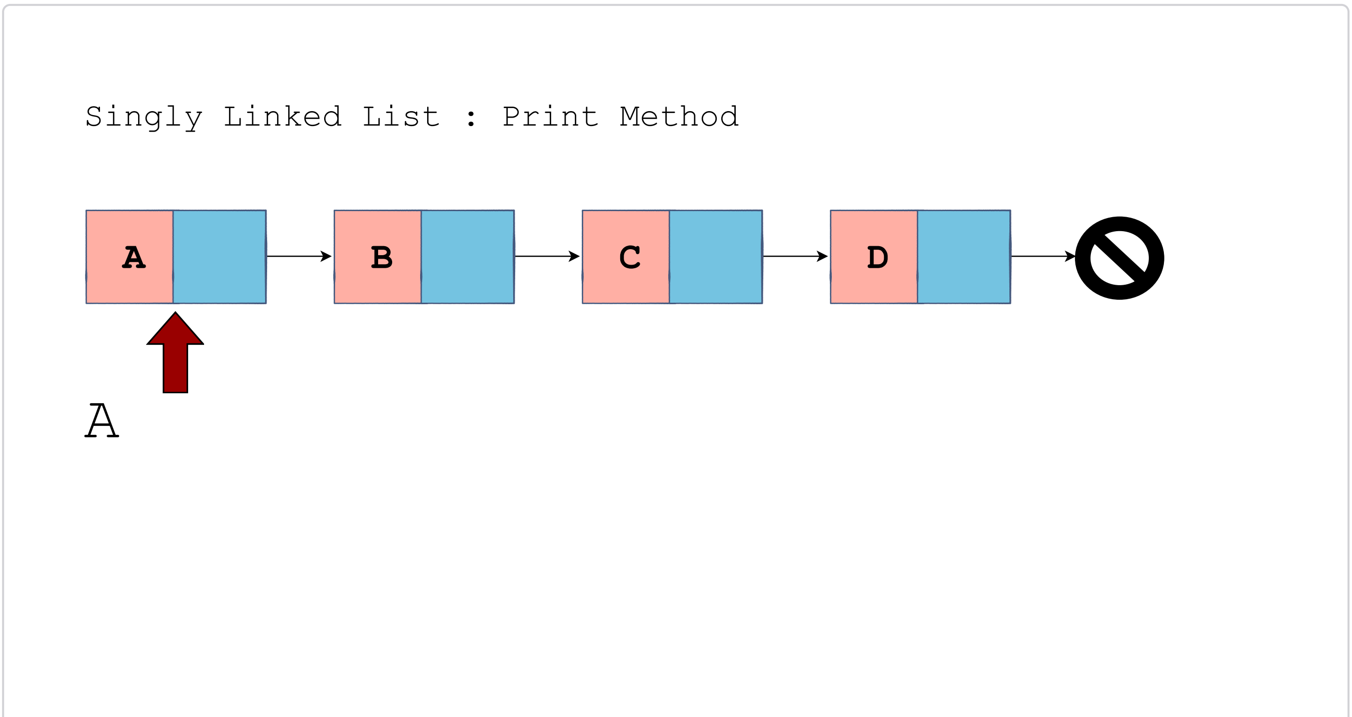
Length

In this lesson, you will learn how to calculate the length of a linked list.

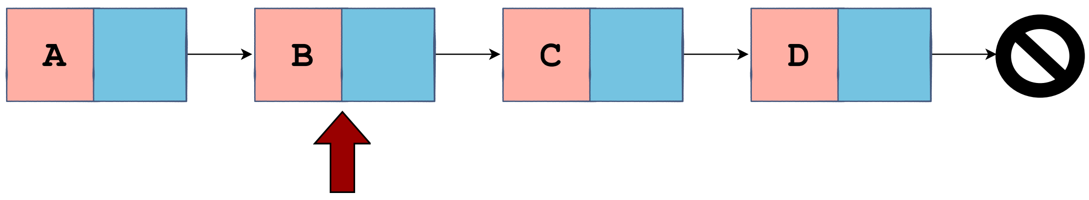
In this lesson, we'll calculate the length or the number of nodes in a given linked list. We'll be doing this in both an iterative and recursive manner.

Algorithm

Let's look at a linked list and recall how we managed to print out the elements of a linked list. We iterate through every element of the linked list. We start from the head node and while we don't reach `None`, we print the data field of the node that we point to and increment the while loop by setting the current node equal to the next node.



