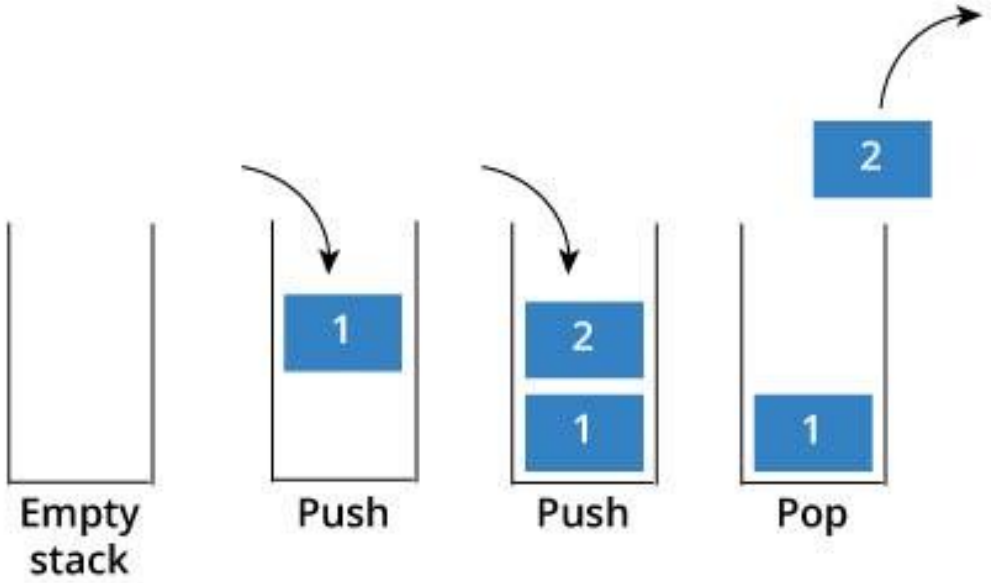
Stacks

An example of a complex object



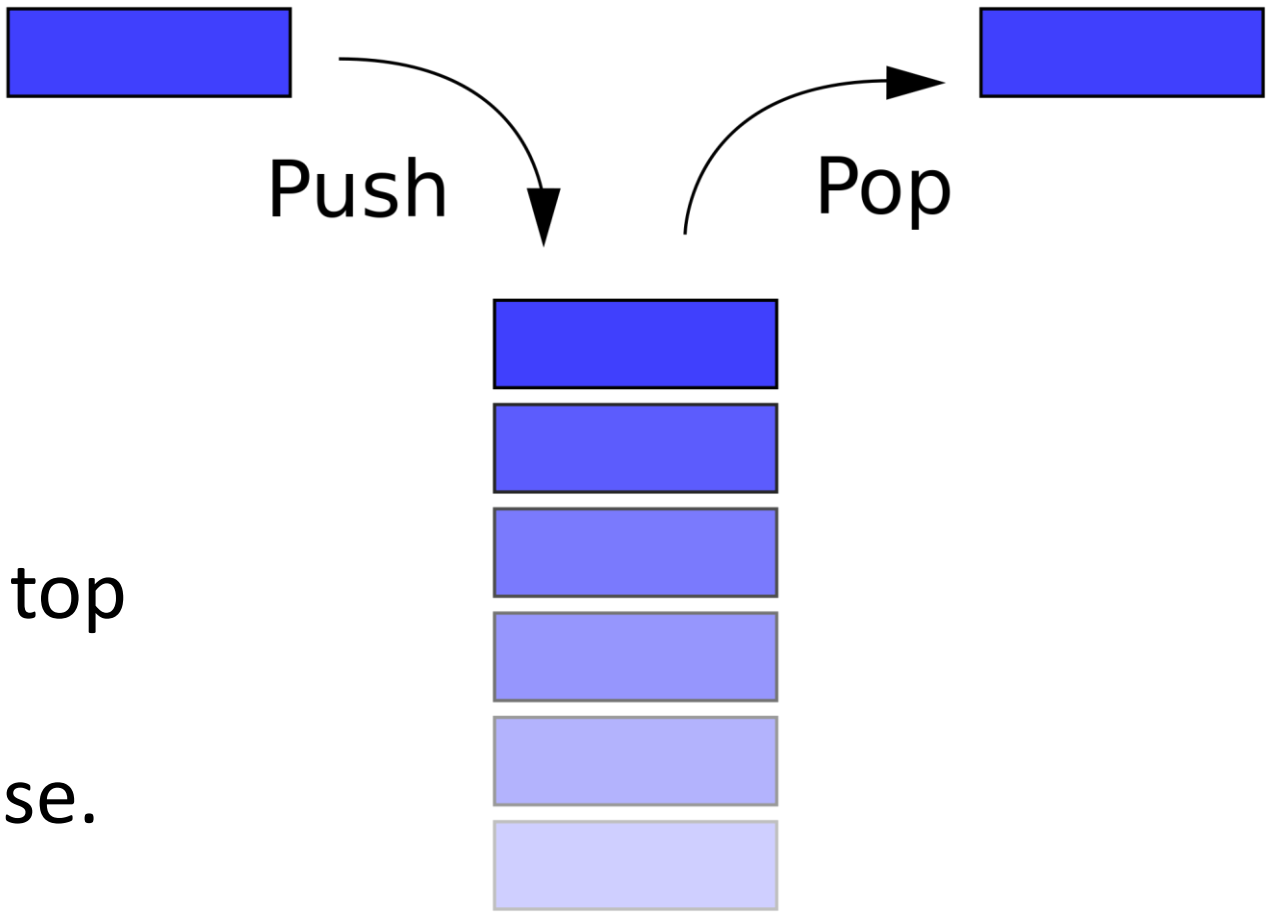
ADT

- Abstract Data Type
- An standard object that is used for storing data; pop up frequently in coding.
- They are well designed and coded
- They do ONE task, really well. Nothing else.
- Examples: Stack, Queue, Tree, Heap, Hash Table

Stack - LIFO

- An standard object type (an ADT)
- Last in, first out (LIFO)
- Everything occurs to the top
- Used for back and undo buttons; Also recursive calls (recall: Stack overflow)

