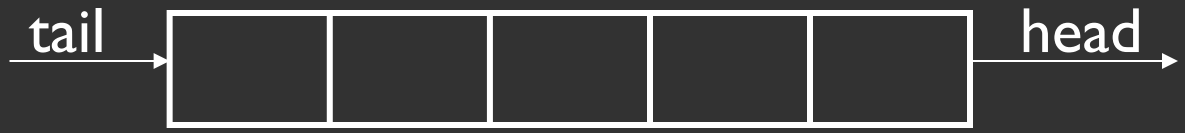
CSCI 136
Data Structures & Advanced Programming

Queues

Queues



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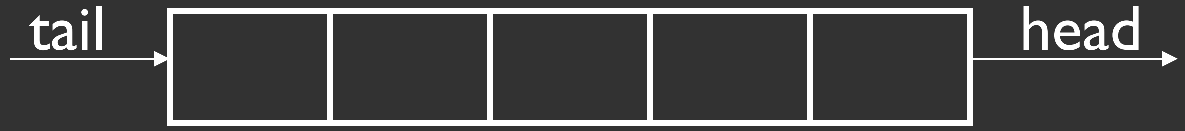

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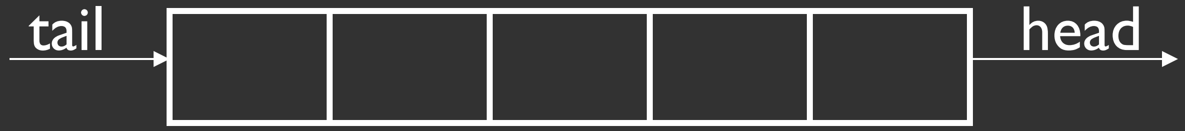

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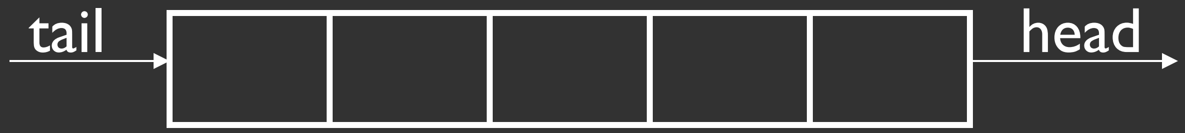

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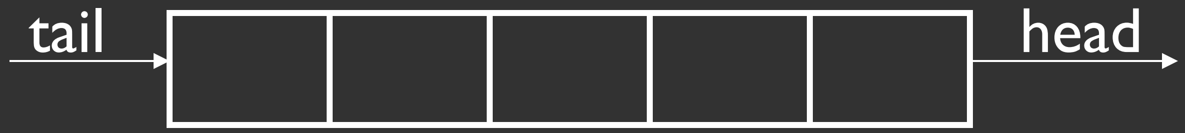

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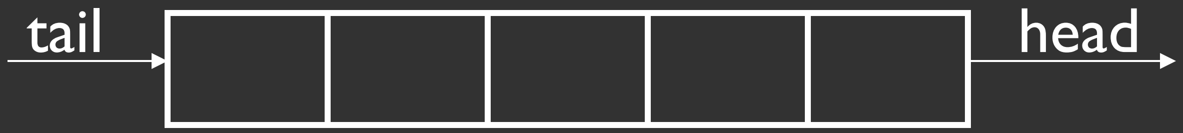

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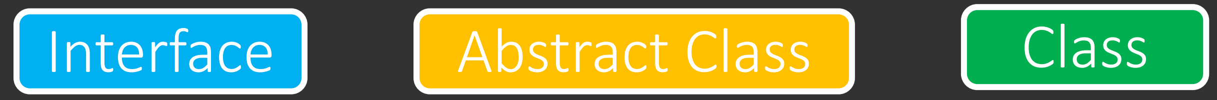
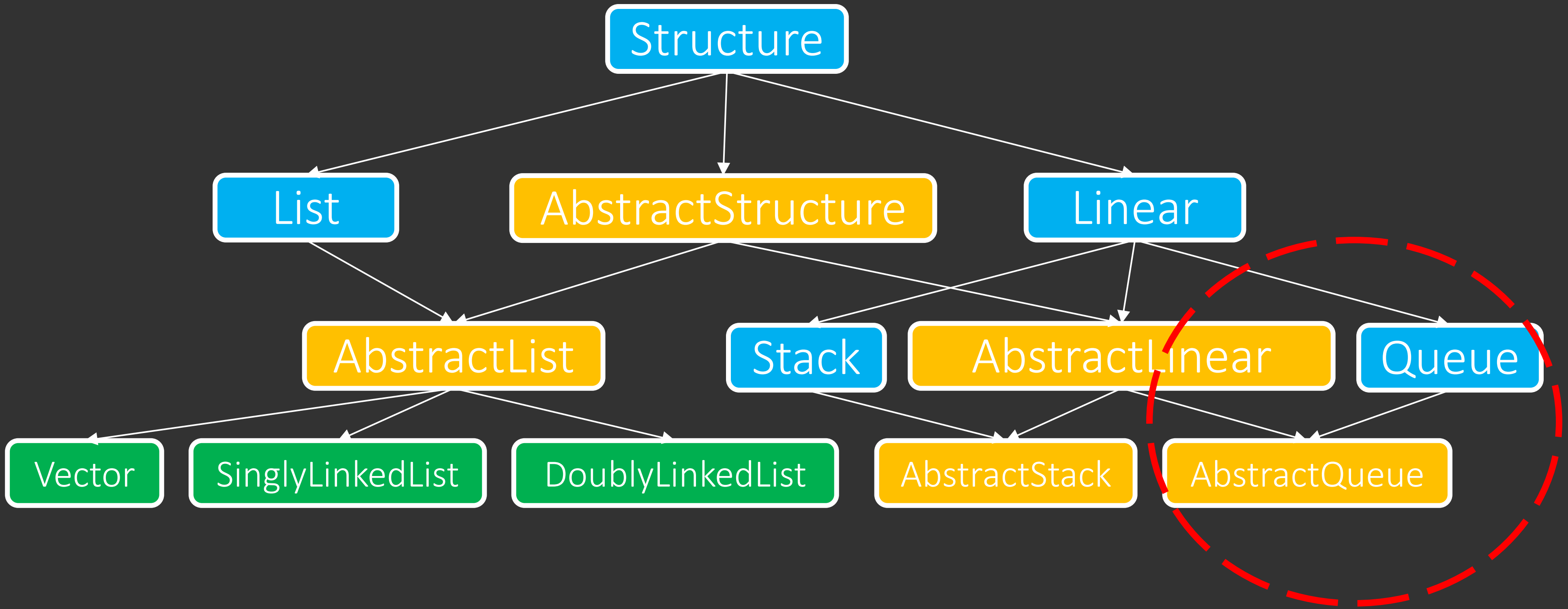
  - Routing network traffic

The Structure5 Universe (+ Linear!)





Stacks vs. Queues

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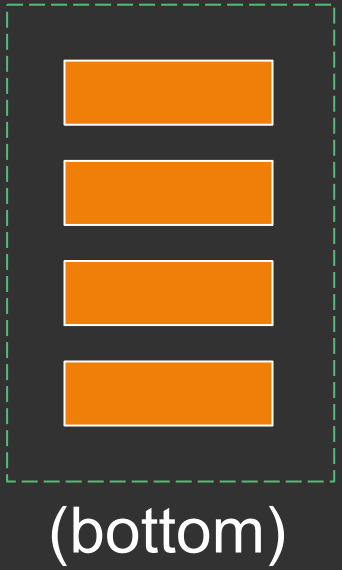

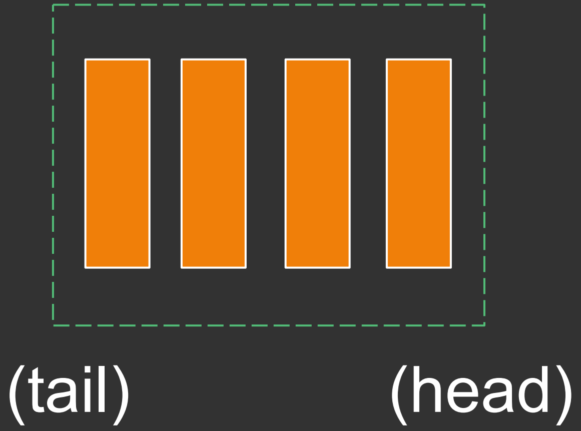

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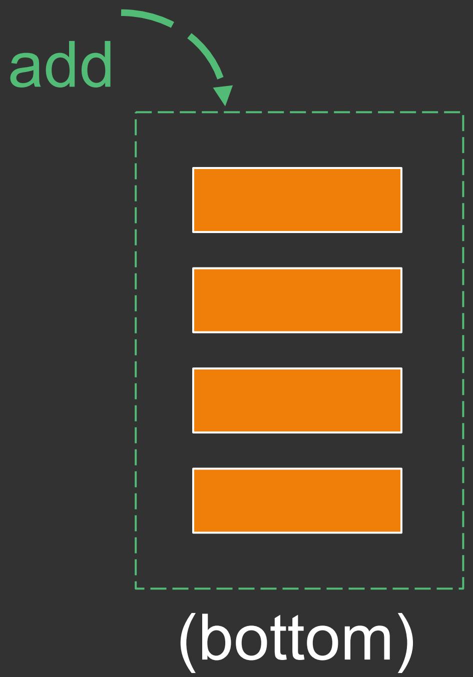

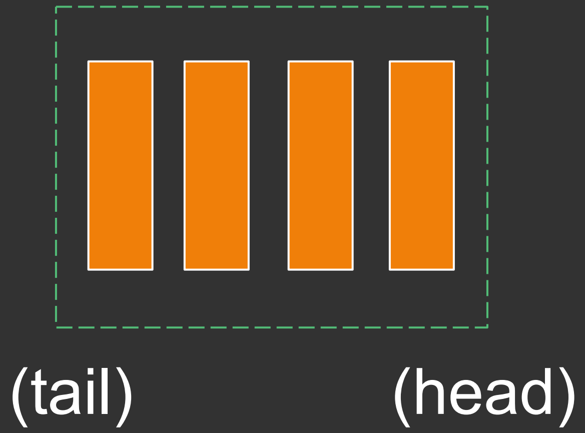

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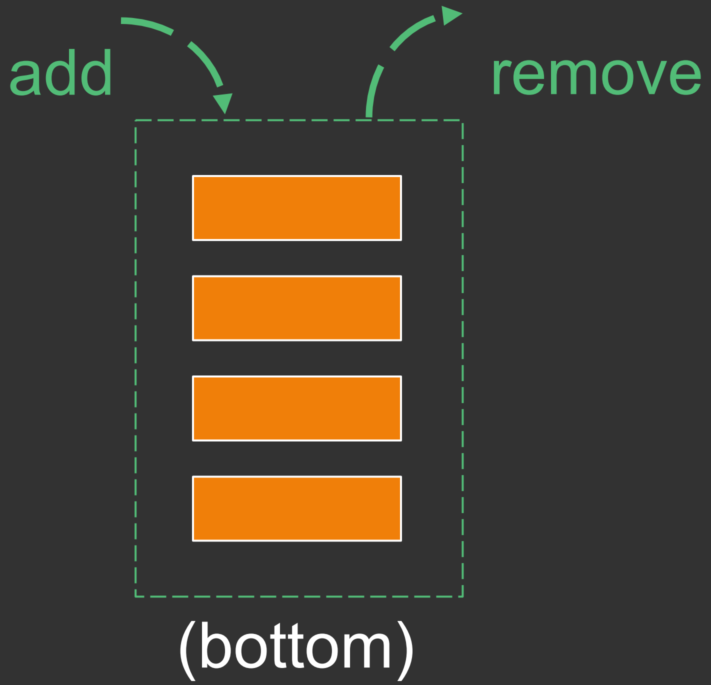

