

26-0: Stack

A Stack is a Last-In, First-Out (LIFO) data structure.

Stack Operations:

- Add an element to the top of the stack (push)
- Remove the top element (pop)
- Check if the stack is empty

26-1: Stack

- Can only access the top element of a stack
 - To get to elements lower in the stack, need to pop off elements on top
 - Like a stack of plates at a cafeteria
 - Or like the Java call stack

26-2: Stack Implementation

```
class Stack
{
    // What instance variables are necessary to implement
    // a stack using an array?
}
```

26-3: Stack Implementation

```
class Stack
{
    Object stackElements[];
    int top;

    public Stack(int MaxSize) { ... }
    public void push(Object elem) { ... }
    public Object pop() { ... }
    public boolean isEmpty() { ... }
}
```

26-4: Stack Implementation

```
class Stack
{
    Object stackElements[];
    int top;
    public Stack(int MaxSize) {
        stackElements = new Object[MaxSize];
        top = 0;
    }
    public void push(Object elem) {
        stackElements[top++] = elem;
    }
    public Object pop() {
        return StackElements[--top];
    }
    public boolean isEmpty() {
        return top == 0;
    }
}
```

26-5: Stack Implementation

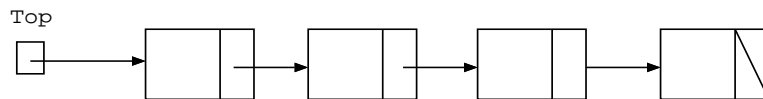
- $O()$ Running time for each operation?
 - push()
 - pop()
 - isEmpty()

26-6: **Stack Implementation**

- $O()$ Running time for each operation?
 - push() $O(1)$
 - pop() $O(1)$
 - isEmpty() $O(1)$

26-7: **Stack Implementation**

- Linked list
 - How to push / pop?
 - (diagrams on board, code is part of lab)

26-8: **Stack Implementation**26-9: **Queue**

A Queue is a First-In, First-Out (FIFO) data structure.

Queue Operations:

- Enqueue: Add an element to the end (tail) of the queue
- Dequeue: Remove the element from the front (head) of the queue
- Check if the queue is empty

26-10: **Queue**

- Linked List Implementation

26-11: **Queue**

- Linked List Implementation
 - Maintain a pointer to the first and last element in the Linked List
 - Add elements to the back of the Linked List
 - Remove elements from the front of the linked list

26-12: **Queue**