Stack Functions



Push = Add to the top
Pop = Remove from the top

You can’t do anything else.
No sorting.

```
1. Stack s = new Stack();
2. System.out.println(s.isEmpty());
3. s.push("9");
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```

true

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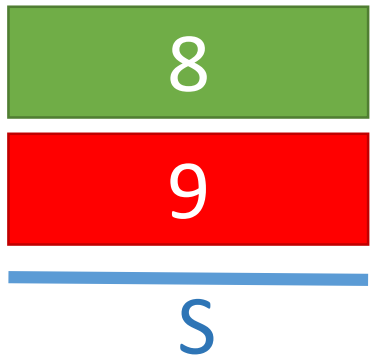
```

true



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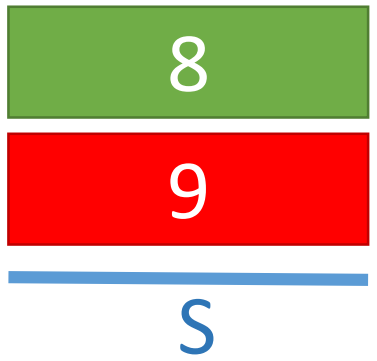
```

true

2



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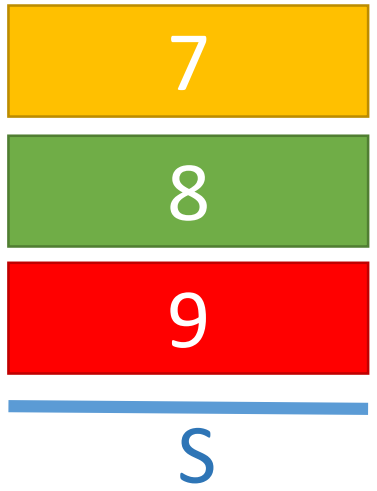
```

true

2



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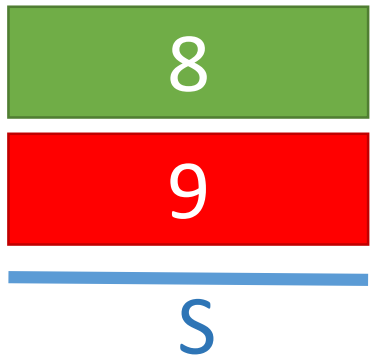
```

true

2

7



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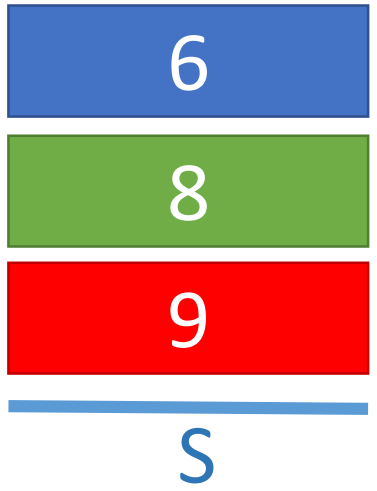
```

true

2

7



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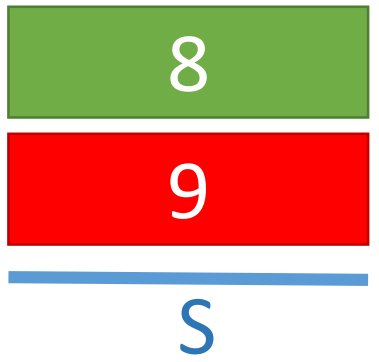
```

true

2

7

6



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12. System.out.println(s.isEmpty());
```