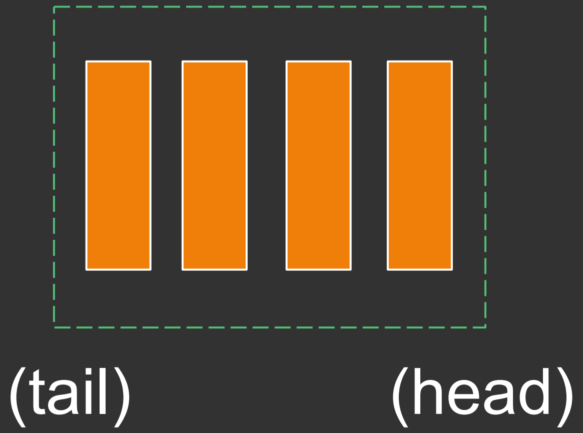

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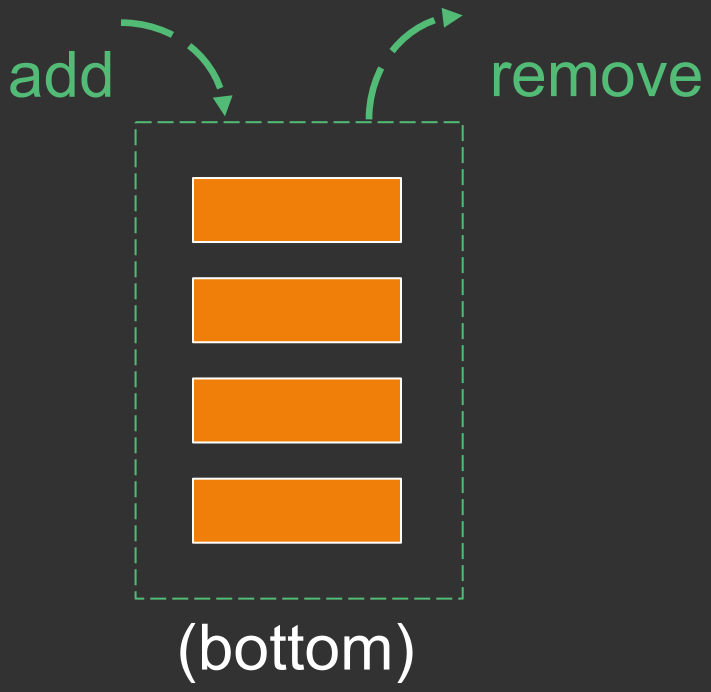

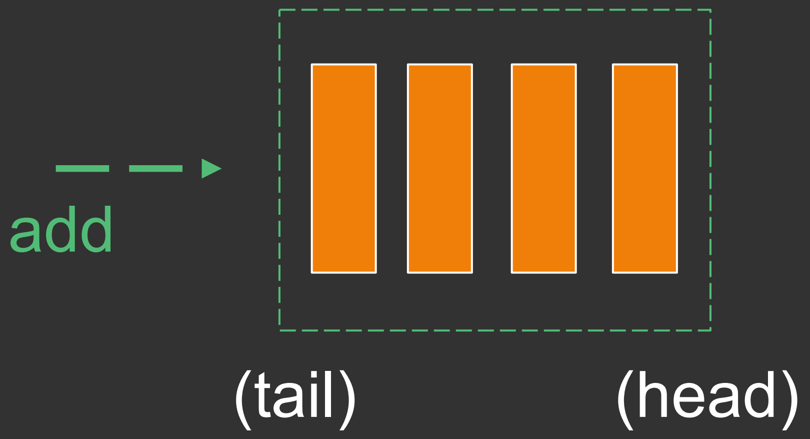

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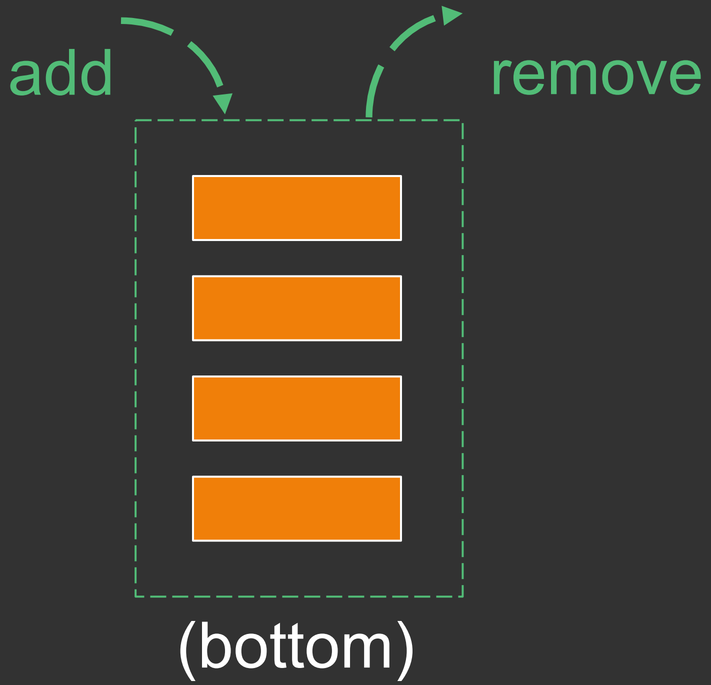

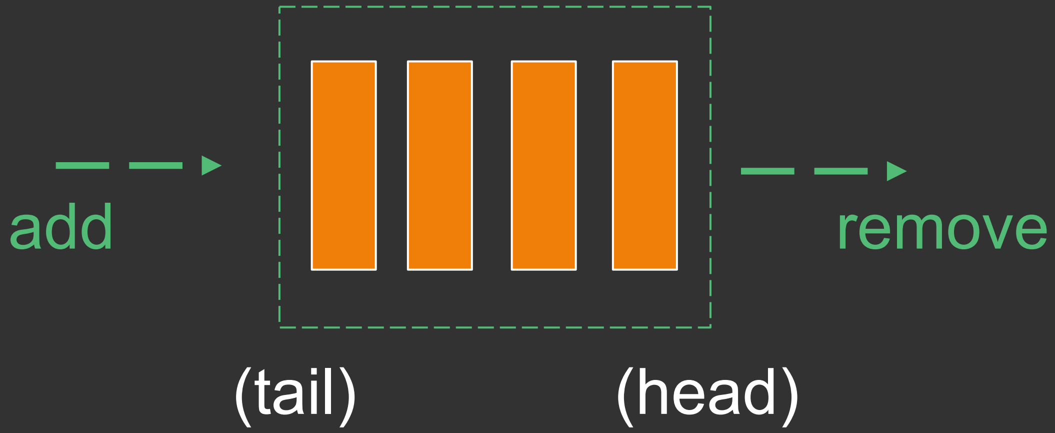

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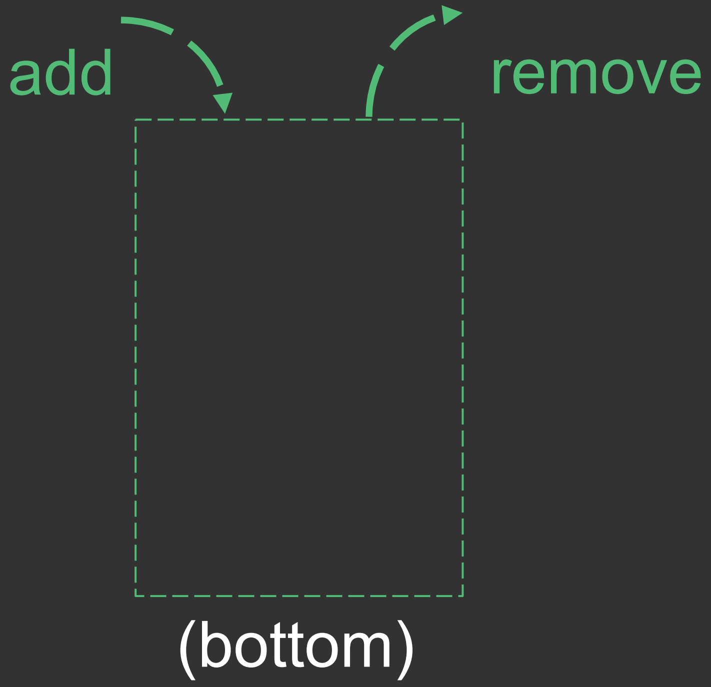

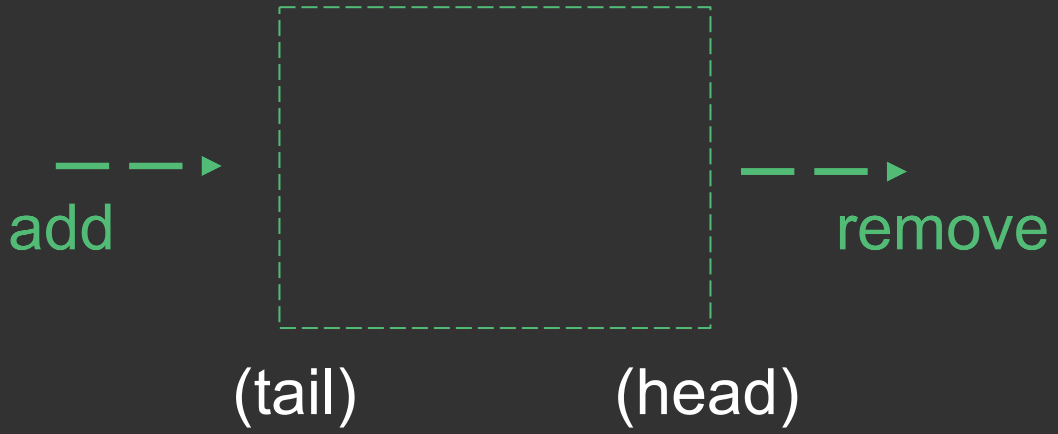

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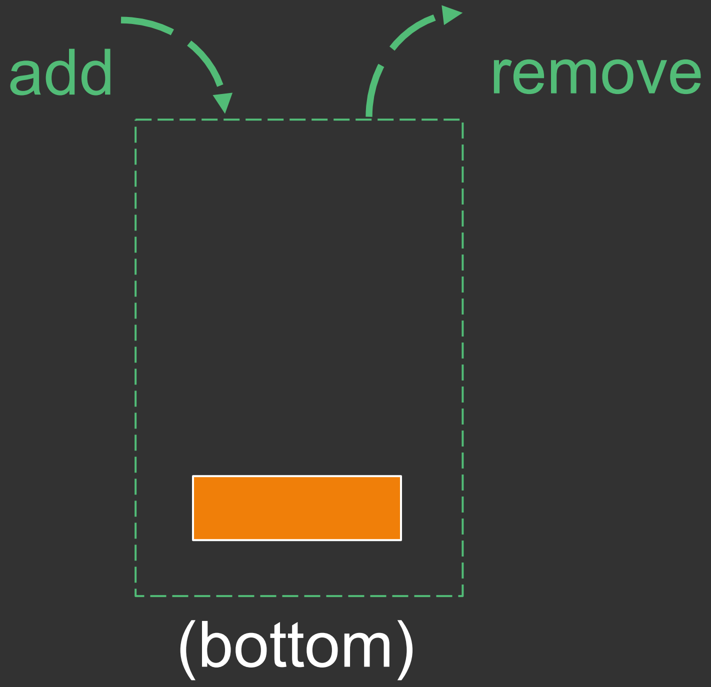

