

# INTRO TO PA01

## OPERATOR OVERLOADING

## RECURSION

## GDB

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Problem Solving with Computers-II



```
#include <iostream>
using namespace std;

int main(){
    cout<<"Hola Facebook\n";
    return 0;
}
```



# Announcements

- PA01 released, due in one week
- Midterm next week (Wed)(08/29) - All topics covered until Tuesday of next week (Linked Lists and BST).

For more details visit <https://ucsb-cs24.github.io/m19/exam/e01/>

# PA01: Card matching game with linked lists

Alice:



Bob:



# Review PA01: Card matching game with linked lists

Correct output after running `make && ./game alice_cards.txt bob_cards.txt`:

Alice picked matching card c 3  
 Bob picked matching card s a  
 Alice picked matching card h 9

Alice's cards:  
 h 3  
 s 2  
 c a

Bob's cards:  
 c 2  
 d j

Note: 0=10, a=ace, k=king, q=queen, j=jack

Contents of `alice_cards.txt`:



Contents of `bob_cards.txt`:



# Overloading Binary Comparison Operators

We would like to be able to compare two objects of the class using the following operators

`==`

`!=`

and possibly others

**Last class: overloaded == for LinkedList**

# Overloading input/output stream

Wouldn't it be convenient if we could do this:

```
LinkedList list;  
cout<<list; //prints all the elements of list
```

# Overloading Binary Arithmetic Operators

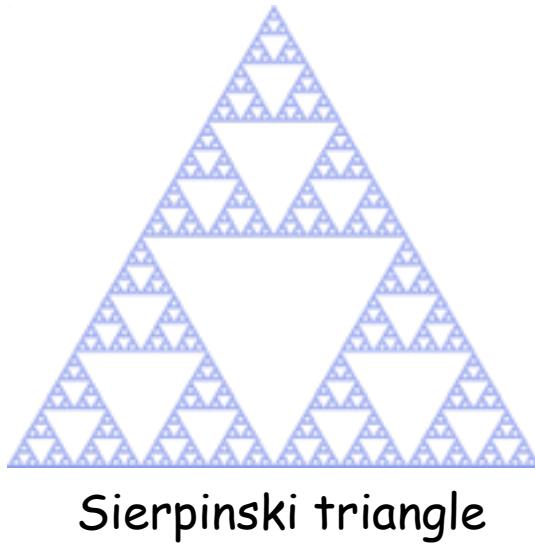
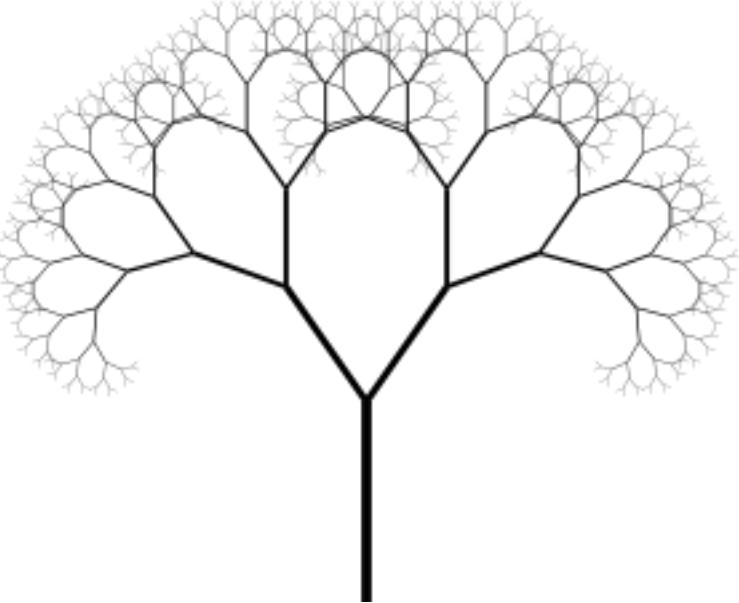
We would like to be able to add two points as follows

```
LinkedList 11, 12;
```

```
//append nodes to 11 and 12;
```

```
LinkedList 13 = 11 + 12 ;
```