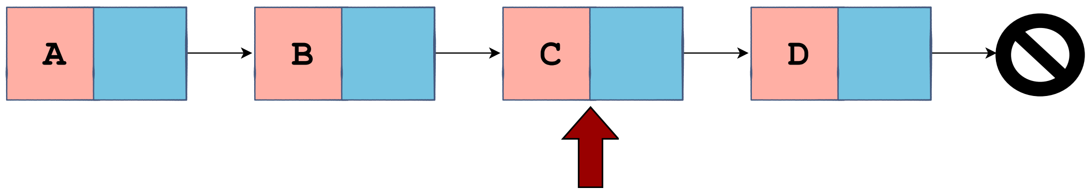
Singly Linked List : Print Method



A

B

Singly Linked List : Print Method

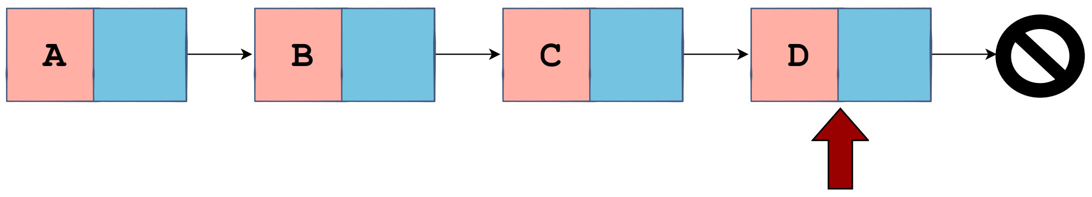


A

B

C

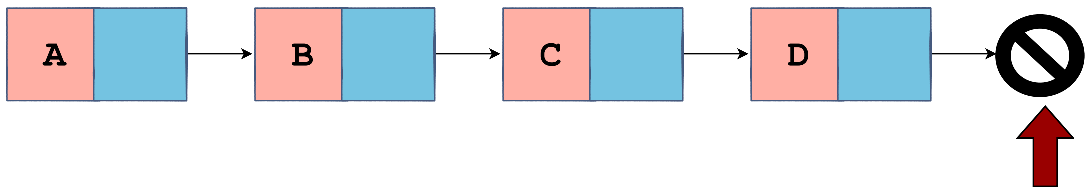
Singly Linked List : Print Method



```
A
B
C
D
```

4 of 5

Singly Linked List : Print Method



```
A
B
C
D        Loop terminated.
```

5 of 5

Iterative Implementation

The above algorithm is going to help us construct an iterative method to calculate the length of a linked list. Let’s go ahead and create a method `len_iterative` and step through it.

```
def len_iterative(self):
    count = 0
    cur_node = self.head

    while cur_node:
        count += 1
        cur_node = cur_node.next
    return count
```

len_iterative(self)

`len_iterative` takes `self` since it's a class method. As we start from the beginning of the linked list, we set `cur_node` equal to the head of the linked list on **line 3**. Then we go through each of the nodes until we hit `None`, which will terminate the `while` loop on **line 4**. We keep a count of how many nodes by setting a `count` variable equal to zero at the beginning of the method on **line 2**. `count` will keep track of the number of nodes we've encountered as long as the `cur_node` is not `None` by incrementing itself on **line 5**.

Let's go ahead and verify this code:

```
class Node:
    def __init__(self, data):
        self.data = data
        self.next = None


class LinkedList:
    def __init__(self):
        self.head = None

    def print_list(self):
        cur_node = self.head
        while cur_node:
            print(cur_node.data)
            cur_node = cur_node.next

    def append(self, data):
        new_node = Node(data)

        if self.head is None:
            self.head = new_node
            return

        last_node = self.head
        while last_node.next:
            last_node = last_node.next
        last_node.next = new_node

    def prepend(self, data):
        new_node = Node(data)

        new_node.next = self.head
        self.head = new_node
    def insert_after_node(self, prev_node, data):

        if not prev_node:

            print("Previous node does not exist.")
            return

        new_node = Node(data)

        new_node.next = prev_node.next
        prev_node.next = new_node

    def delete_node(self, key):

        cur_node = self.head

        if cur_node and cur_node.data == key:
            self.head = cur_node.next
            cur_node = None
            return

        prev = None
        while cur_node and cur_node.data != key:
            prev = cur_node
            cur_node = cur_node.next

        if cur_node is None:
            return

        prev.next = cur_node.next
        cur_node = None

    def delete_node_at_pos(self, pos):

        cur_node = self.head

        if pos == 0:
            self.head = cur_node.next
            cur_node = None
            return

        prev = None
        count = 1
        while cur_node and count != pos:
            prev = cur_node
            cur_node = cur_node.next
            count += 1

        if cur_node is None:
            return

        prev.next = cur_node.next
        cur_node = None

    def len_iterative(self):

        count = 0
        cur_node = self.head

        while cur_node:
            count += 1
            cur_node = cur_node.next
        return count
```

```
llist = LinkedList()
llist.append("A")
llist.append("B")
llist.append("C")
llist.append("D")


print(llist.len_iterative())
```

