STACKS AND QUEUES

15-121

What's new?

- Array: random access data structure
  - any element could be accessed directly in conctant time
- LinkedList: sequential access
  - elements are accessed in a particular order
- **limited/restricted access** data structures
  - Stacks
  - Queues

Stacks and Queues: restricted lists

- Stacks and queues constrain where items can be added/removed
- Stacks
  - Everything happens “at the top”
  - Last-In-First-Out (**LIFO**)
- Queues
  - remove from front, add at back
  - First-In-First-Out (**FIFO**)
- Interfaces …

Stack Interface

- The data type stack is an **adapter** class
- A stack is built on top of other data structures.
  - an array, a vector, an ArrayList, a linked list, or any other collection.
- Regardless of the type of the underlying data structure, a Stack must implement the same functionality.
- This is achieved by providing a unique **interface**

Stack Interface

```
public interface StackInterface<E>
{
   public void push(E e);

   public E pop();

   public E peek();

   public boolean isEmpty();
}
```

Stack applications

- Where have you seen stack-like (LIFO) behavior?
  - Lunch trays?
  - The simplest application of a stack is to reverse a word.
    - You push a given word to stack - letter by letter - and then pop letters from the stack.
  - The "undo" mechanism in text editors
    - This operation is accomplished by keeping all text changes in a stack.
  - Parenthesis balancing

Queue Interface

- The data type Queue is an **adapter** class
- A Queue is built on top of other data structures.
  - an array, a vector, an ArrayList, a linked list, or any other collection.
- Regardless of the type of the underlying data structure, a Queue must implement the same functionality.
- This is achieved by providing a unique **Queue interface**

Queue Interface

```
interface QueueInterface<E>
{
   public boolean isEmpty();

   public E getFront();

   public E dequeue();

   public void enqueue(E e);

   public void clear();
}
```

Queue applications

- Where have you seen queue-like (FIFO) behavior?
  - Lunch lines
  - roundabout throughput