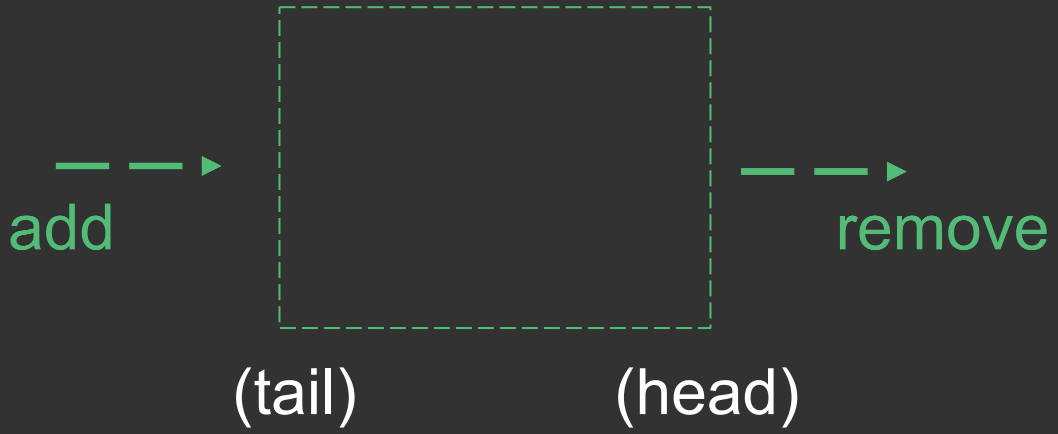

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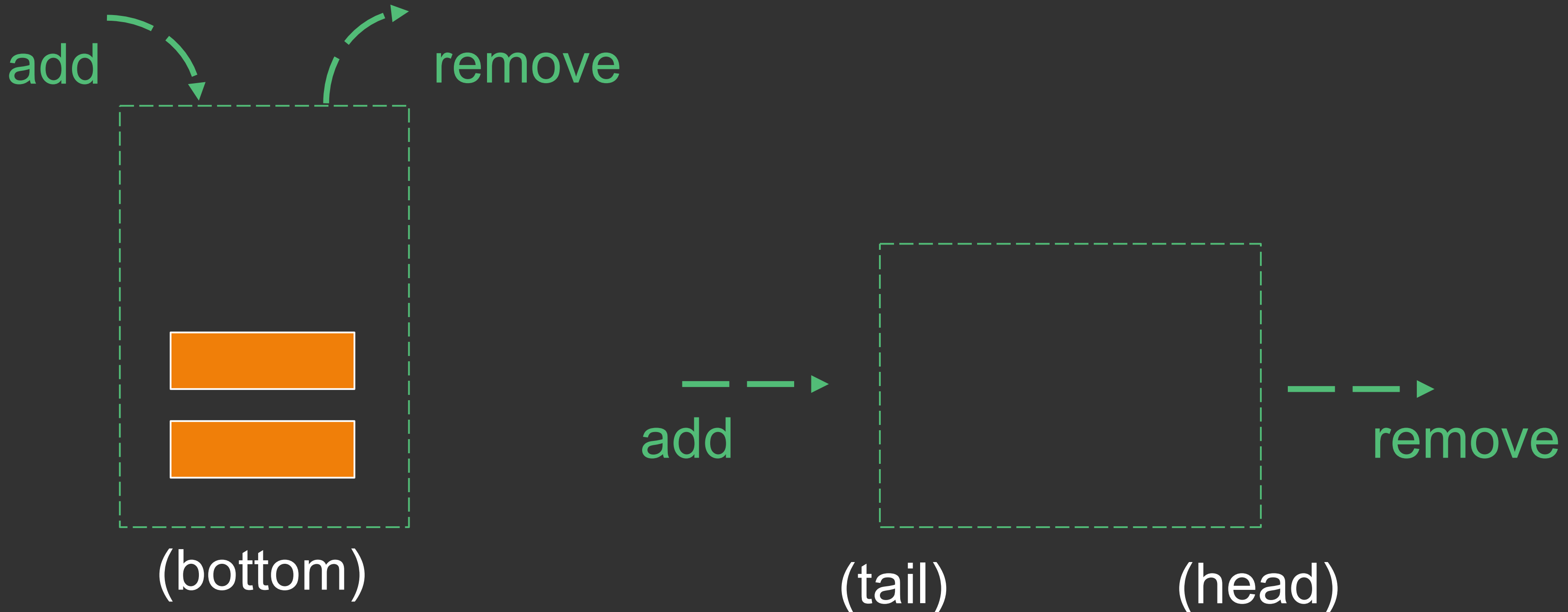

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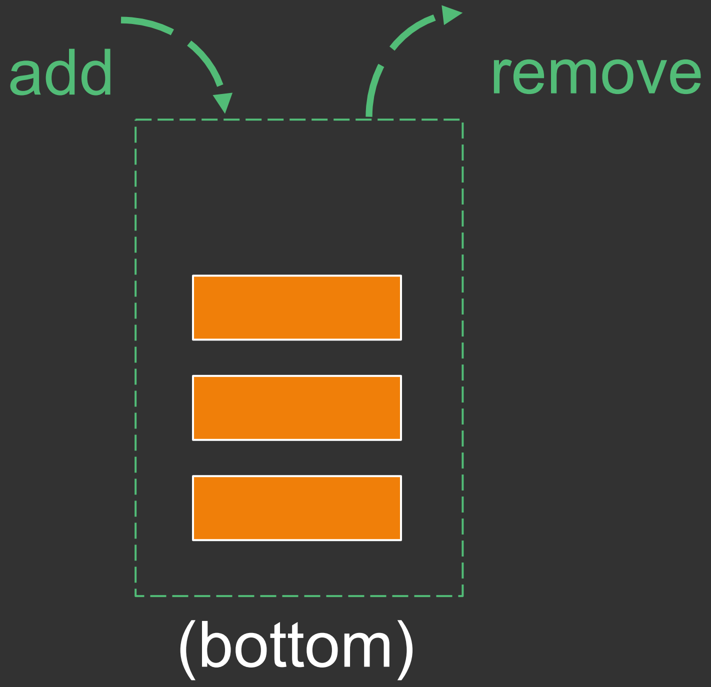

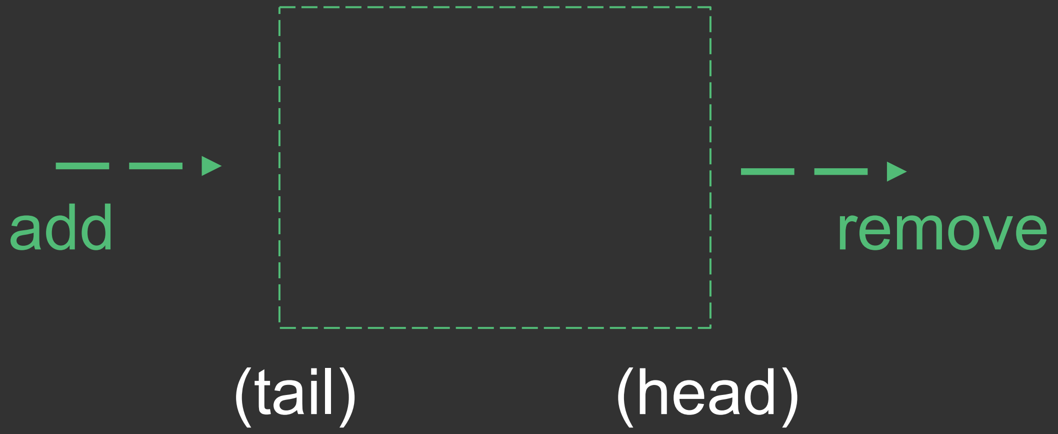

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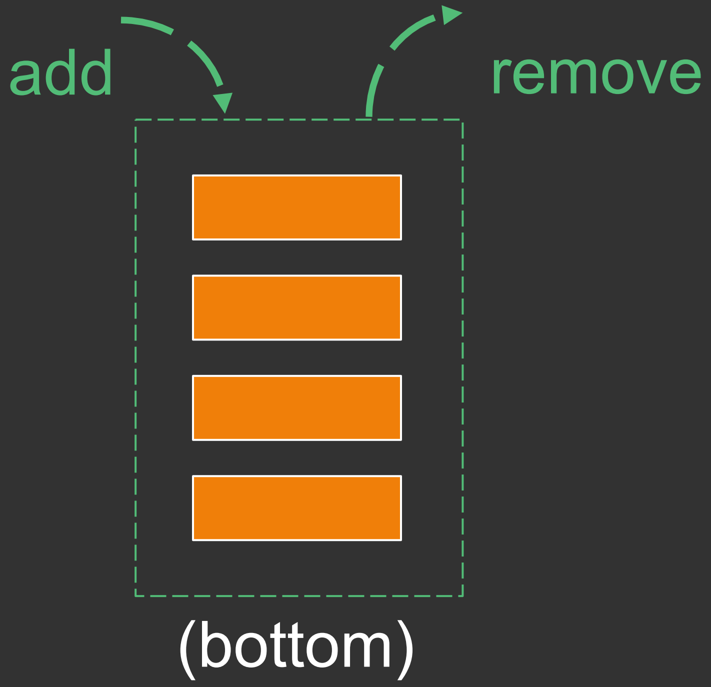