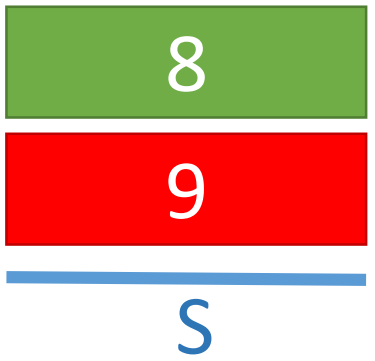
true

2

7

6

2



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```

true

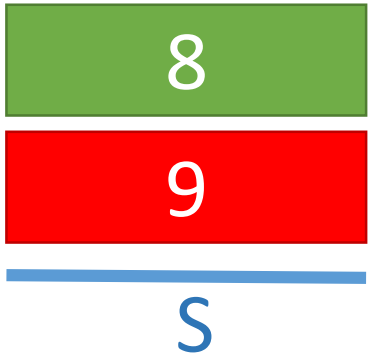
2

7

6

2

false



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12. System.out.println(s.isEmpty());
```

true

2

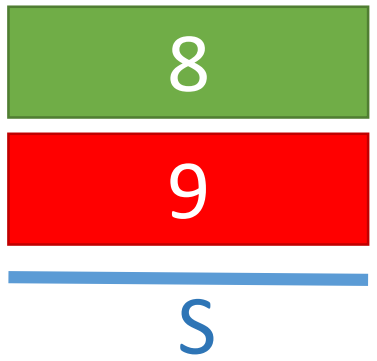
7

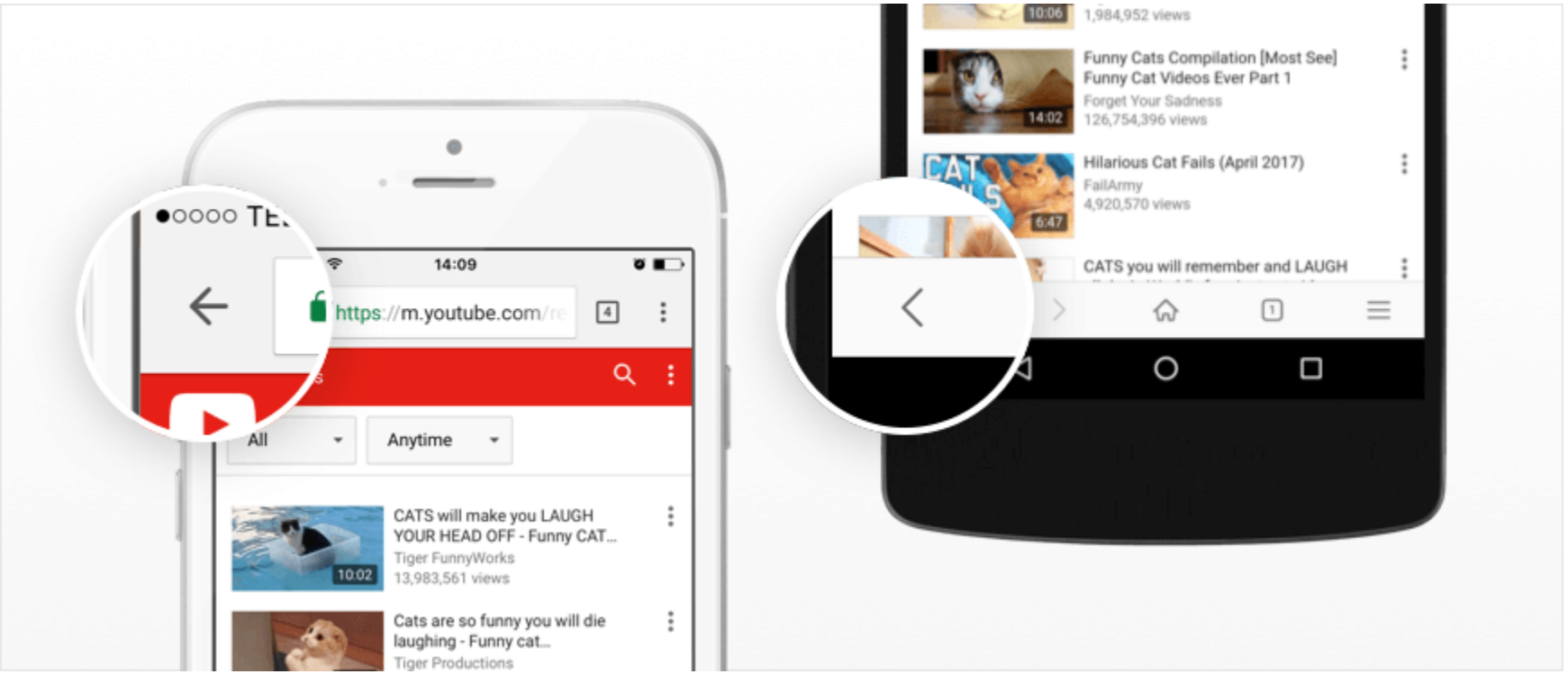
6

2

false

false