# Recursion



Sierpinski triangle



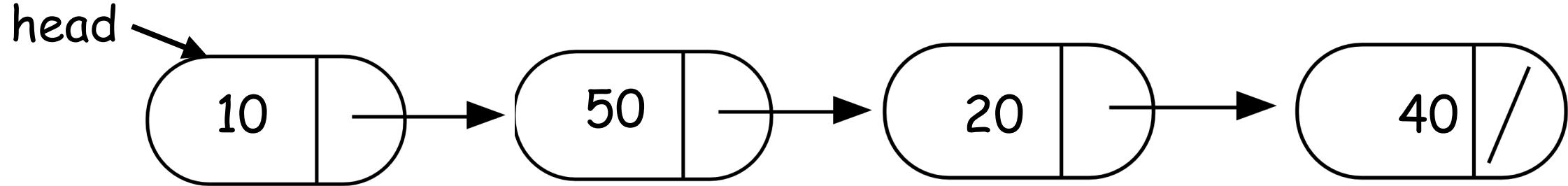
Zooming into a Koch's snowflake



Describe a linked-list recursively

## Common methods of linked list that can be implemented using recursion

- Sum all the values
- Print all the values
- Search for a value
- Delete all the nodes in a linked list



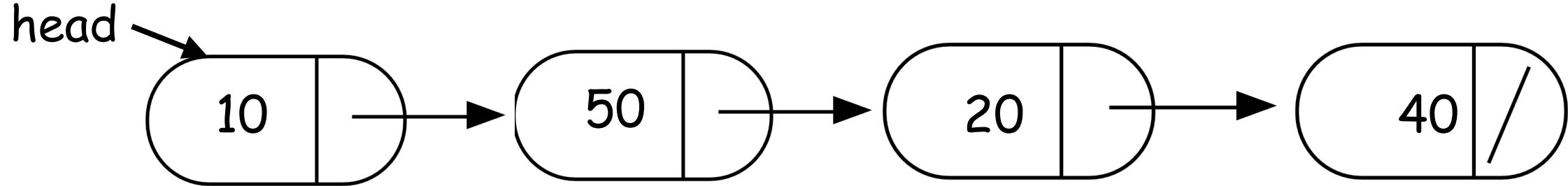
```
int IntList::sum() {  
    //Return the sum of all elements in a linked list  
}
```

# Helper functions

- Sometimes your functions takes an input that is not easy to recurse on
- In that case define a new function with appropriate parameters: This is your helper function
- Call the helper function to perform the recursion
- Usually the helper function is private

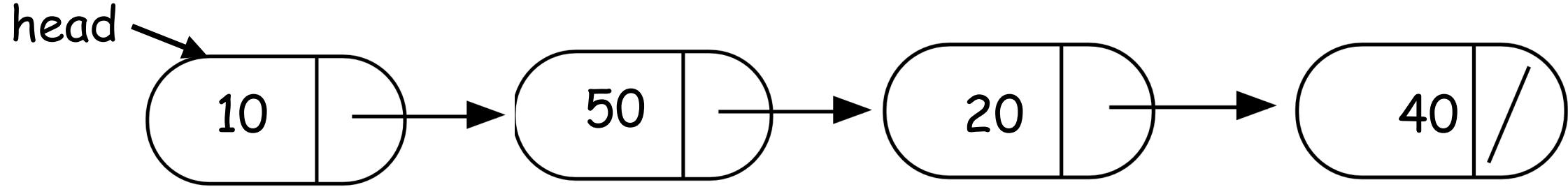
For example

```
Int IntList::sum( ) {  
  
    return sum(head);  
    //helper function that performs the recursion.  
}
```



```
int IntList::sum(Node* p) {
```

```
}
```



```
bool IntList::clear(Node* p) {
```

```
}
```