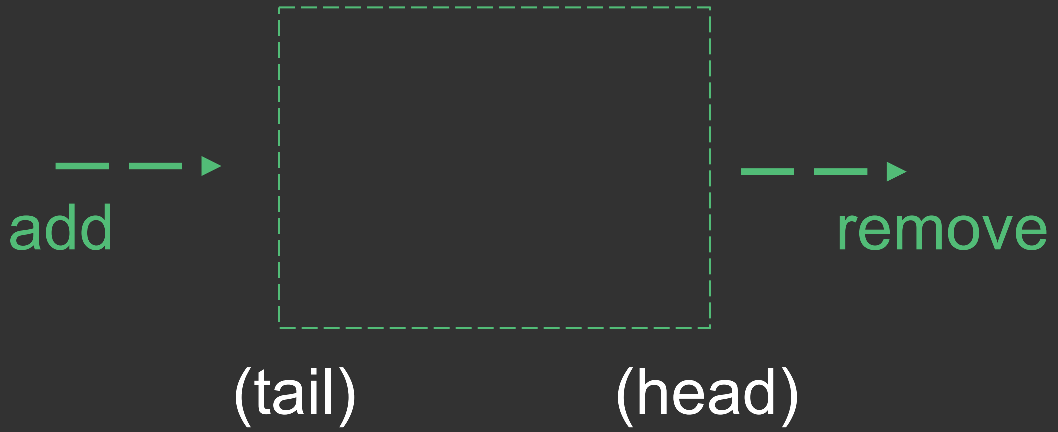

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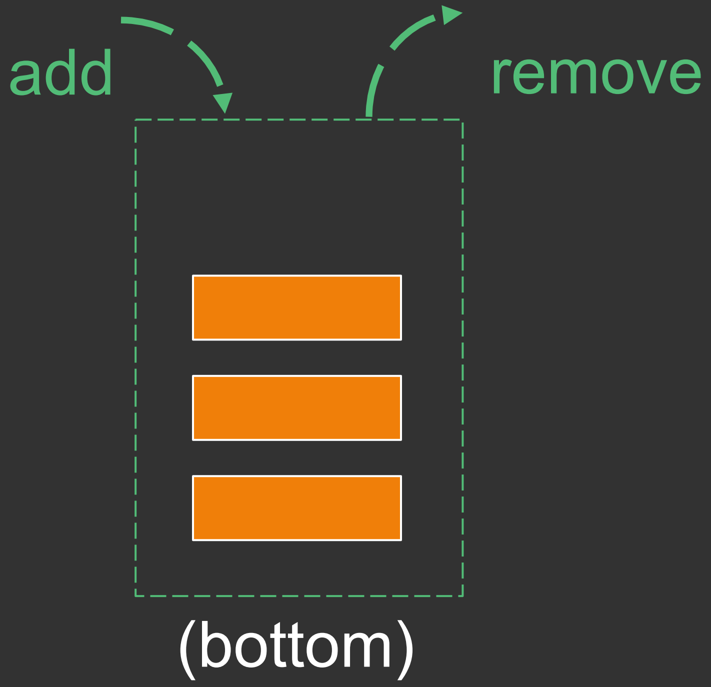

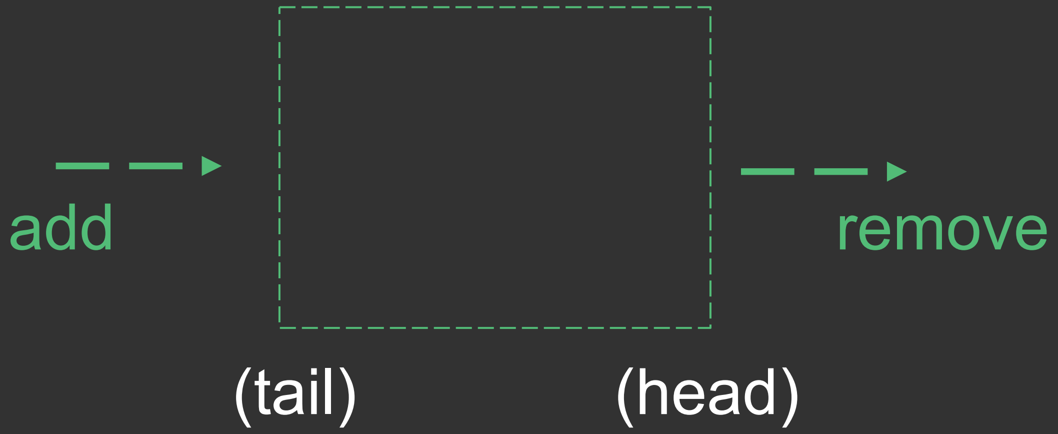

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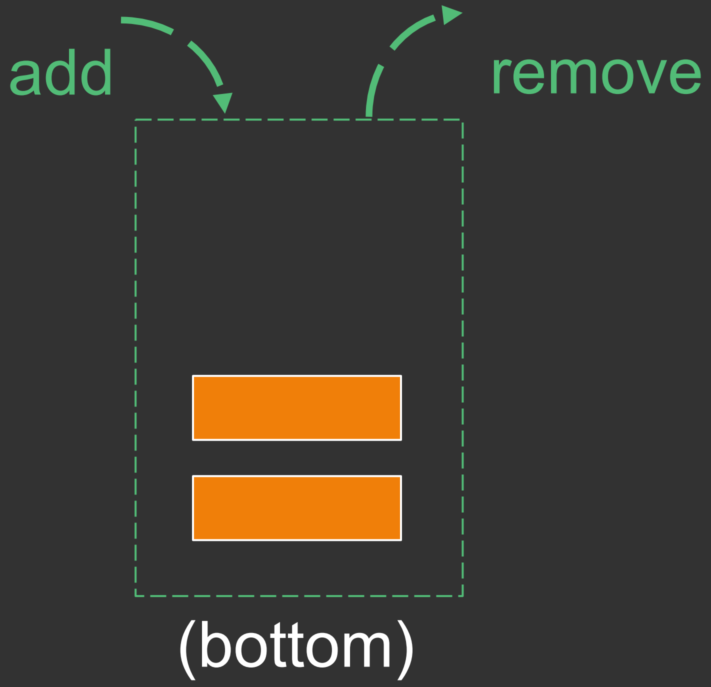

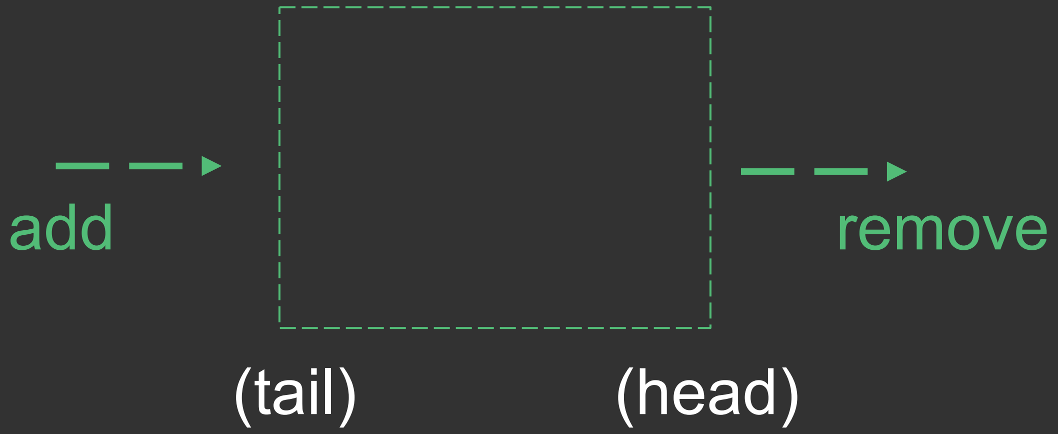

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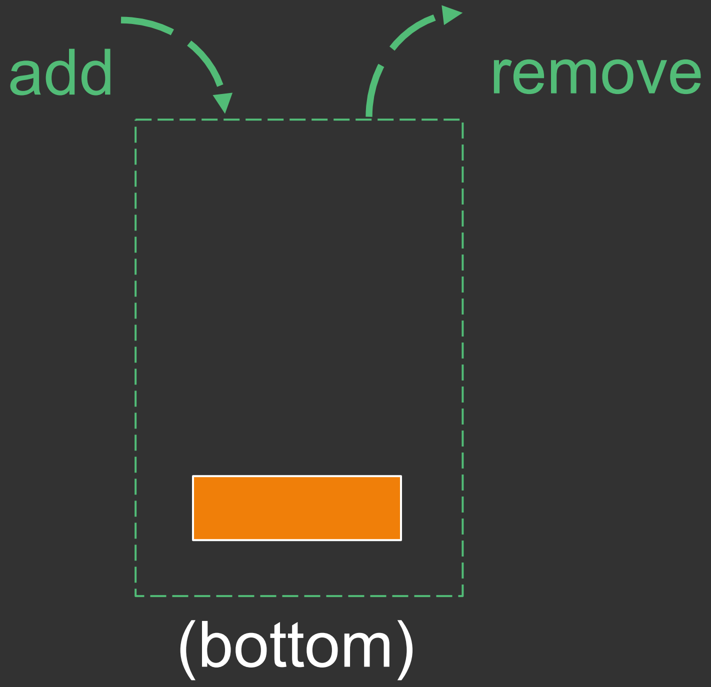

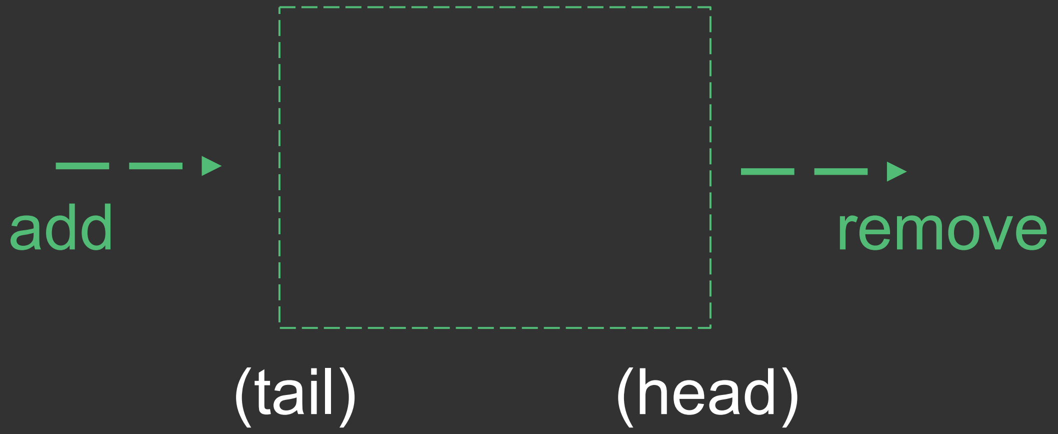

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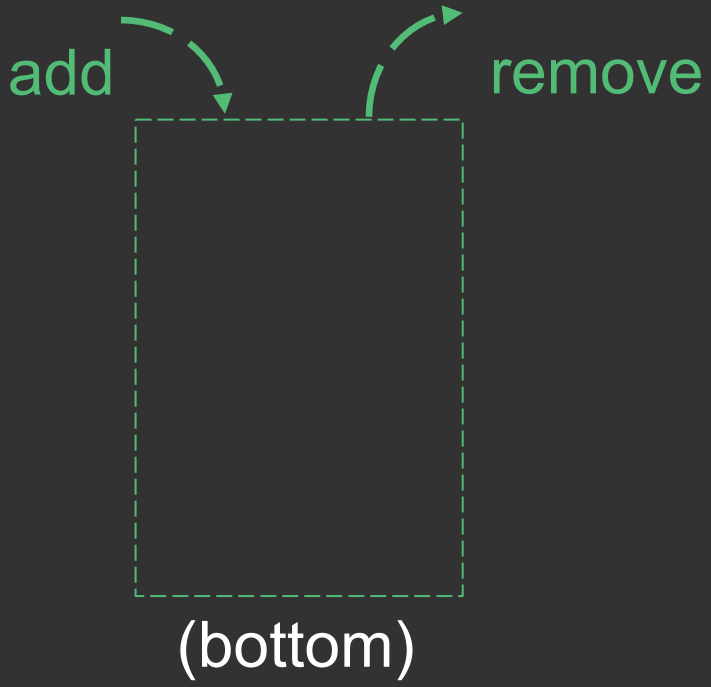