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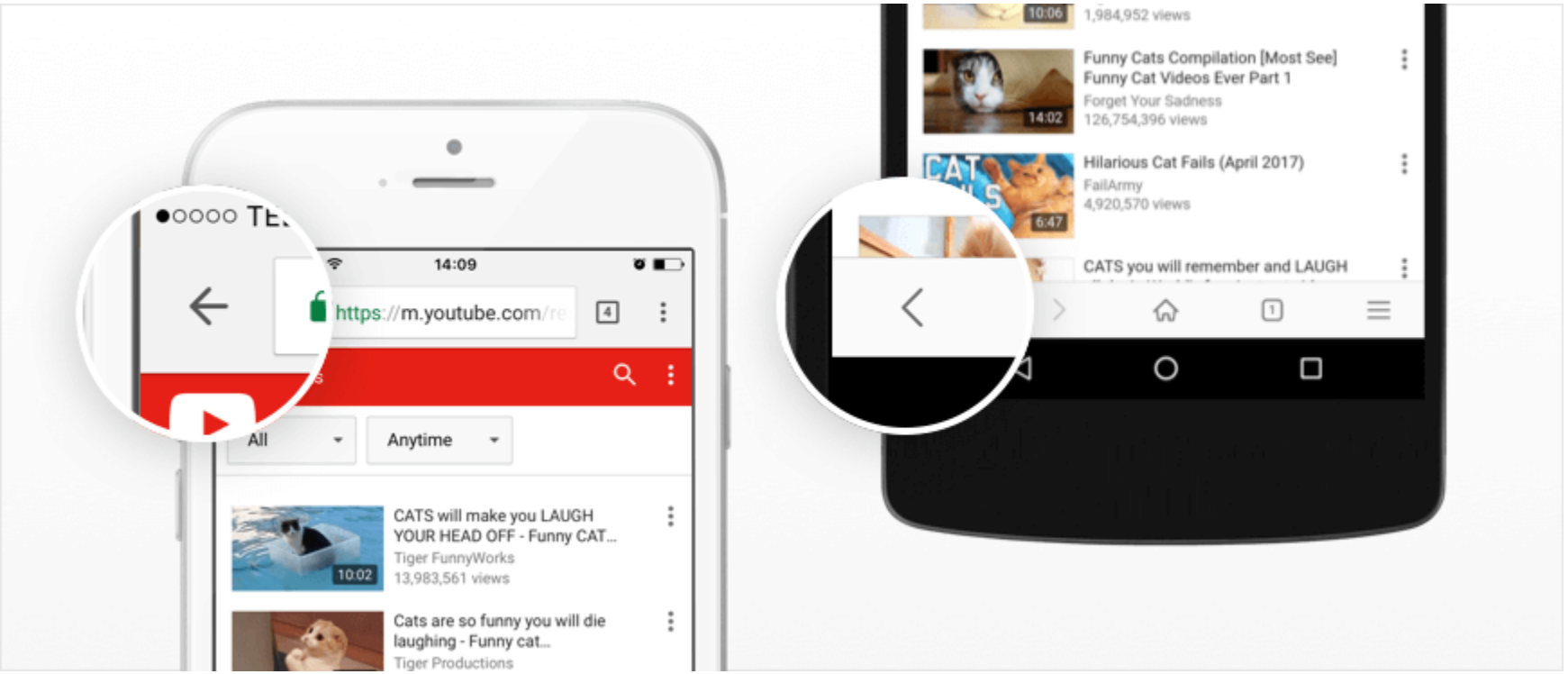

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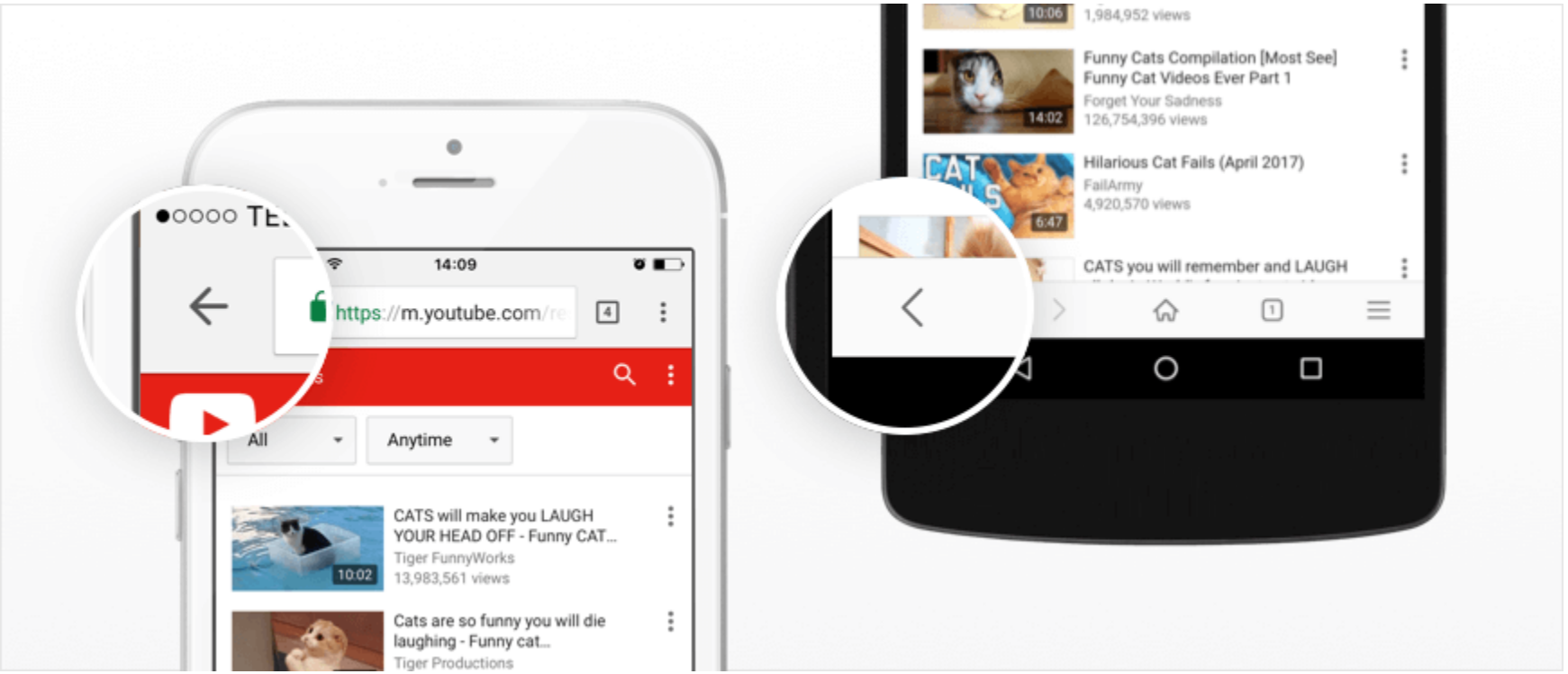

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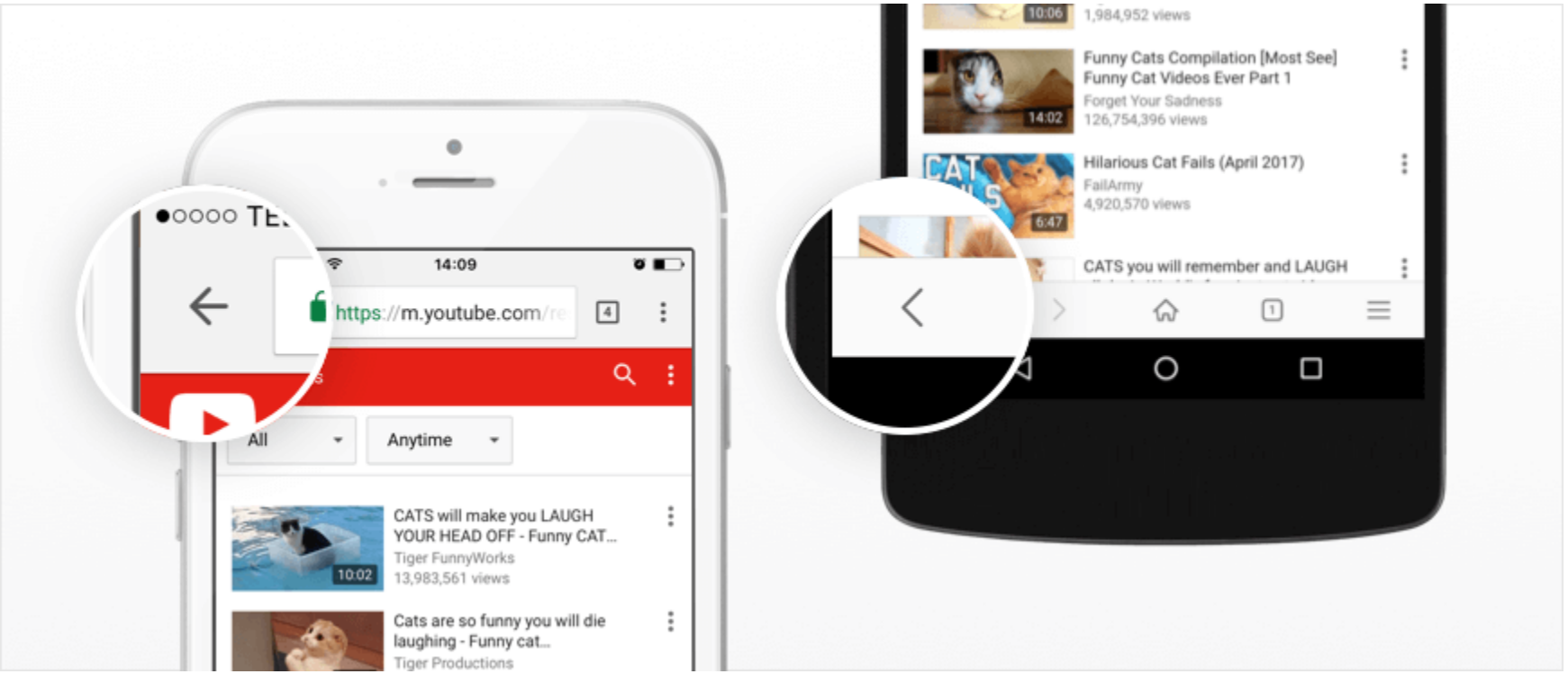

Twitch

Google

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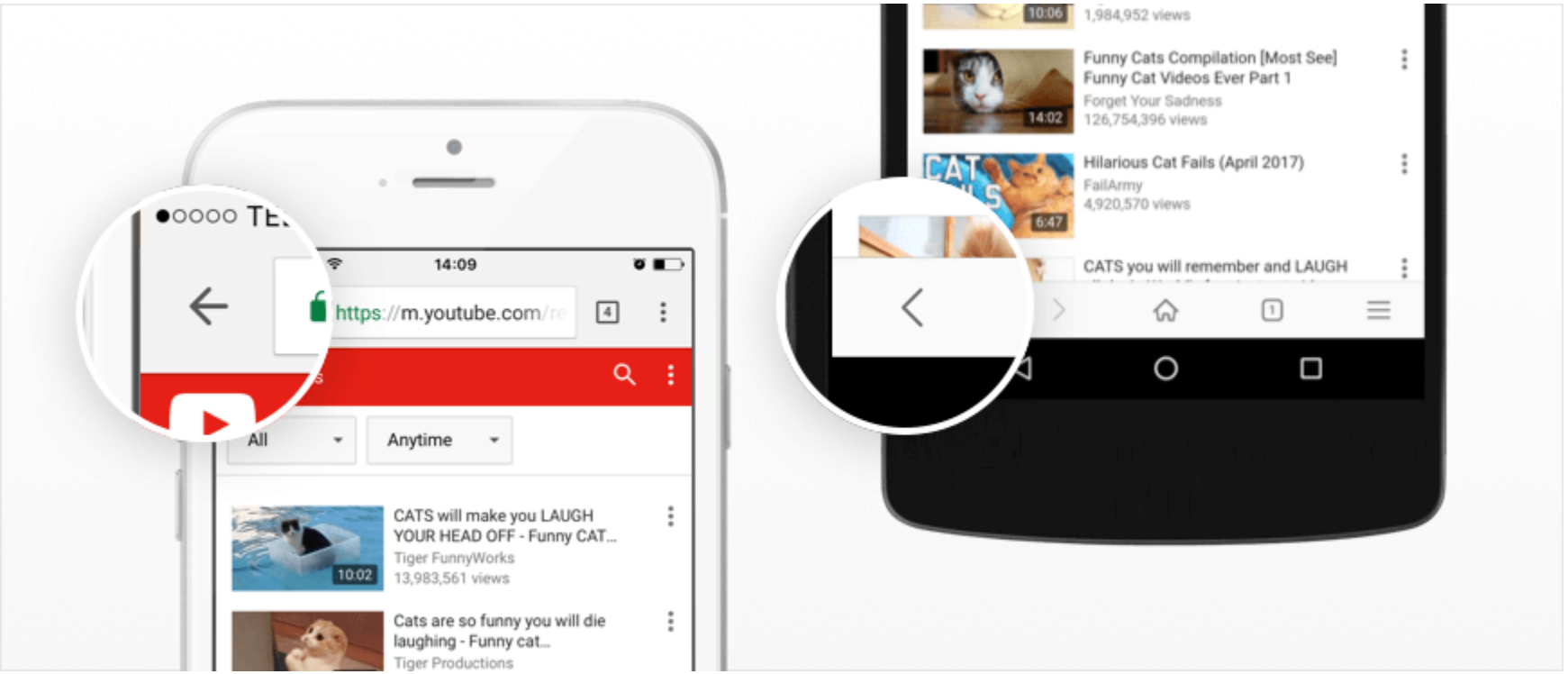

BACK

Twitch