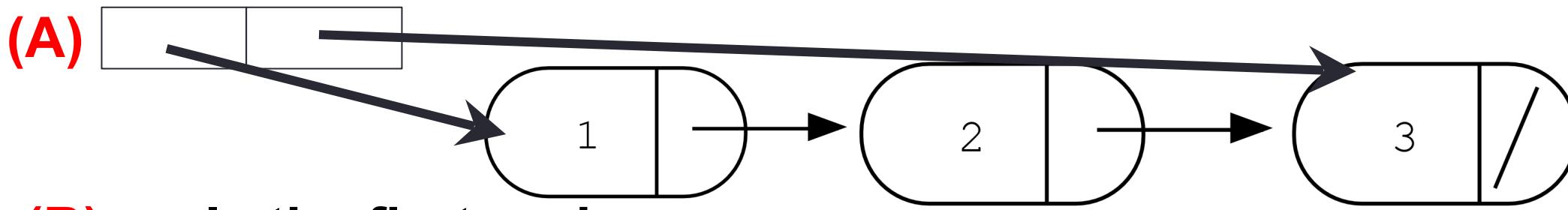
# Concept Question

```
LinkedList::~LinkedList(){
    delete head;
}
```

```
class Node {
public:
    int info;
    Node *next;
};
```

Which of the following objects are deleted when the destructor of Linked-list is called?

head tail



(B): only the first node

(C): A and B

(D): All the nodes of the linked list

(E): A and D

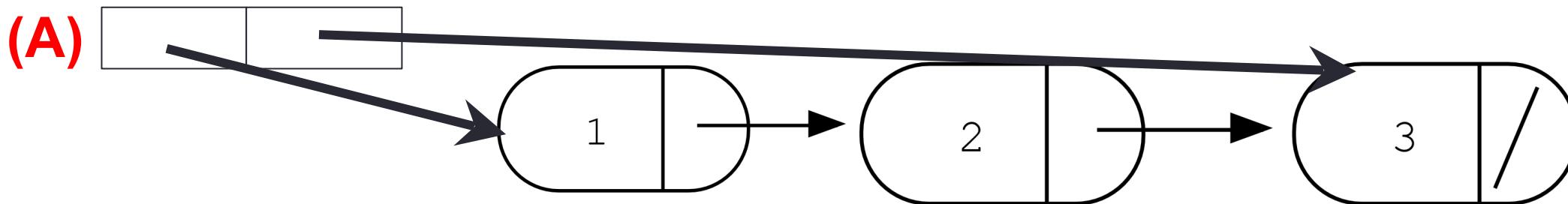
# Concept question

```
LinkedList::~LinkedList(){  
    delete head;  
}
```

```
Node::~Node(){  
    delete next;  
}
```

Which of the following objects are deleted when the destructor of Linked-list is called?

head tail



**(B): All the nodes in the linked-list**

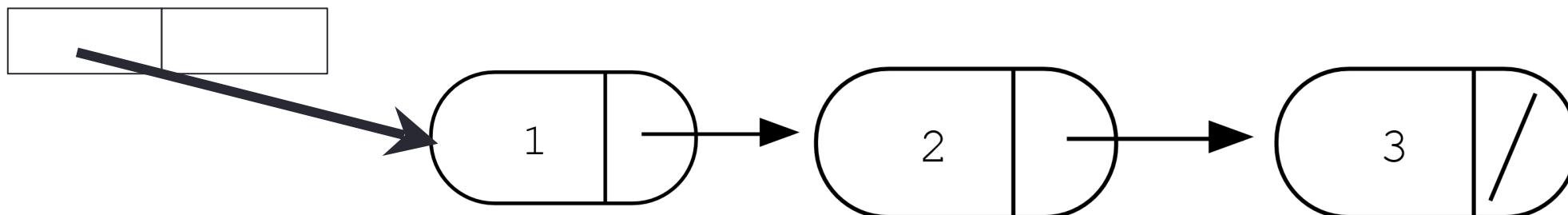
**(C): A and B**

**(D): Program crashes with a segmentation fault**

**(E): None of the above**

```
LinkedList::~LinkedList(){
    delete head;
}
```

head tail



```
Node::~Node(){
    delete next;
}
```



# GDB: GNU Debugger

- To use gdb, compile with the -g flag
  - Setting breakpoints (b)
  - Running programs that take arguments within gdb (r arguments)
  - Continue execution until breakpoint is reached (c)
  - Stepping into functions with step (s)
  - Stepping over functions with next (n)
  - Re-running a program (r)
  - Examining local variables (info locals)
  - Printing the value of variables with print (p)
  - Quitting gdb (q)
  - Debugging segfaults with backtrace (bt)
- \* Refer to the gdb cheat sheet: <https://ucsb-cs24.github.io/m19/lectures/GDB-cheatsheet.pdf>

# Next time

- Binary Search Trees