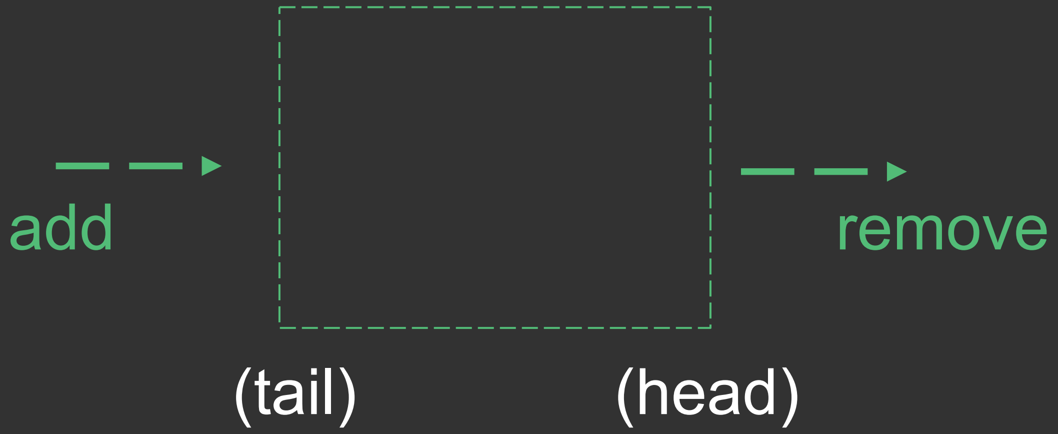

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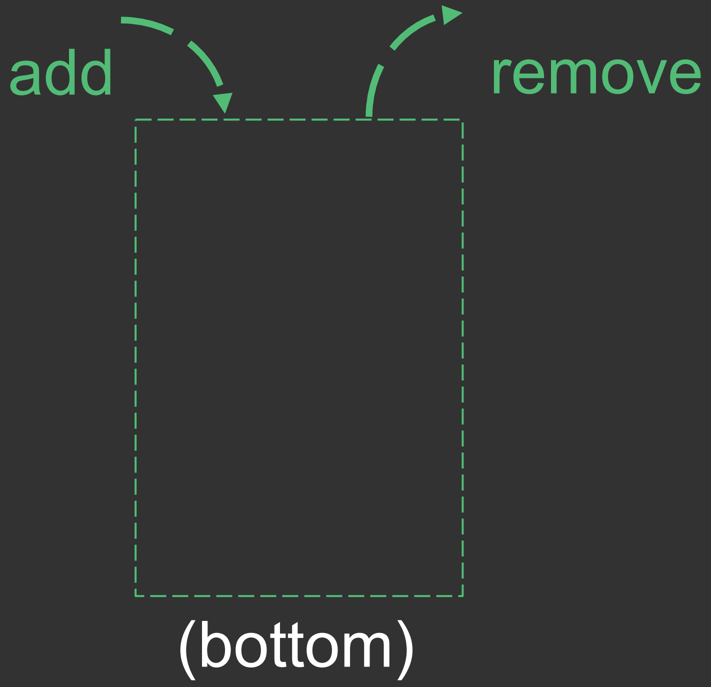

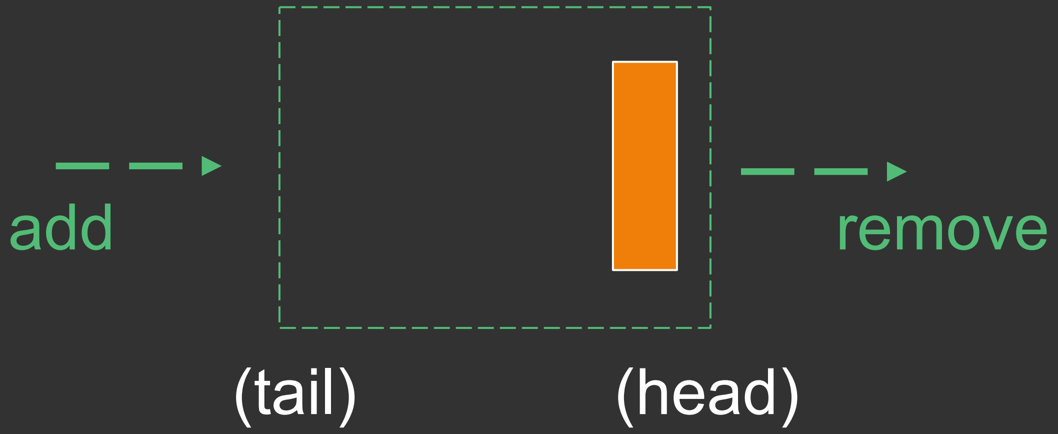

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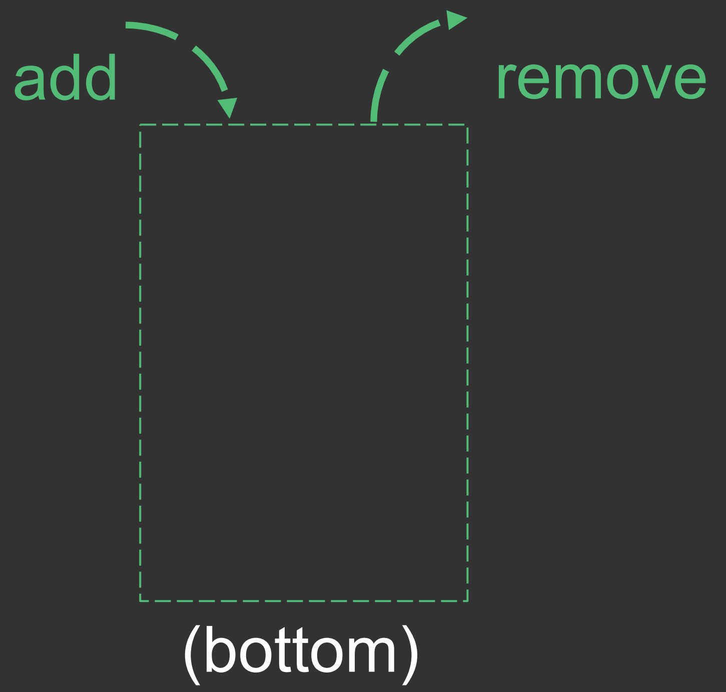

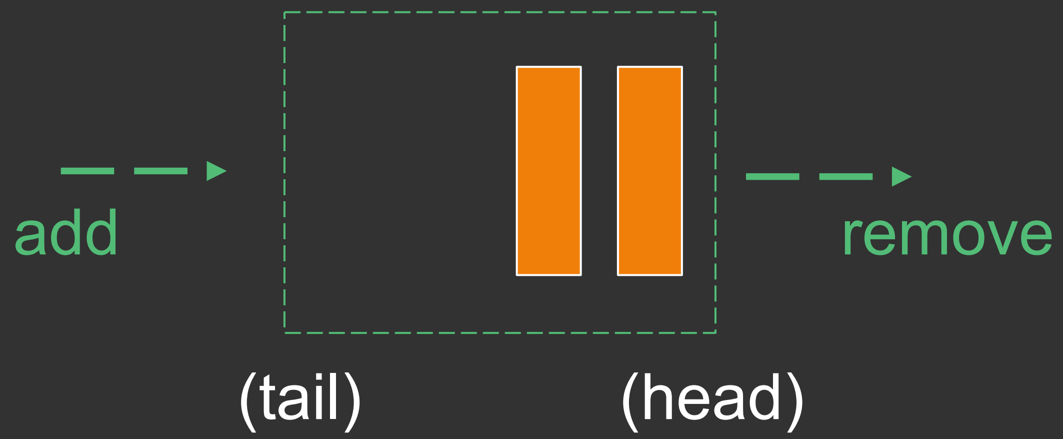

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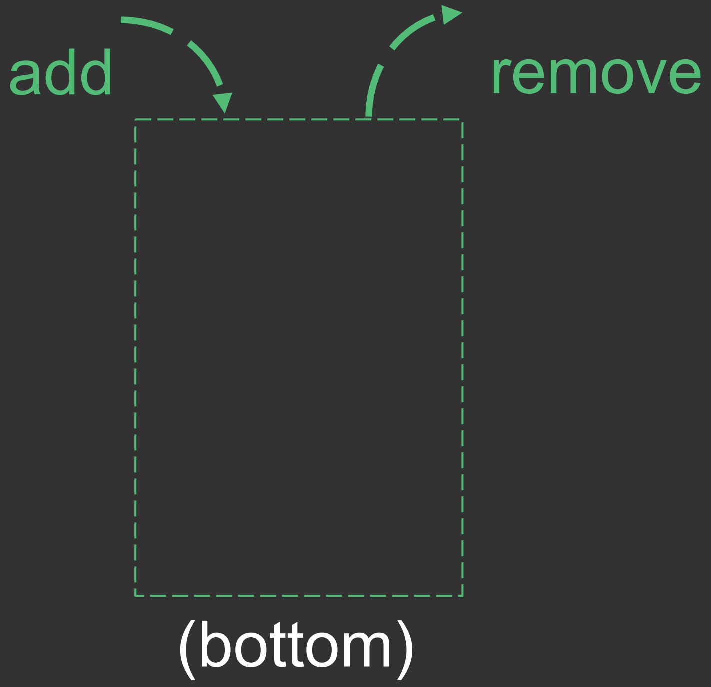

