Data Structures I:
Stacks and Queues

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Disclaimer: Keep alcohol out of the hands of minors.

- 60ml gin
- 10ml vermouth
- 1 olive

https://www.youtube.com/watch?v=NJarxpYyoFI
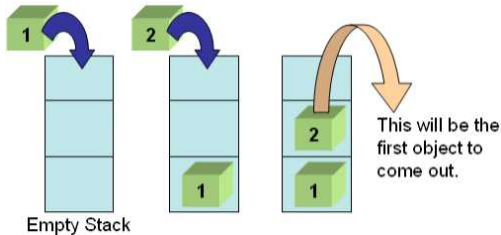
	insertFirst	insert(i)	deleteFirst	delete(i)	get(i)
ArrayList	O(n)	O(n)	O(n)	O(n)	O(1)
LinkedList	O(1)	O(n)	O(1)	O(n)	O(n)

Table: Complexity analysis of the operations of LinkedList and ArrayList.

- Methods for both LinkedList and ArrayList are the same, but implementations are different.
- LinkedList is more efficient for insertion and ArrayList is more efficient for random access.
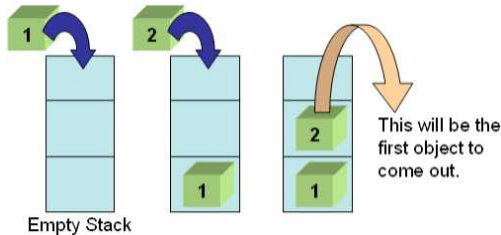
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- A stack allows access to only the last item inserted.
- If you remove this item, then you can access the next-to-last item inserted

This will be the first object to come out.

Empty Stack

http://www.codeproject.com/KB/dotnet/Stacks/Stack.jpg

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http://visualgo.net/list.html

1. Check whether parentheses, braces, and brackets are balanced in a computer program source file.

2. Help traverse the nodes of a tree.

3. Search vertices of a graph

4. Most microprocessors use a stack-based architecture.

5. Some calculators use a stack-based architecture.

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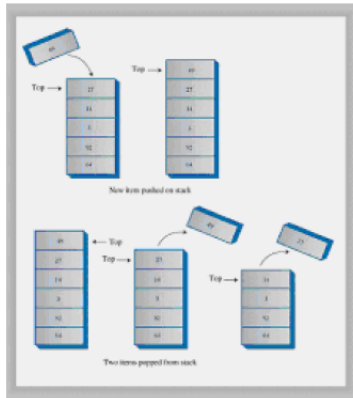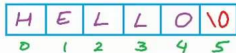5. Some calculators use a stack-based architecture.

Figure: Operation of the StackX class methods. Taken from [Laf98].

```
class StackX
{
public StackX(int size);
public void push(int j);
public double pop();
public double peek();
public boolean isEmpty();
public boolean isFull();
}
```

Using stack to reverse

Problem: Reverse a string

H	E	L	L	O	\0
0	1	2	3	4	5

```cpp
void Reverse(char *C,int n)
{
    stack<char> S;
    //loop for push
    for(int i=0;i<n;i++){
        S.push(C[i]);
    }
    //loop for pop
    for(int i =0;i<n;i++){
        C[i] = S.top();
        S.pop();
    }
}
```
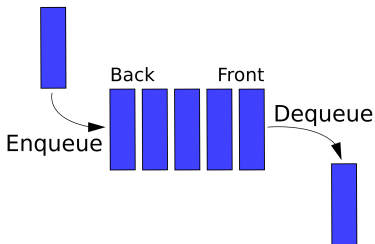
mycodeschool.com

Figure: Reverse a string using a Stack. Taken from mycodeschool.com.

https://www.youtube.com/watch?v=hNP72JdOIgY

```
String str = "hola";
Stack<String> stack=new Stack<String>();
for (int i=0;i<str.length();i++)
  stack.push(str.substring(i,i+1));
String strrev = "";
while(!stack.isEmpty())
  strrev += stack.pop();
```

- In a queue, the first item inserted is the first to be removed

Taken from Wikipedia

http://visualgo.net/list.html

- Breadth-First Search
- When a resource is shared among multiple consumers
    - Examples include CPU scheduling, Disk Scheduling...
- When data is transferred asynchronously between two processes
    - Examples include IO Buffers, pipes, file IO, TCP/IP...

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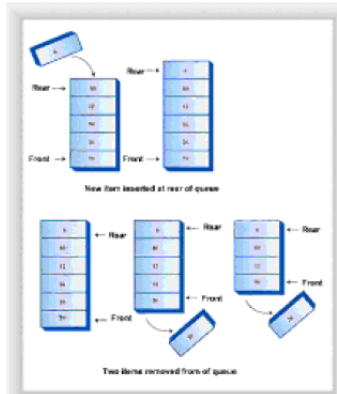   - Examples include IO Buffers, pipes, file IO, TCP/IP...

Figure: Operation of the Queue class methods. Taken from [Laf98].

```
class Queue
{
public Queue(int s)
public void insert(int j)
public int remove()
public int peekFront()
public boolean isEmpty()
public boolean isFull()
public int size()
}
```

```java
Queue queue = new LinkedList ();
//exception could be thrown
queue.add("item1");
//no exceptions thrown
queue.offer("Item3");
//Removes the first item
System.out.println(queue.remove());
//may returns false.
System.out.println(queue.poll());
//may return a null value
System.out.println(queue.peek());
```
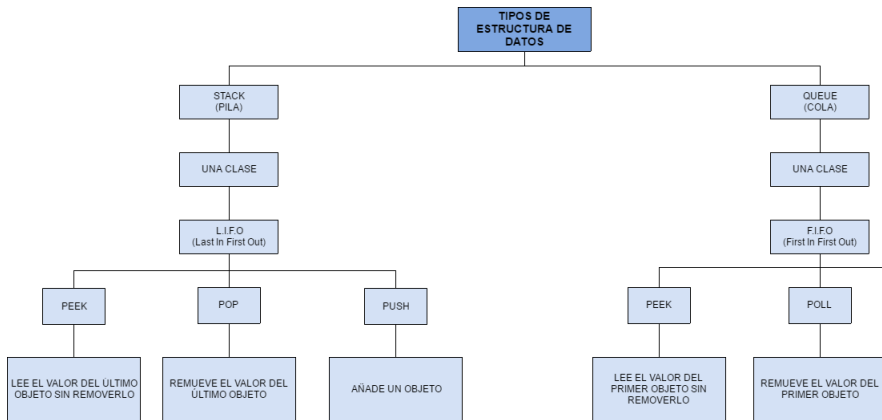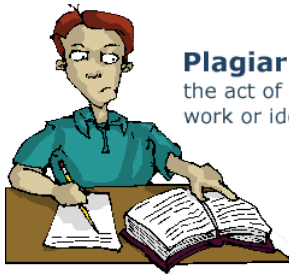
Figure: Mapa conceptual. Contribución de Camilo Villa.

- A stack is also called "Last in, first out" (LIFO).
- A queue is also called "First in, first out" (FIFO).

- Please check the slides after class to learn how to reference images, trademarks, videos and fragments of code.
- Avoid plagiarism

Figure: Figure about plagiarism, University of Malta [Uni09]

📄 Robert Lafore.

Data Structures and Algorithms in Java.

QUE; 1 edition (8 November 2002), 1998.

📄 University of Malta.

Plagarism — The act of presenting another's work or ideas as your own, 2009.

[Online; accessed 29-November-2013].

- Stacks and Queues
  - Mitchell Waite. Data Structures and Algorithms in Java. Chapter 4.