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Queues

Comp Sci 1575 Data Structures

Queues: Enqueue and Dequeue

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- Queue elements may only be inserted at the back and removed from the front
- Insertion is done at one end
- Deletion is performed at the other end
- **Enqueue** inserts an element at the end of the list (called the rear)
- **Dequeue** deletes (and returns) an element at the start (known as the front)
- First-In First-Out (FIFO)

Queues: Enqueue and Dequeue

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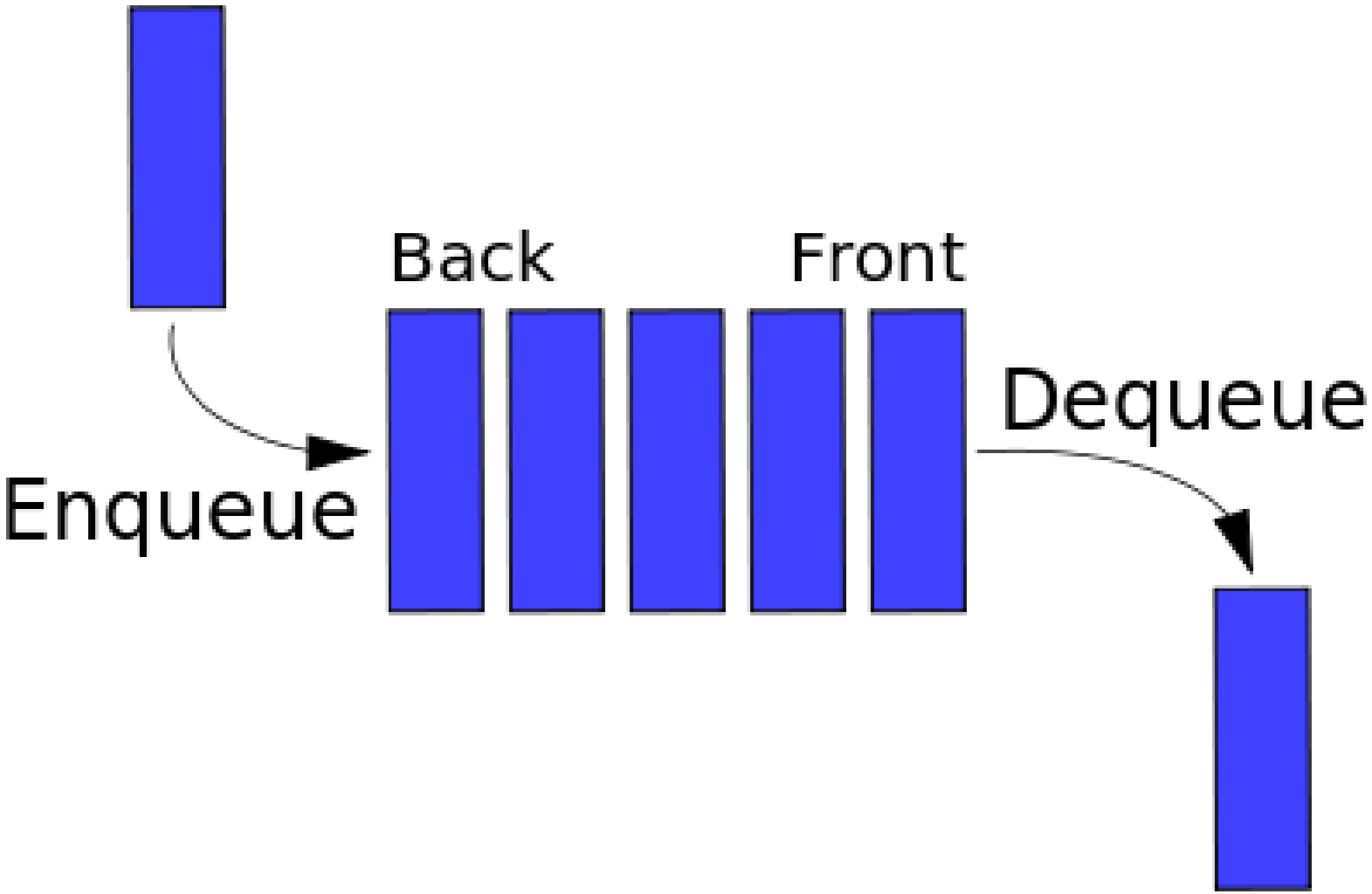

