search(llist.head, 21))
            System.out.println("Yes");
        else
            System.out.println("No");
    }
}
// This code is contributed by Pratik Agarwal
```

Output:

```
Yes
```

Python

```python
# Recursive Python program to
# search an element in linked list

# Node class
class Node:

    # Function to initialise
    # the node object
    def __init__(self, data):
        self.data = data # Assign data
        self.next = None # Initialize next as null

class LinkedList:

    def __init__(self):
        self.head = None # Initialize head as None

    # This function insert a new node at
    # the beginning of the linked list
    def push(self, new_data):

        # Create a new Node
        new_node = Node(new_data)

        # Make next of new Node as head
        new_node.next = self.head

        # Move the head to
        # point to new Node
        self.head = new_node


    # Checks whether the value key
    # is present in linked list
    def search(self, li, key):

        # Base case
        if(not li):
            return False

        # If key is present in
        # current node, return true
        if(li.data == key):
            return True

        # Recur for remaining list
        return self.search(li.next, key)

# Driver Code
if __name__=='__main__':

    li = LinkedList()

    li.push(1)
    li.push(2)
    li.push(3)
    li.push(4)

    key = 4

    if li.search(li.head,key):
        print("Yes")
    else:
        print("No")

# This code is contributed
# by Manoj Sharma
```

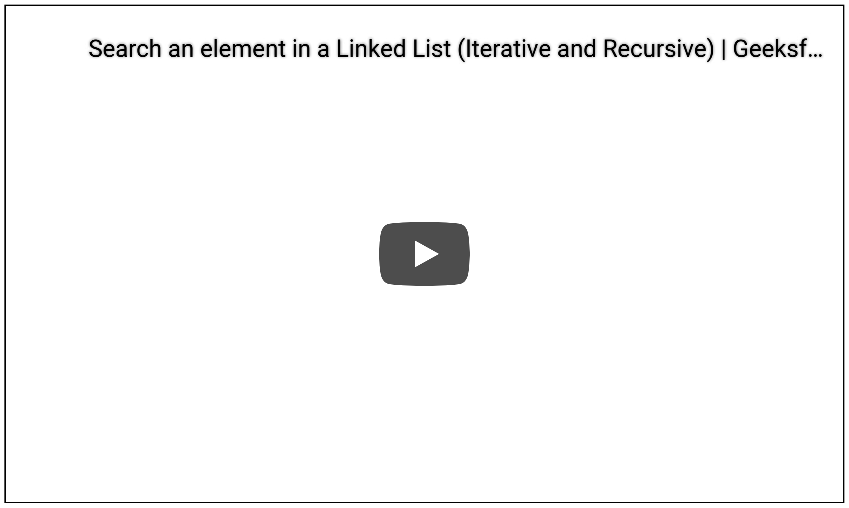
C#

```csharp
// Recursive C# program to search
// an element in linked list
```

```
using System;

// Node class
public class Node
{
    public int data;
    public Node next;
    public Node(int d)
    {
        data = d;
        next = null;
    }
}

// Linked list class
public class LinkedList
{
    Node head; //Head of list

    //Inserts a new node at the front of the list
    public void push(int new_data)
    {
        //Allocate new node and putting data
        Node new_node = new Node(new_data);

        //Make next of new node as head
        new_node.next = head;

        //Move the head to point to new Node
        head = new_node;
    }

    // Checks whether the value x is present
    // in linked list
    public bool search(Node head, int x)
    {
        // Base case
        if (head == null)
            return false;

        // If key is present in current node,
        // return true
        if (head.data == x)
            return true;

        // Recur for remaining list
        return search(head.next, x);
    }

    // Driver code
    public static void Main()
    {
        // Start with the empty list
        LinkedList llist = new LinkedList();

        /* Use push() to construct below list
        14->21->11->30->10 */
        llist.push(10);
        llist.push(30);
        llist.push(11);
        llist.push(21);
        llist.push(14);

        if (llist.search(llist.head, 21))
            Console.WriteLine("Yes");
        else
            Console.WriteLine("No");
    }
}

// This code is contributed by PrinciRaj1992
```

Output:

```
Yes
```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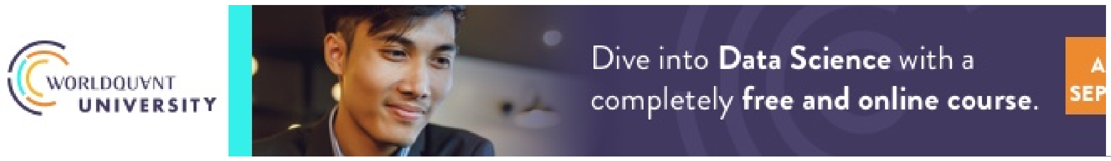
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