Written Homework #2
CS 163: Data Structures

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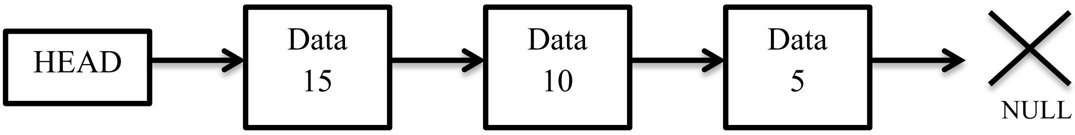
1. Recursion

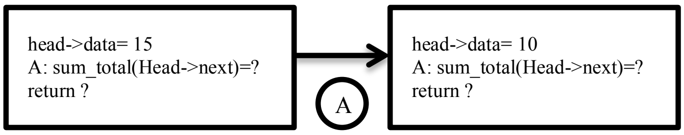
Above we have a recursive function to sum all data in a Linear Linked List.

```
int list::sum_total(node * head)
{
          if(!head)
           return 0;
          else
                    return head->data + sum_total(head->next);
                                                A
}
```

For this code, we will use the following LLL:



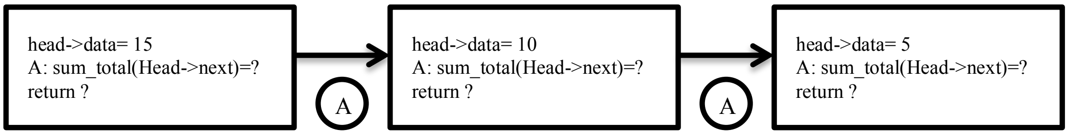
After call this function by the ADT *list*, we will have the beginning of the box trace. At the point A of the code a recursive call is made, and the new invocation of the function sum_total begins execution.


head->data= 15
A: sum_total(Head->next)=?
return ?

A

head->data= 10
A: sum_total(Head->next)=?
return ?

At point A a recursive call is made, and the new invocation of the function sum_total begins execution:


head->data= 15
A: sum_total(Head->next)=?
return ?

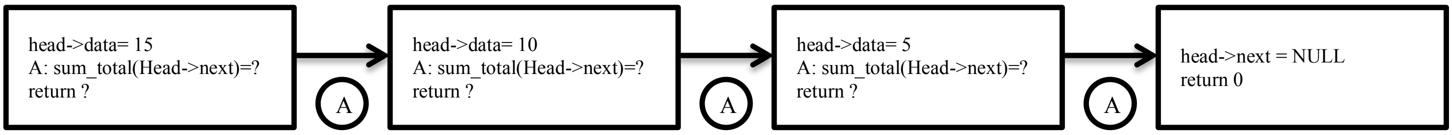
A

head->data= 10
A: sum_total(Head->next)=?
return ?

A

head->data= 5
A: sum_total(Head->next)=?
return ?

At point A a recursive call is made, and the new invocation of the function sum_total begins execution:


head->data= 15
A: sum_total(Head->next)=?
return ?

A

head->data= 10
A: sum_total(Head->next)=?
return ?

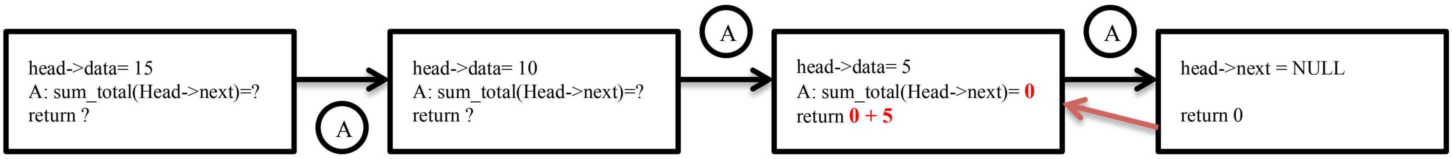
A

head->data= 5
A: sum_total(Head->next)=?
return ?

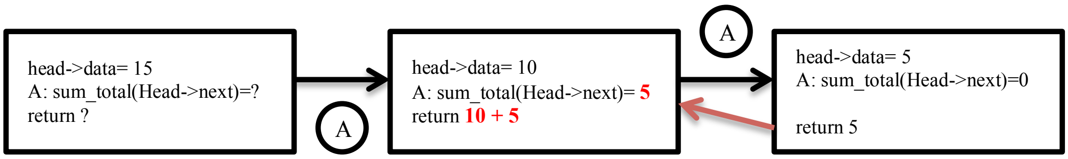
A

head->next = NULL
return 0

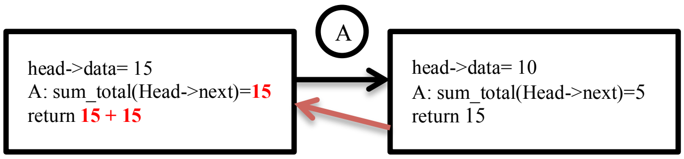
The base case was reached (head = NULL), so this invocation of sum_total completes and return a value to the caller:



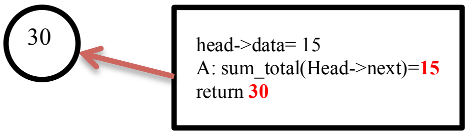
The method value is returned to calling box, which continues execution:


head->data= 15
A: sum_total(Head->next)=?
return ?
A
head->data= 10
A: sum_total(Head->next)= 5
return 10 + 5
A
head->data= 5
A: sum_total(Head->next)=0
return 5

The method value is returned to calling box, which continues execution:



The current invocation of sum_total completes and returns the value to the initial call.



The value 30 is returned.

2. Ethics

My ethics says that I have to say the truth, even if he is my friend. However, I can’t end with the expectations of a future career or job of a friend just because of some arguments. I cannot be his judge. Therefore, the best thing to do is not lie and says just that there isn't anything to say.

3. Algorithm

Algorithm to copy a Circular Linked List of integers.

After the list that will be copied was populated.

List from.list

Execute the following algorithm:

```
Start
        If the from.head node from the from.list, which will be copied, is NULL
                Return a failed message

        Else
                Create an auxiliary pointer and point to the from.head
                        from.current = from.head;

                Create and allocate memory for a head node of the copy list
                        head = new node

                Copy data from the from.head
                        head -> data= from.head -> data

                Point the next pointer of copy head to him-self
                        head -> next = head

                Create an auxiliary node and point to the head value of the copy list
                        current = head

                If the next pointer of from.current isn't from.head
                        Loop – While the next pointer from.current isn't from.head.
                                Create a new node and linking the list
                                        current->next = new node
                                        current = current->next
                                Copy data from the from.list
                                        current -> data = from.current->next->data
                                Traverse the from.list
                                        from.current = from.current -> next
                        End Loop

                        At the final of the list, link the last node with the his head
                                current->next = head

End
```

4. Experiencing Linux

After compile the program using the debugging flag (-g).

- **Locate a segmentation fault**
  To locate a seg fault you will probably have a signal SIGSEV. Therefore, we have to open the backtrace and see which frame occurred the segmentation fault.

- **Display the contents of a data member**
  Using the command: *print expression*. Print the value of a variable or expression.

- **Backtrace**
  A backtrace is a summary of how your program got where it is. For example after the segmentation fault the backtrace can be used to see what happen exactly. We can use this tipping the command *backtrace* in the gdb.