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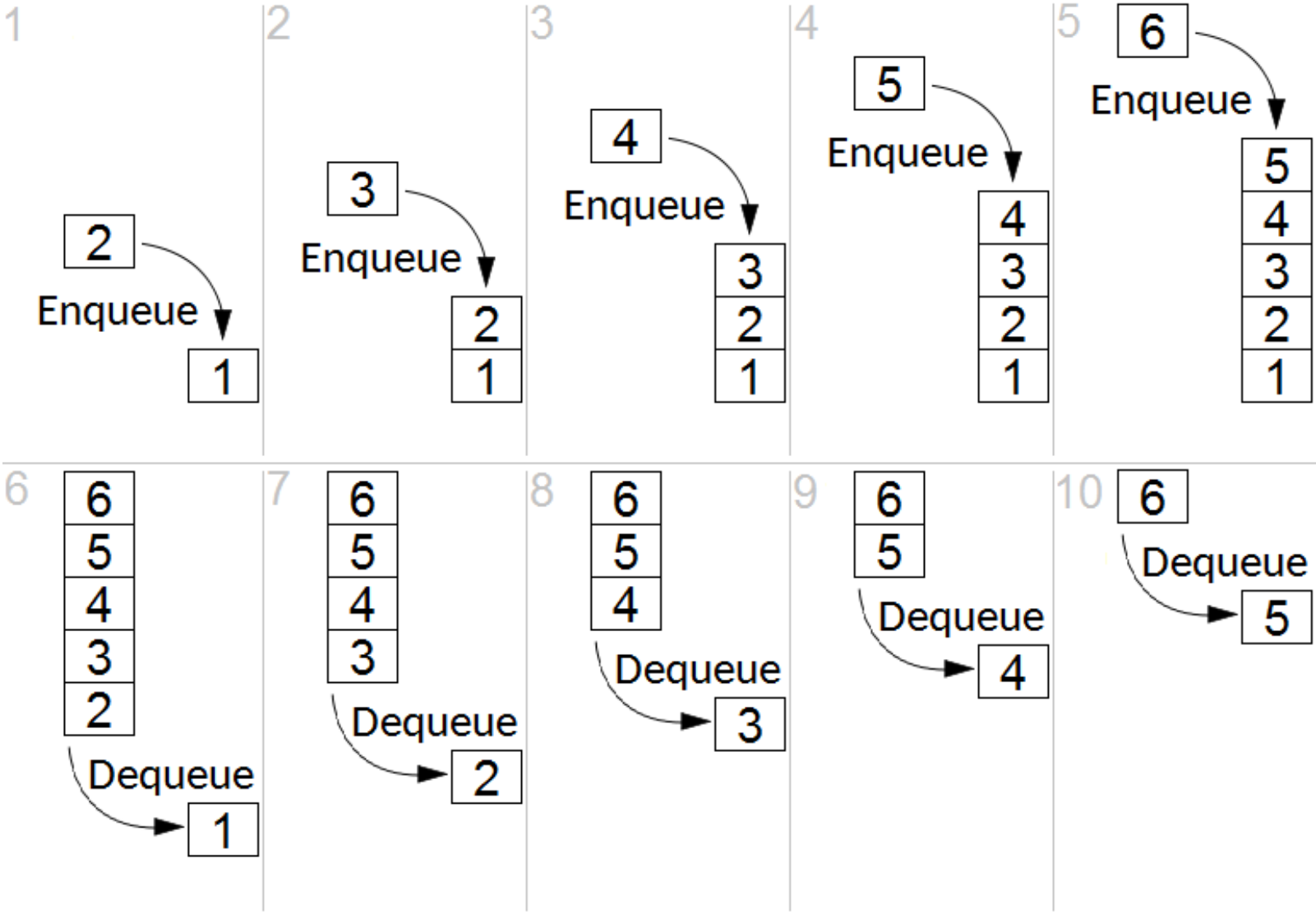