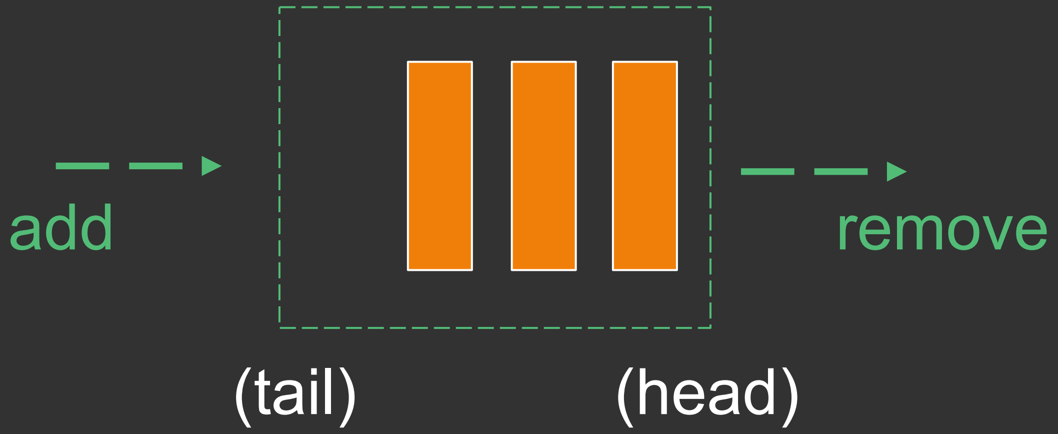

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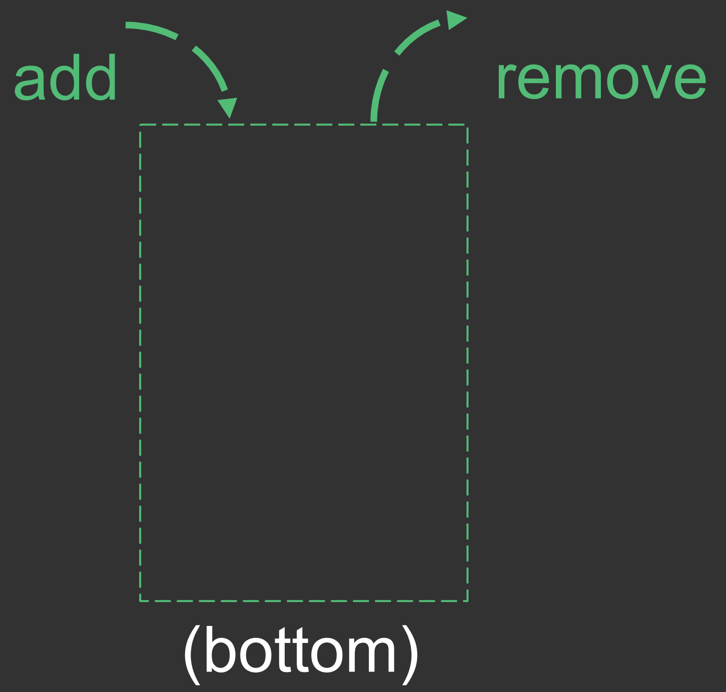

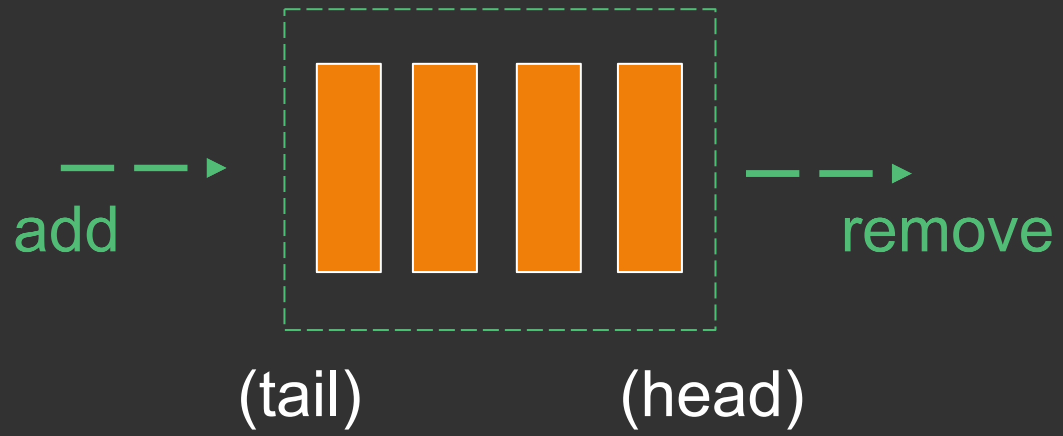

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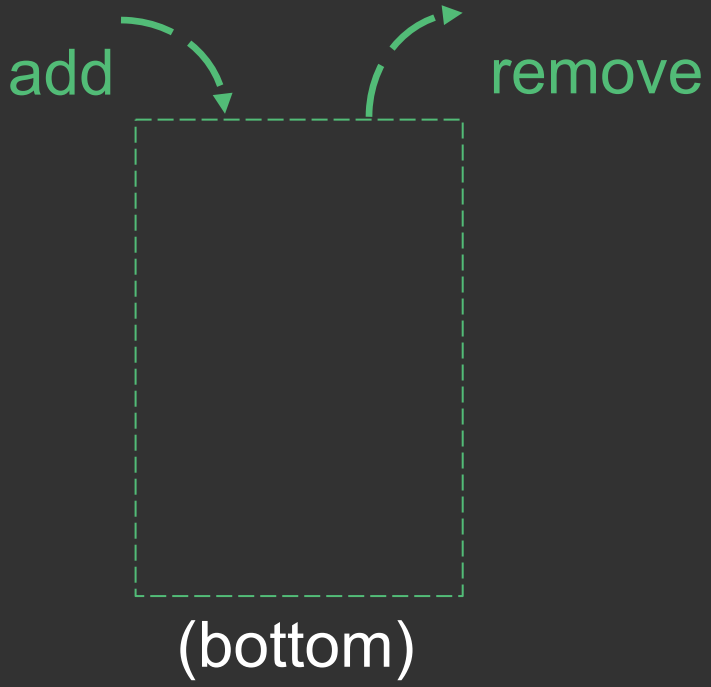

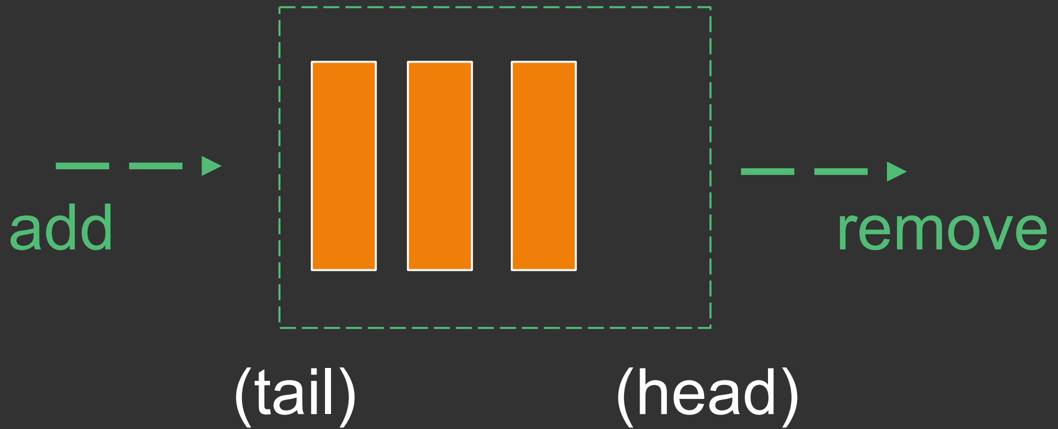

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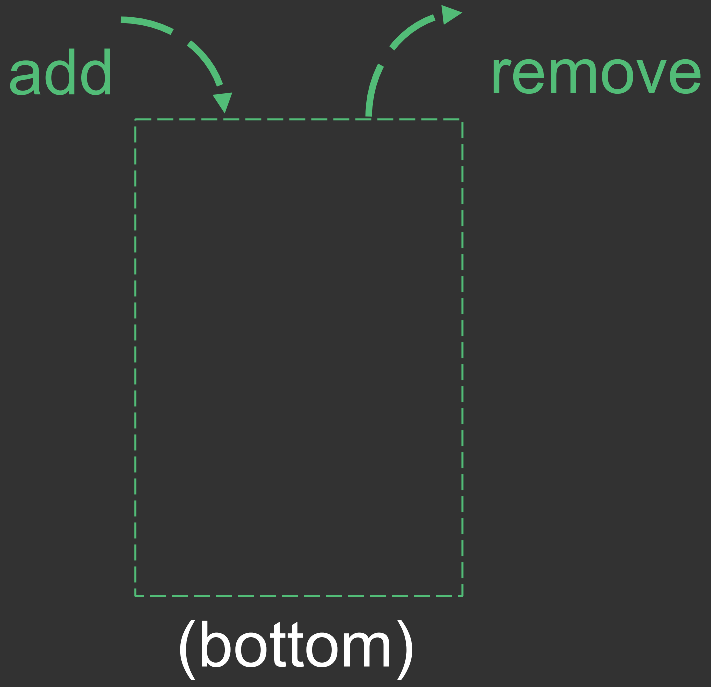

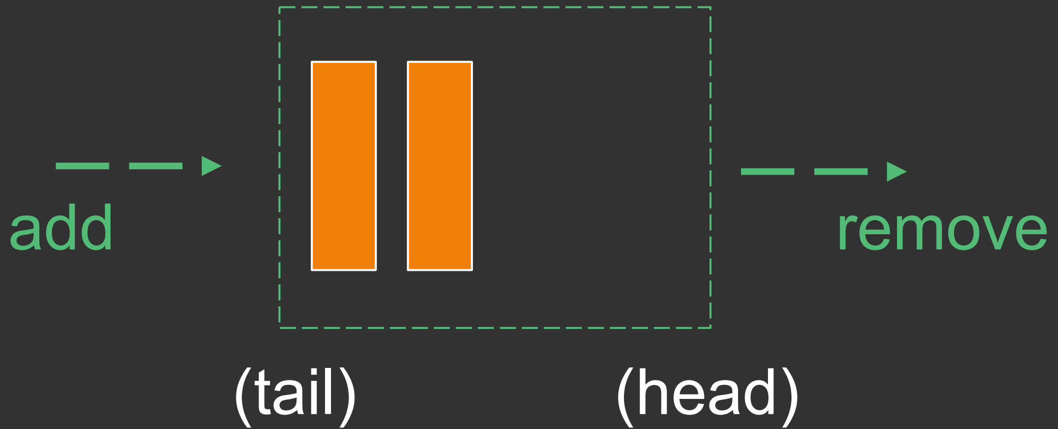

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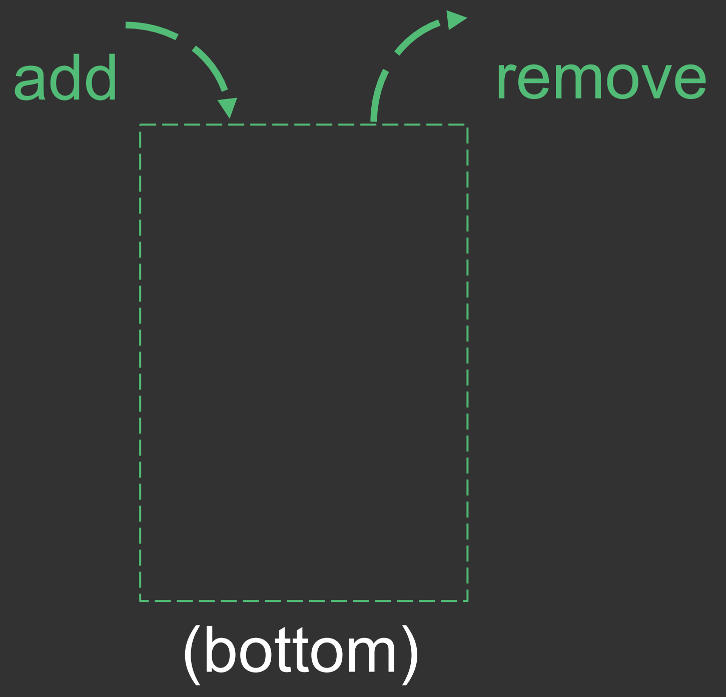