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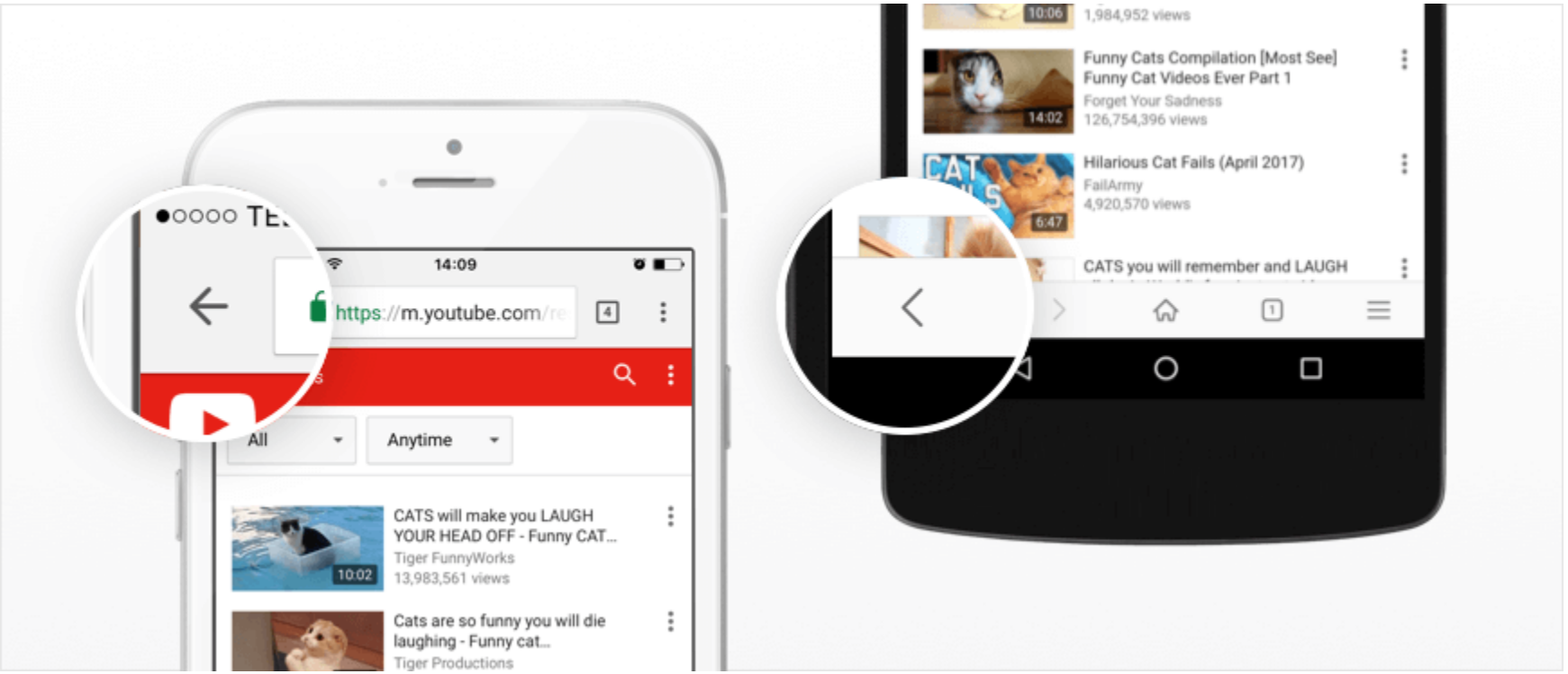

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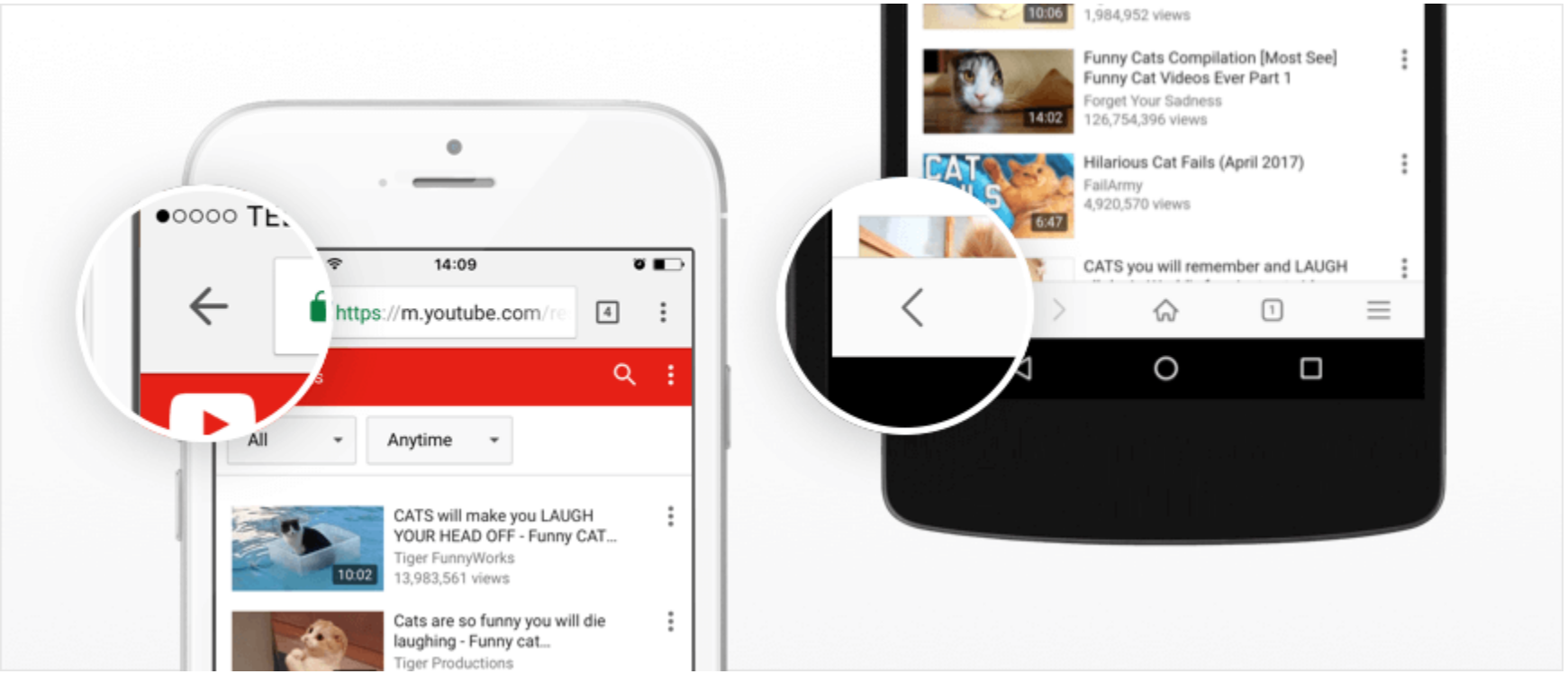

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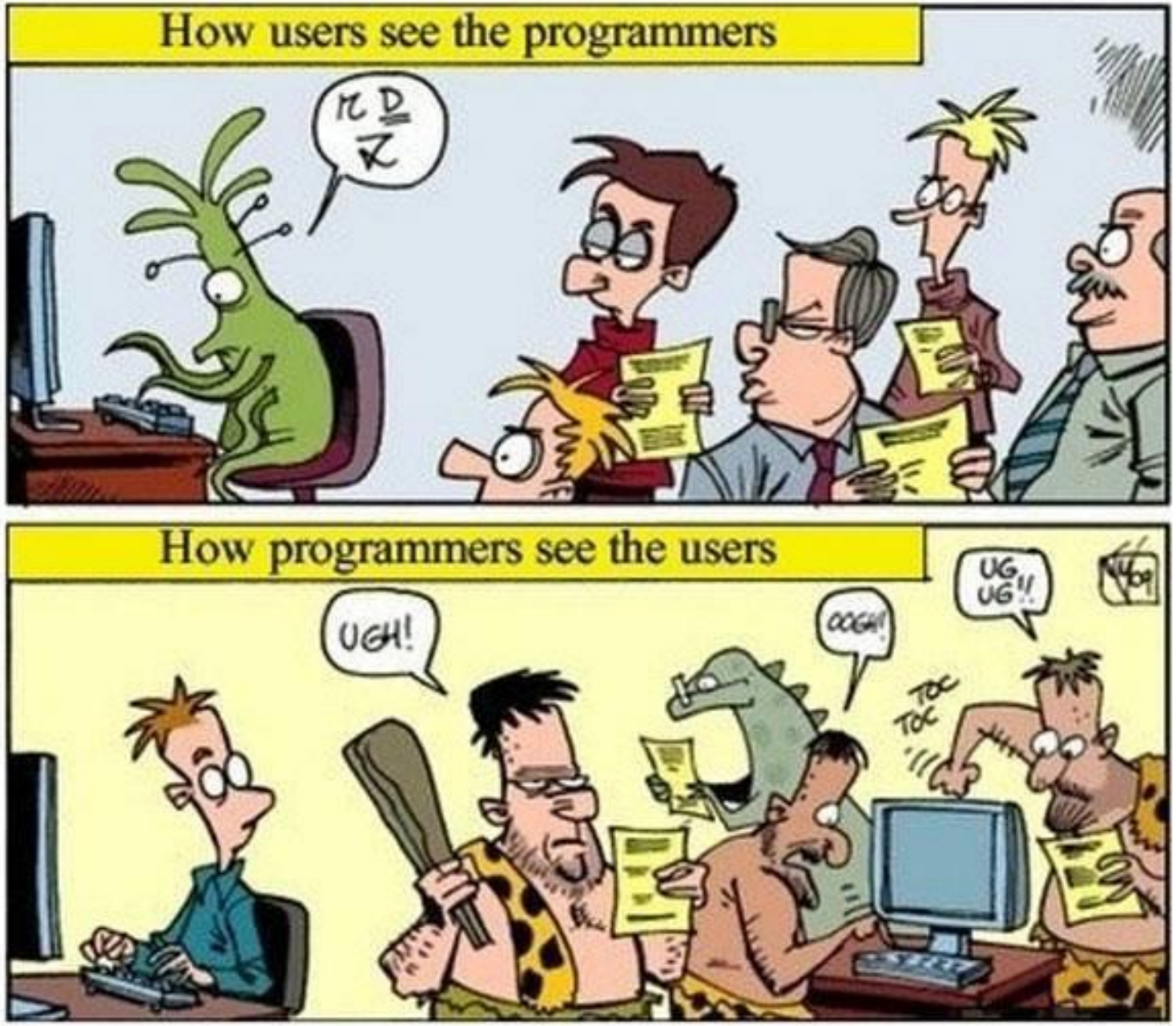
back

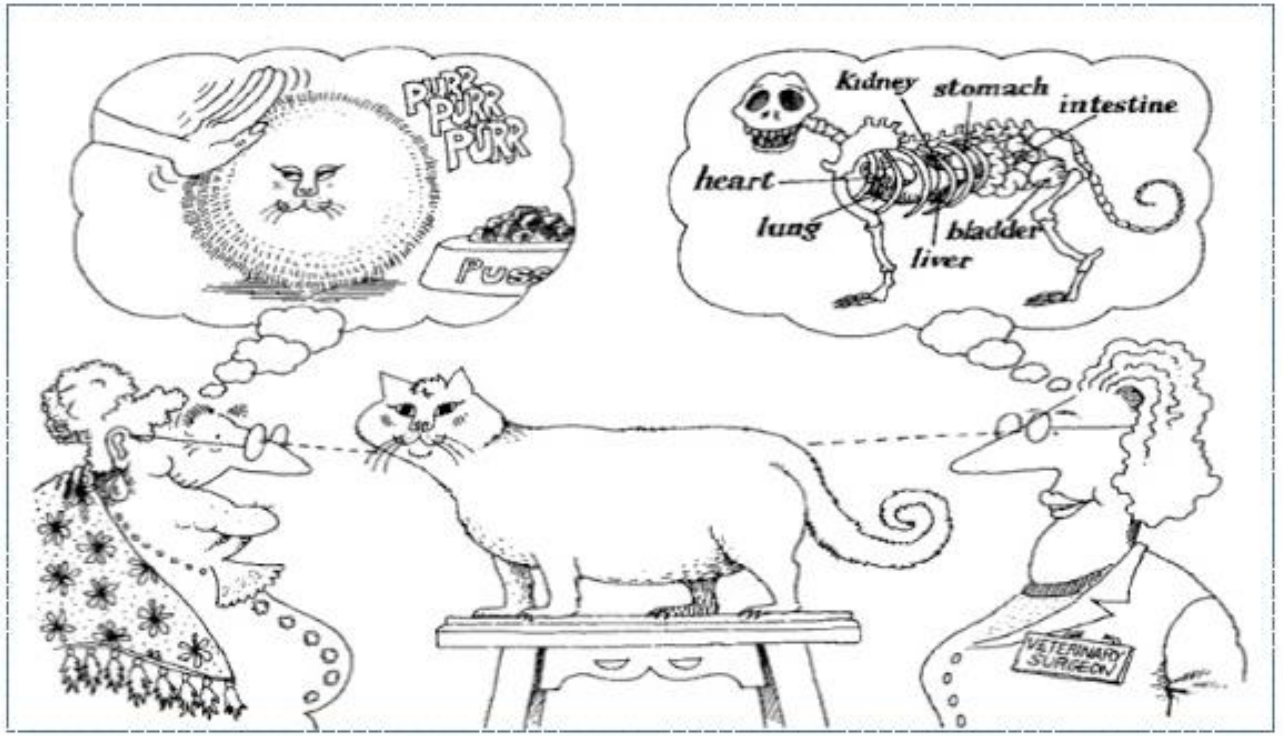
Object = data + methods

- We are grouping together the stack data AND its methods.
- Our stack will be self-contained and programmers who need a back or undo button can use it easier.

Remember that with objects, our user has changed!



With Objects, your user changes to other programmers.



- Stacks are also a good example of information hiding.
- Who cares how push and pop are coded?
- You just need to be aware of how they are called and you can make a back button.

Object = data + methods