class Node and class LinkedList

In the code above, we have a linked list object `llist` and we insert four entries into the linked list (**lines 100-103**).

The statement on **line 106** `print(llist.len_iterative())` gives an output of 4 which proves that our implementation is correct.

Recursive Implementation

Let's move on to the recursive implementation of calculating the length of a linked list:

```
def len_recursive(self, node):
  if node is None:
    return 0
  return 1 + self.len_recursive(node.next)
```

len_recursive(self, node)

In the implementation of `len_recursive`, we pass in a `node` to the method. Now if we want to calculate the length of the whole linked list, we have to pass the start of the linked list as the `node` on **line 1**. On **line 4**, we have a recursive call to `self.len_recursive` where we pass `node.next` to it.

Now, whenever we have a recursive function, we need a base case. For the `len_recursive` method, the base case is whether or not we've encountered the end of the linked list. If we reach the end of the linked list, meaning the `node` is `None`, we return zero on **line 3**. Otherwise, if the `node` is not `None`, we call `len_recursive` on **line 4** and pass in the next node. Also on **line 4**, we return `1` plus what we're going to return from `self.len_recursive(node.next)`.

Now we'll call this method in a way similar to the iterative method, but we're going to pass the node that corresponds to the head of the linked list to this method.

```
class Node:
    def __init__(self, data):
        self.data = data
        self.next = None


class LinkedList:
    def __init__(self):
        self.head = None

    def print_list(self):
        cur_node = self.head
        while cur_node:
            print(cur_node.data)
            cur_node = cur_node.next

    def append(self, data):
        new_node = Node(data)

        if self.head is None:
            self.head = new_node
            return

        last_node = self.head
        while last_node.next:
            last_node = last_node.next
        last_node.next = new_node

    def prepend(self, data):
        new_node = Node(data)

        new_node.next = self.head
        self.head = new_node

    def insert_after_node(self, prev_node, data):

        if not prev_node:
            print("Previous node does not exist.")
            return

        new_node = Node(data)

        new_node.next = prev_node.next
        prev_node.next = new_node

    def delete_node(self, key):

        cur_node = self.head

        if cur_node and cur_node.data == key:
            self.head = cur_node.next
            cur_node = None
            cur_node = None
            return

        prev = None
        while cur_node and cur_node.data != key:
            prev = cur_node
            cur_node = cur_node.next

        if cur_node is None:
            return

        prev.next = cur_node.next
        cur_node = None

    def delete_node_at_pos(self, pos):
        if self.head:
            cur_node = self.head

            if pos == 0:
                self.head = cur_node.next
                cur_node = None
                return

            prev = None
            count = 1
            while cur_node and count != pos:
                prev = cur_node
                cur_node = cur_node.next
                count += 1

            if cur_node is None:
                return

            prev.next = cur_node.next
            cur_node = None

    def len_iterative(self):

        count = 0
        cur_node = self.head

        while cur_node:
            count += 1
            cur_node = cur_node.next
        return count

    def len_recursive(self, node):
        if node is None:
            return 0
        return 1 + self.len_recursive(node.next)


llist = LinkedList()
print("The length of an empty linked list is:")
print(llist.len_recursive(llist.head))
llist.append("A")
llist.append("B")
llist.append("C")
llist.append("D")

print("The length of the linked list calculated recursively after inserting 4 elements is:")
print(llist.len_recursive(llist.head))
print("The length of the linked list calculated iteratively after inserting 4 elements is:")
print(llist.len_iterative())
```

class Node and class LinkedList

As you can see from the code above, we get output equal to `4` from the `len_recursive` method. If the linked list is empty, this method returns zero.

In conclusion, it doesn’t matter if we calculate the length of a linked list iteratively or recursively, we will always get the same answer.

I hope you enjoyed the lesson!

In the next lesson, we’ll learn how to swap two nodes in a linked list. See you there!