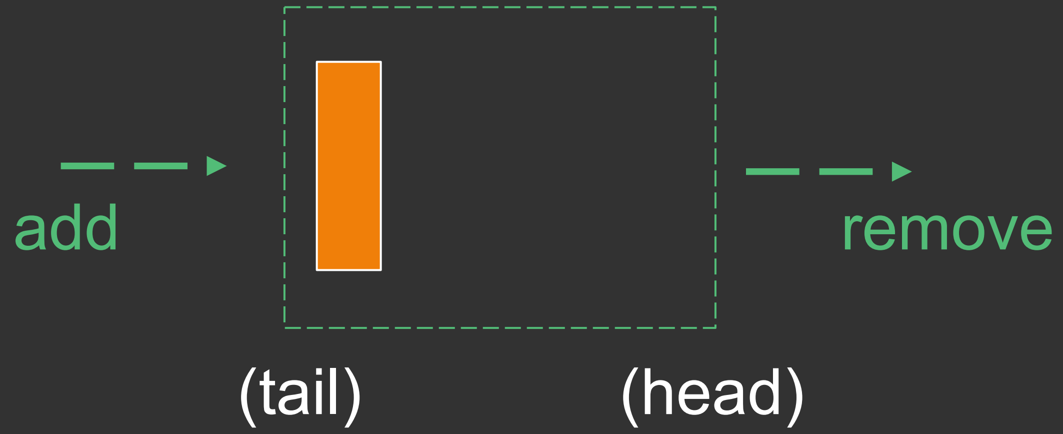

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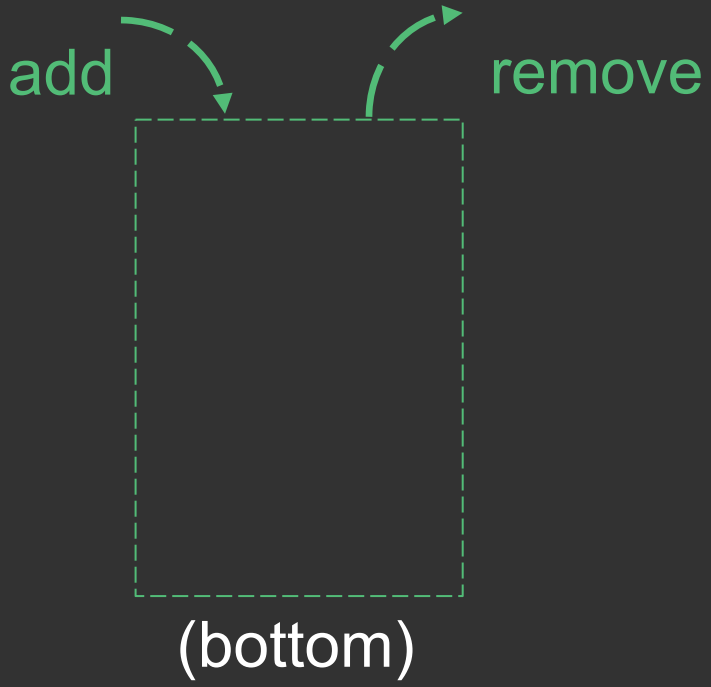

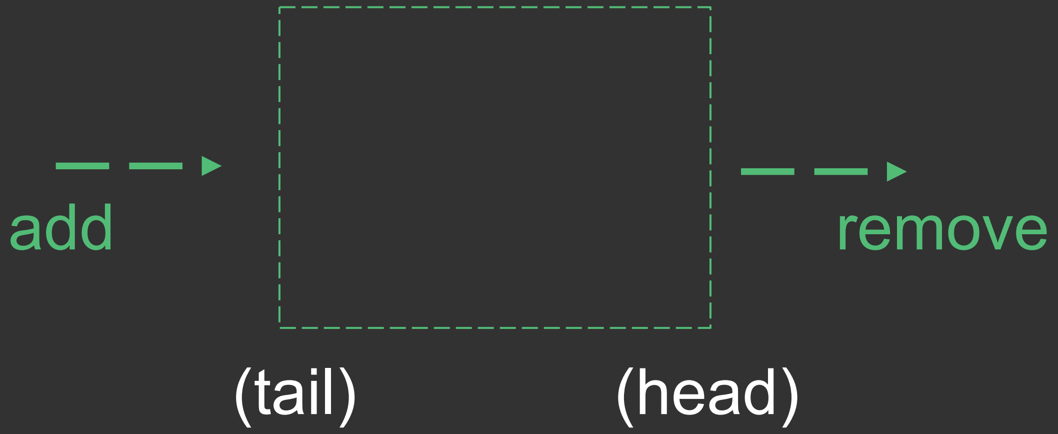

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  - `dequeue`: *remove* value from front of queue,
  - (`peek`: *access* value at front of queue)

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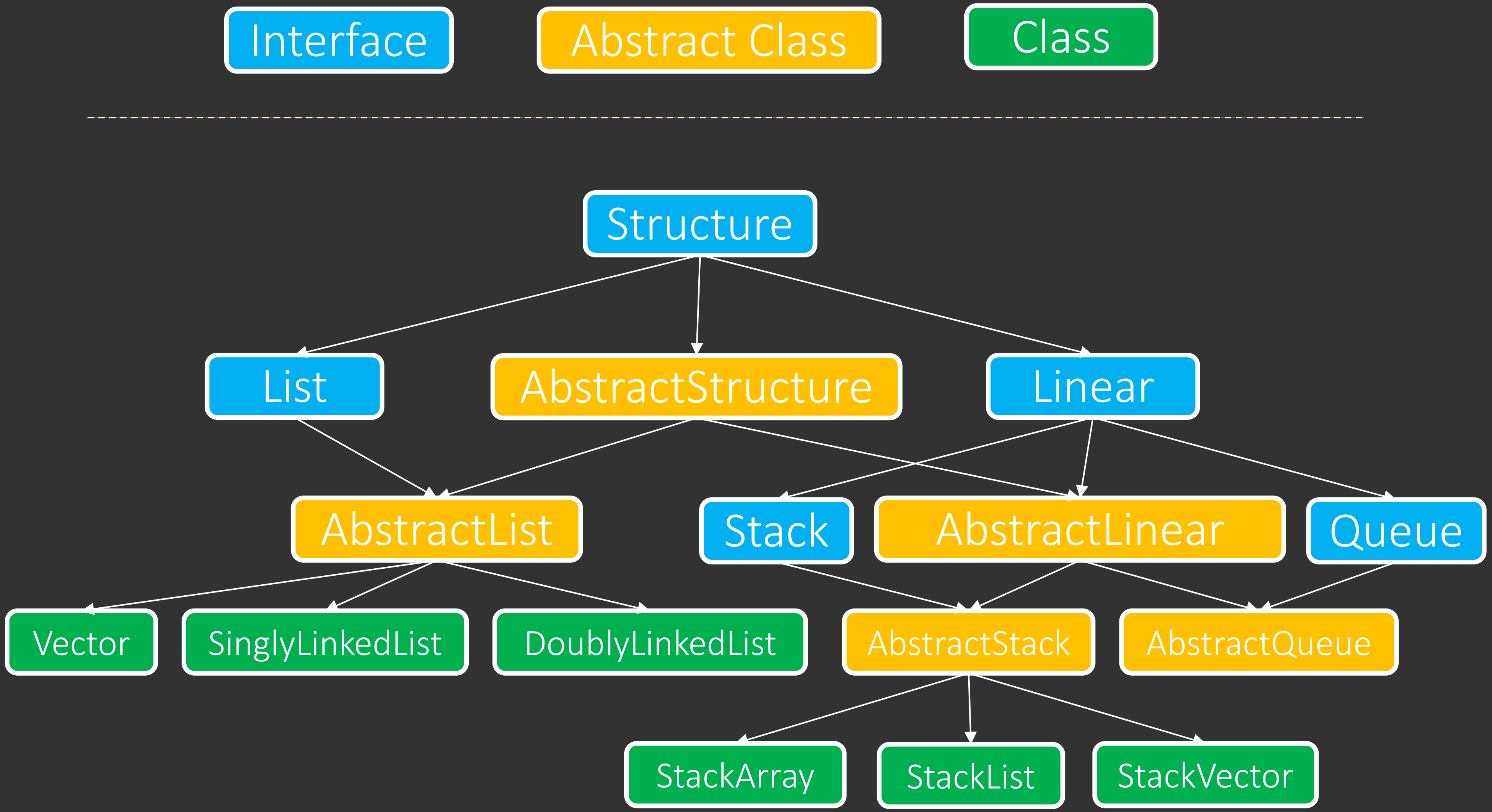
  - By using existing structures (e.g., `Vector`, `LinkedList`), or
  - As “stripped down” versions of those structures
    - We can implement a stacks/queues using the same underlying organization as those structures, but with reduced/simplified/optimized implementations

The Structure5 Universe (+ Stacks!)



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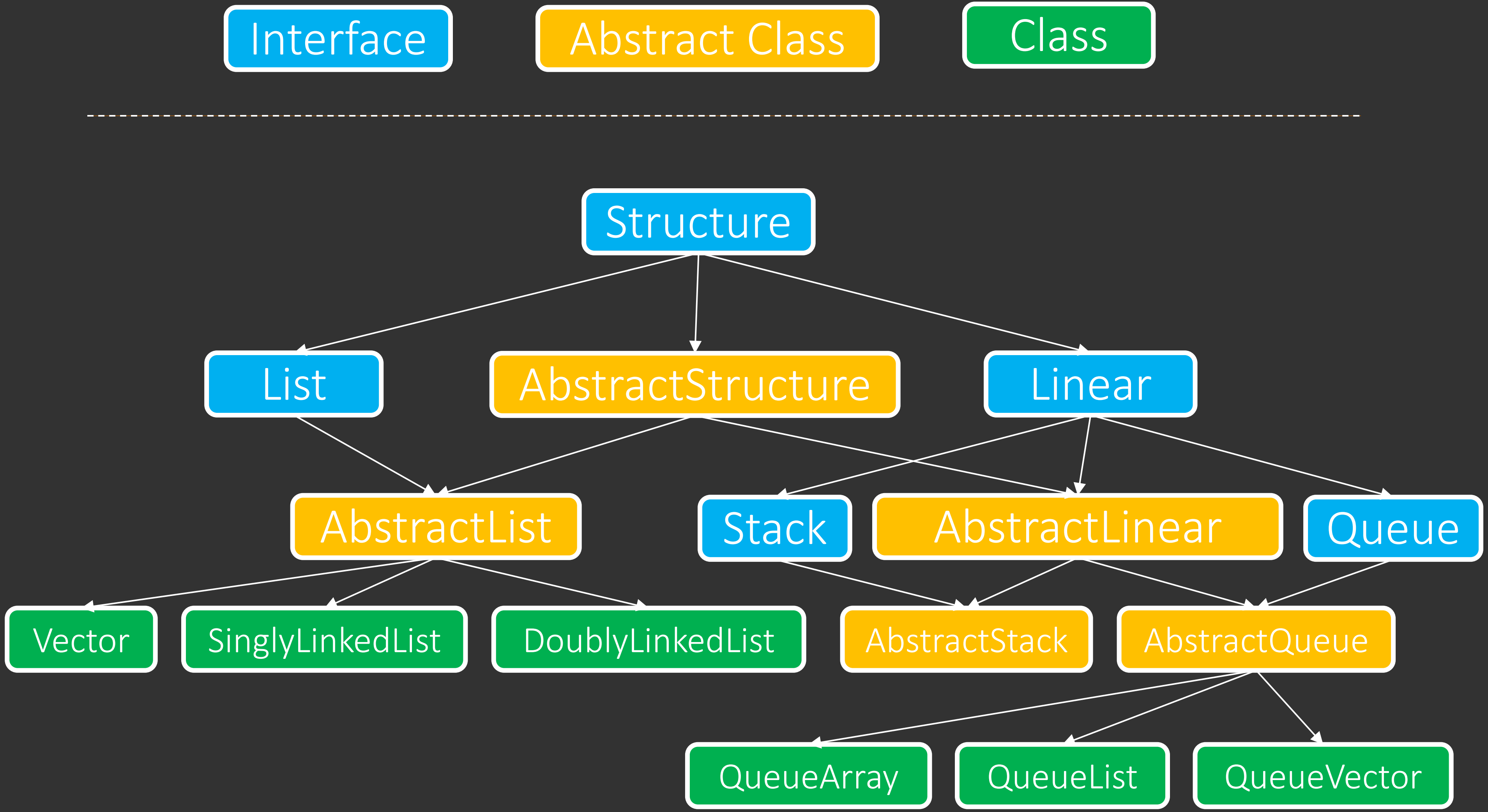