```
public class StackString {

private int count;
private String data[] = new String [50];

public StackString () {
  count = 0;
}

public void push (String addMe) {
  if(!isFull()){
    data [count] = addMe;
    count++;
  }
}

public int size () {
  return count;
}

public boolean isFull () {
  return (count == 50);
}
```

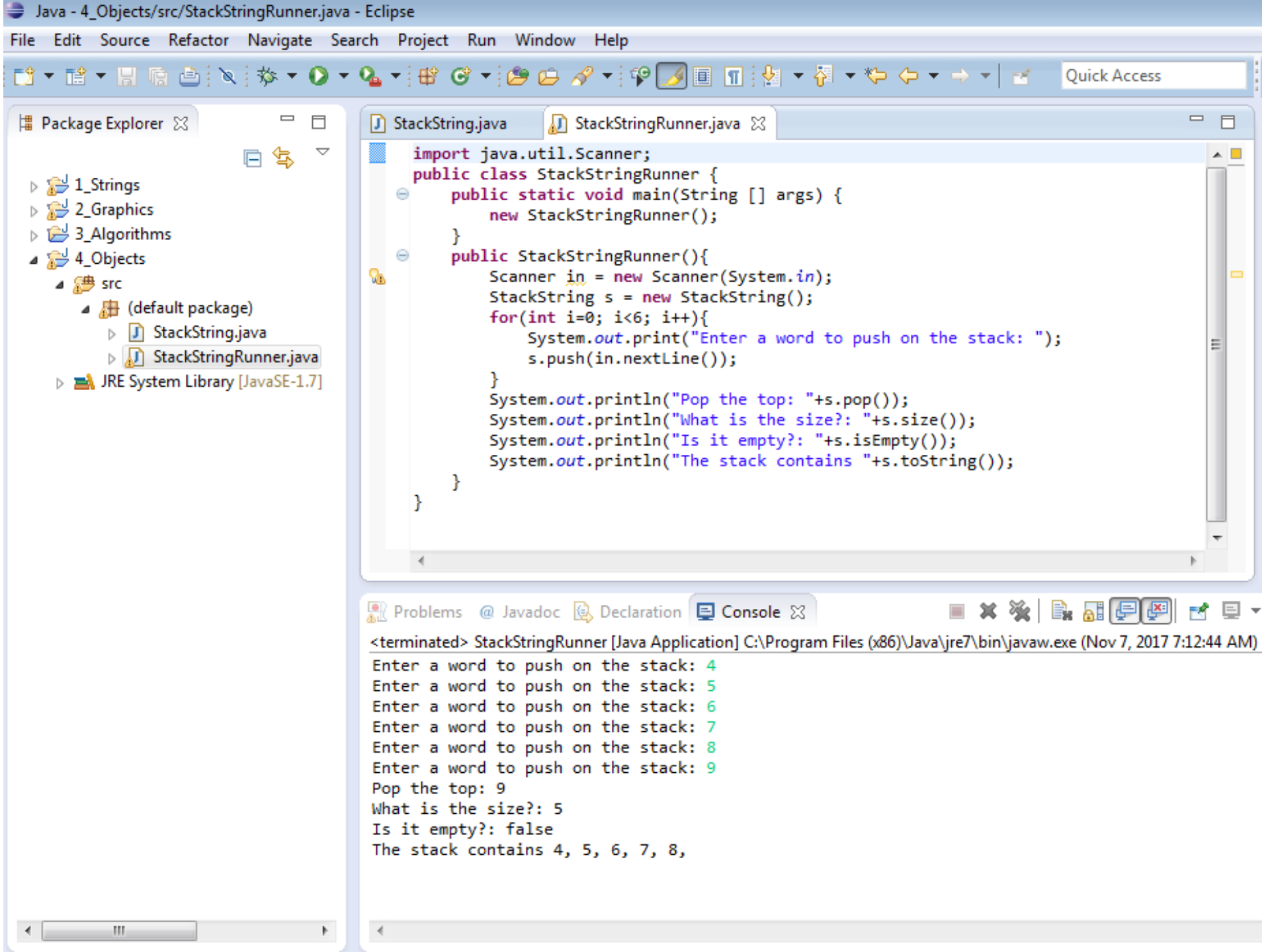
```
public String pop () {
  if(count>0){
     count--;
     return data [count];
  }
  else
    return "Stack empty";
}

public String peek () {
  return data [count--];
}

public boolean isEmpty ()  {
  return count == 0;
}

public void clear () {
  count = 0;
}

}
```


Java - 4_Objects/src/StackStringRunner.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Package Explorer
1_Strings
2_Graphics
3_Algorithms
4_Objects
src
(default package)
StackString.java
StackStringRunner.java
JRE System Library [JavaSE-1.7]
StackString.java
StackStringRunner.java
import java.util.Scanner;
public class StackStringRunner {
public static void main(String [] args) {
new StackStringRunner();
}
public StackStringRunner(){
Scanner in = new Scanner(System.in);
StackString s = new StackString();
for(int i=0; i<6; i++){
System.out.print("Enter a word to push on the stack: ");
s.push(in.nextLine());
}
System.out.println("Pop the top: "+s.pop());
System.out.println("What is the size?: "+s.size());
System.out.println("Is it empty?: "+s.isEmpty());
System.out.println("The stack contains "+s.toString());
}
}
Problems Javadoc Declaration Console
<terminated> StackStringRunner [Java Application] C:\Program Files (x86)\Java\jre7\bin\javaw.exe (Nov 7, 2017 7:12:44 AM)
Enter a word to push on the stack: 4
Enter a word to push on the stack: 5
Enter a word to push on the stack: 6
Enter a word to push on the stack: 7
Enter a word to push on the stack: 8
Enter a word to push on the stack: 9
Pop the top: 9
What is the size?: 5
Is it empty?: false
The stack contains 4, 5, 6, 7, 8,