Queue Interface

Also some others like `add()`, `remove()`, `getFirst()`

```
public interface Queue<E> extends Linear<E> {
 public void enqueue(E item);
 public E dequeue();
 public E peek();
 public int size();
}
```

Implementing Queues

As with Stacks, we have three options:

QueueArray

QueueVector

QueueList

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  int count; // can be used to determine tail...
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 protected Vector<E> data;
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QueueList

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class QueueList<E> implements Queue<E> {
   protected List<E> data; //uses a CircularList
}
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    - Note: uses a Circularly Linked List so we have fast head and tail operations, but we only store one reference per node (next)

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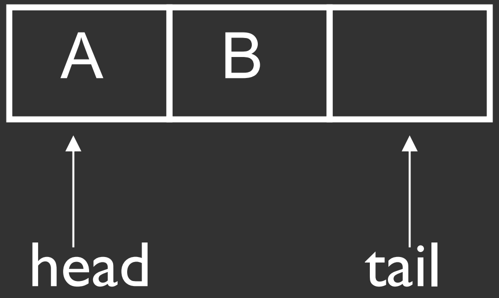

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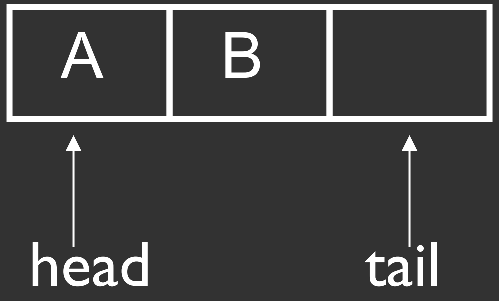

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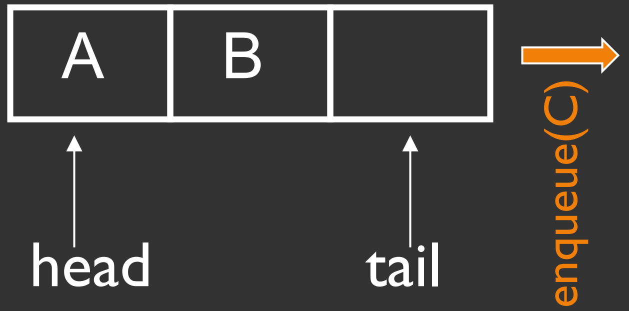

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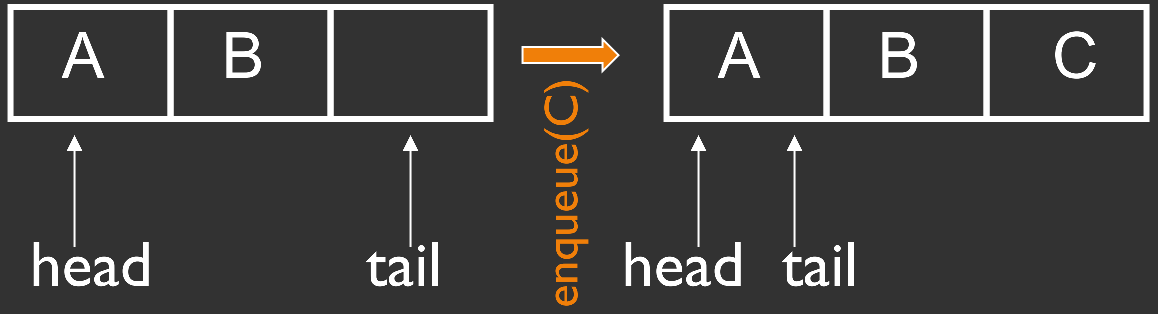

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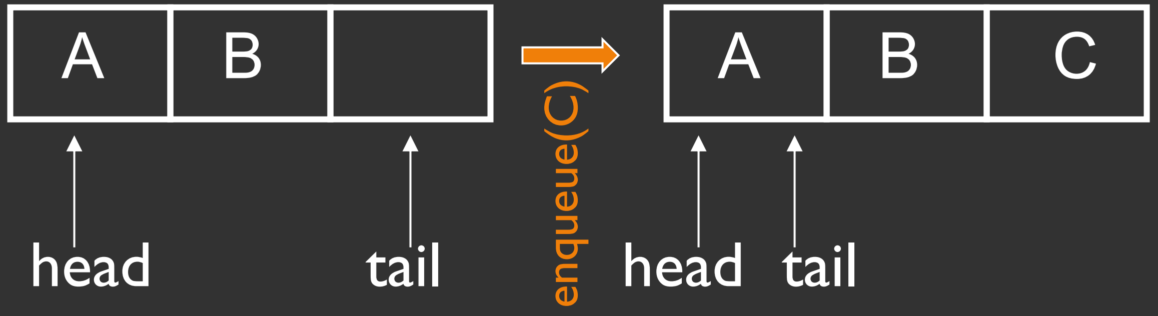

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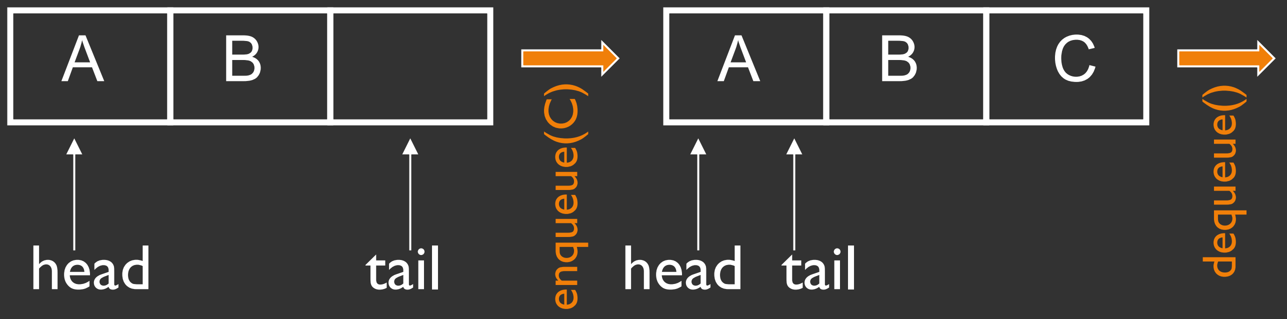

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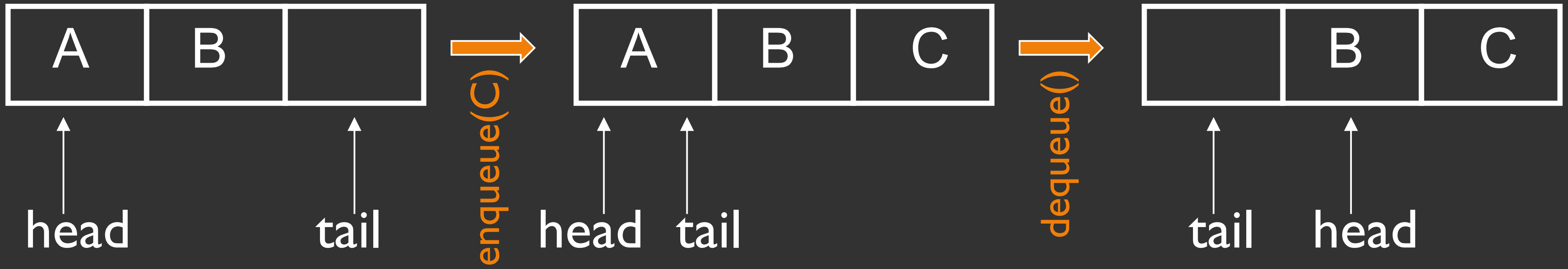

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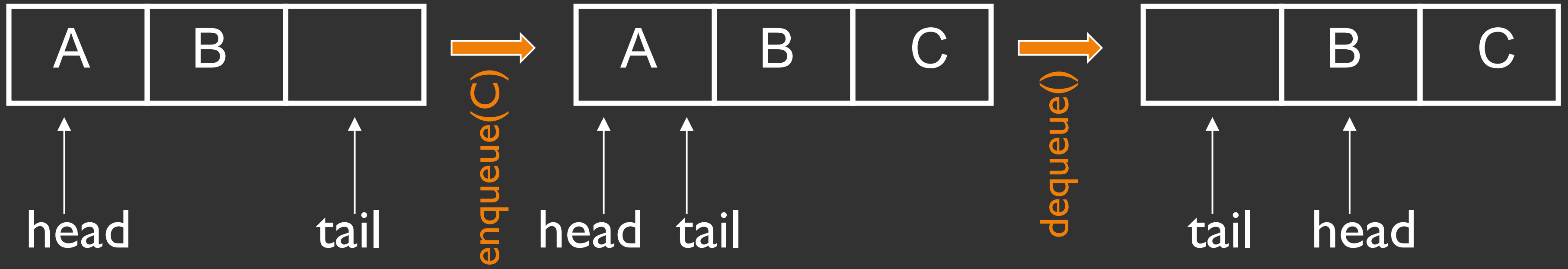

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After wrap around, head > tail in some cases!

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          return value;
    }

     public boolean empty() {
          return count>0;
     }
}
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  - Note: structure5 takes the "black box" approach; intentionally demonstrates tradeoff of specialization

Takeaways

- Queues, like stacks, limit our access to specific locations of our data structure
  - However, this mimics common access patterns
- We can design a data structure that takes advantage of these limitations to optimize perf
- By utilizing these data structures, we can simplify/influence our algorithm design
- Enqueue/dequeue and push/pop are common terms, so be comfortable using them