```
import java.util.Scanner;
public class StackStringRunner {
    public static void main(String [] args) {
        new StackStringRunner();
    }

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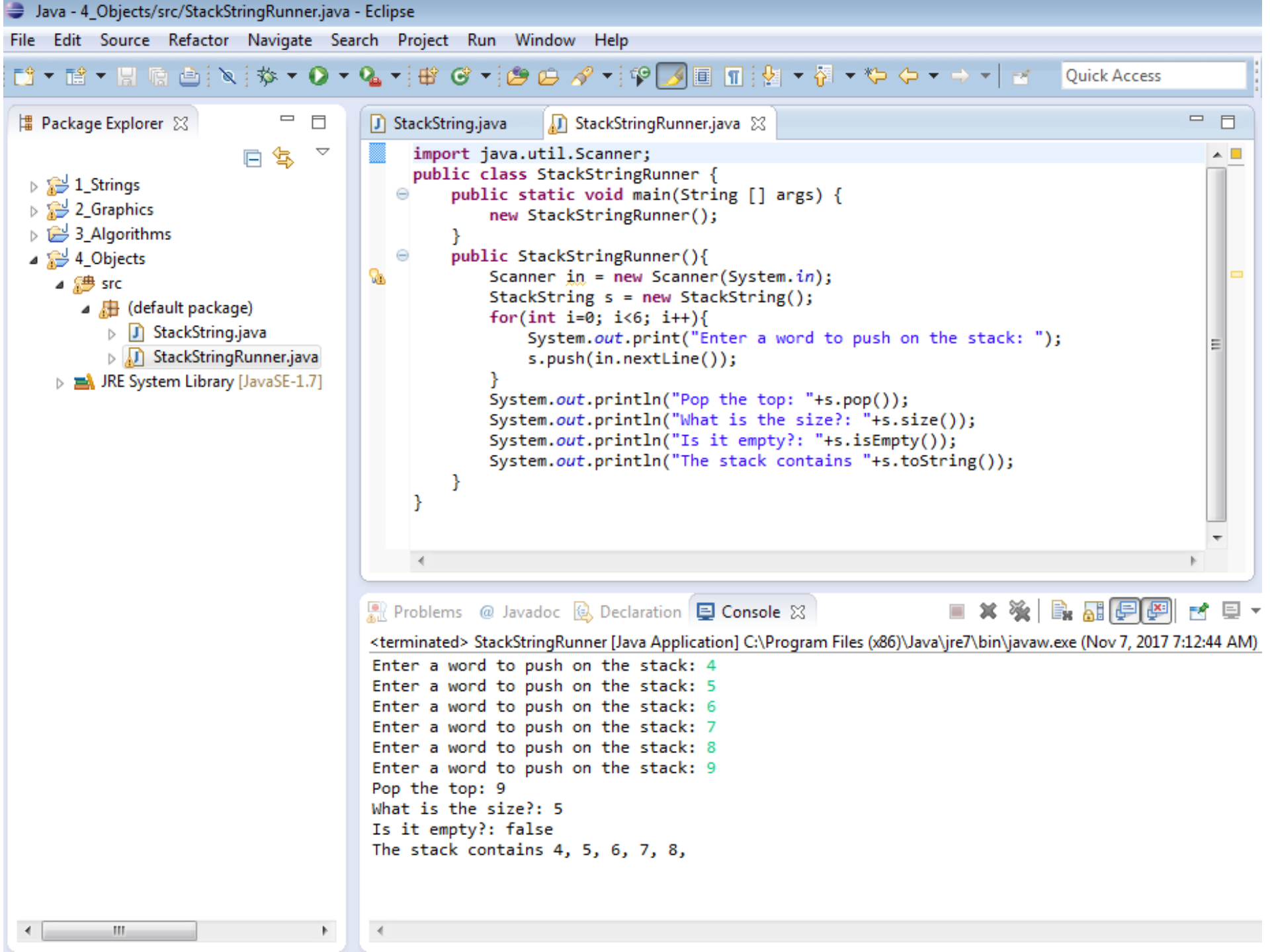
        System.out.println("Is it empty?: "+s.isEmpty());
        System.out.println("The stack contains "+s.toString());
    }
}
```


Java - 4_Objects/src/StackStringRunner.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
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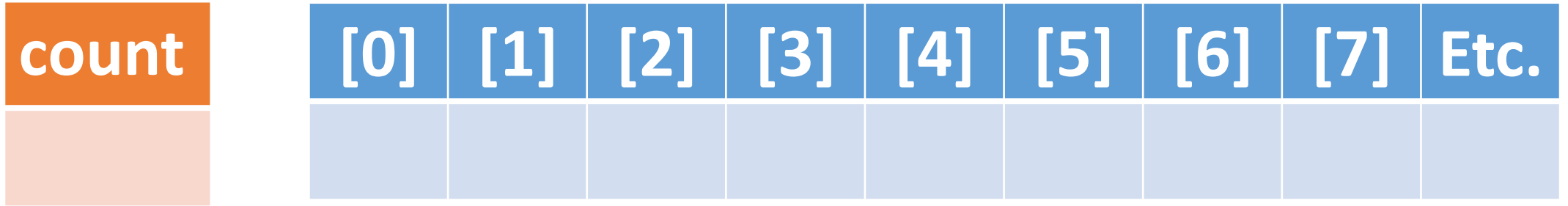
Enter a word to push on the stack: 7
Enter a word to push on the stack: 8
Enter a word to push on the stack: 9
Pop the top: 9
What is the size?: 5
Is it empty?: false
The stack contains 4, 5, 6, 7, 8,

Stack

- A common ADT, An object
- Has a LIFO structure (Last in, first out)
- Functions: size, isFull, isEmpty, push (add), pop (remove), peek (look at the top)
- All operations are O(1), but you are limited to stack functions. The speed comes from the fact that you restricted the functionality a lot.
- For example: You can’t sort a stack: why? Because the order of the stack is the order you want. If you don’t want that order, then you don’t want a stack. Go use an array instead.

```
public class StackString {
     private int count;
     private String data[] = new String [50];
}
```



```
public class StackString {
   private int count;
   private String data[] = new String [50];

public StackString () {
   count = 0;
}
```

count
0

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	Etc.

```
public int size () {
   return count;
}

public boolean isFull () {
   return (count == 50);
}
```

count
0

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	Etc.

```
public String peek () {
   return data [count--];
}

public boolean isEmpty ()  {
   return count == 0;
}

public void clear () {
   count = 0;
}
```

count
0

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	Etc.

```
public void push (String addMe) {
   if(!isFull()){
      data [count] = addMe;
      count++;
   }
}
```

count
0

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	Etc.

```
public String pop () {
   if(count>0){
      count--;
      return data [count];
   }
   else
      return "Stack empty";
}
```

count
0

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	Etc.

```
public String toString () {
//this is not an official Stack method
//it is useful to see what is in your Stack
String ans = "";
for(int i=0; i<count; i++)
  ans+= data[i]+", ";
return ans;
}
```

count
0

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	Etc.