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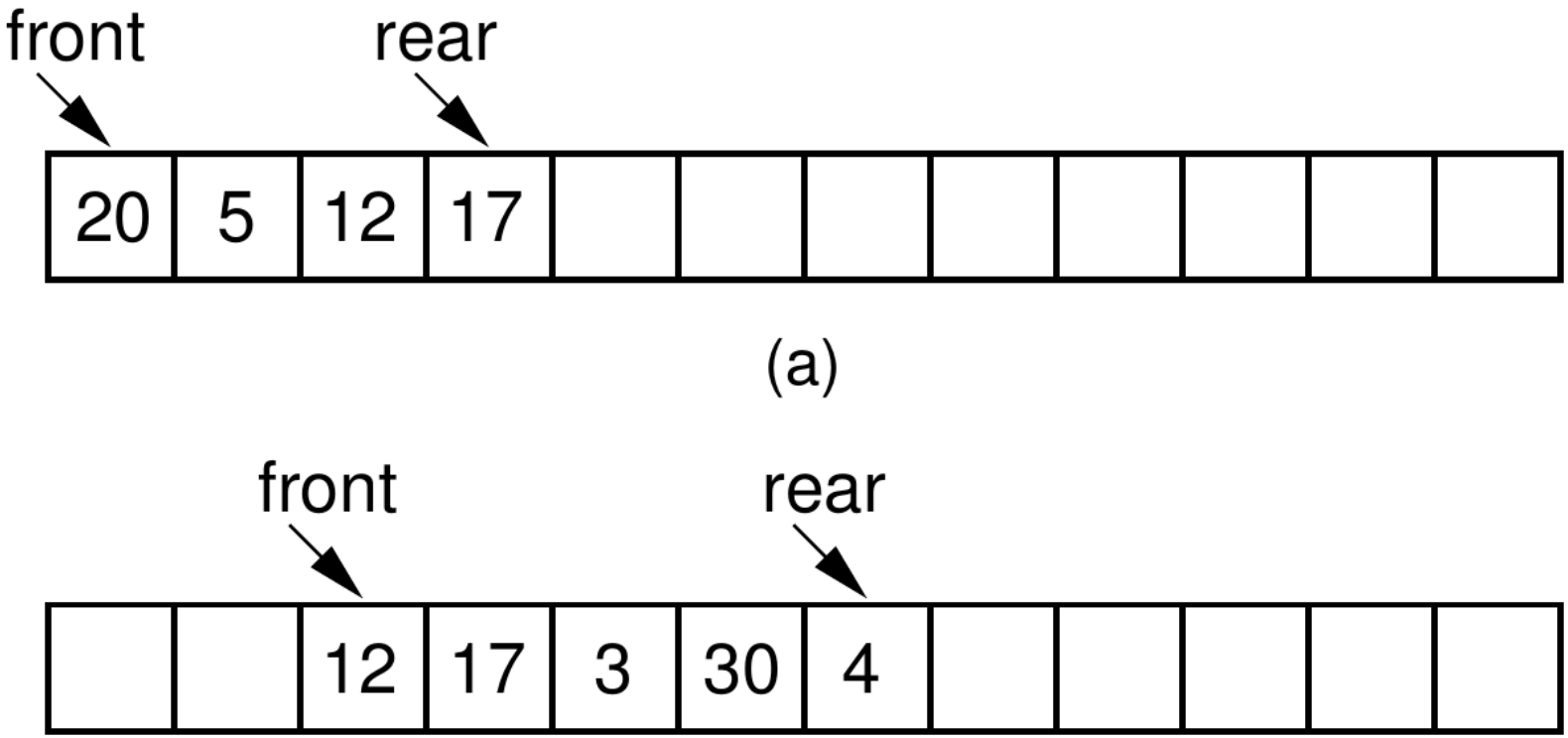

- Which end do we want to enqueue at, and dequeue at?
- What are the rates of growth of each function for each option?
- What happens as we continue performing operations?

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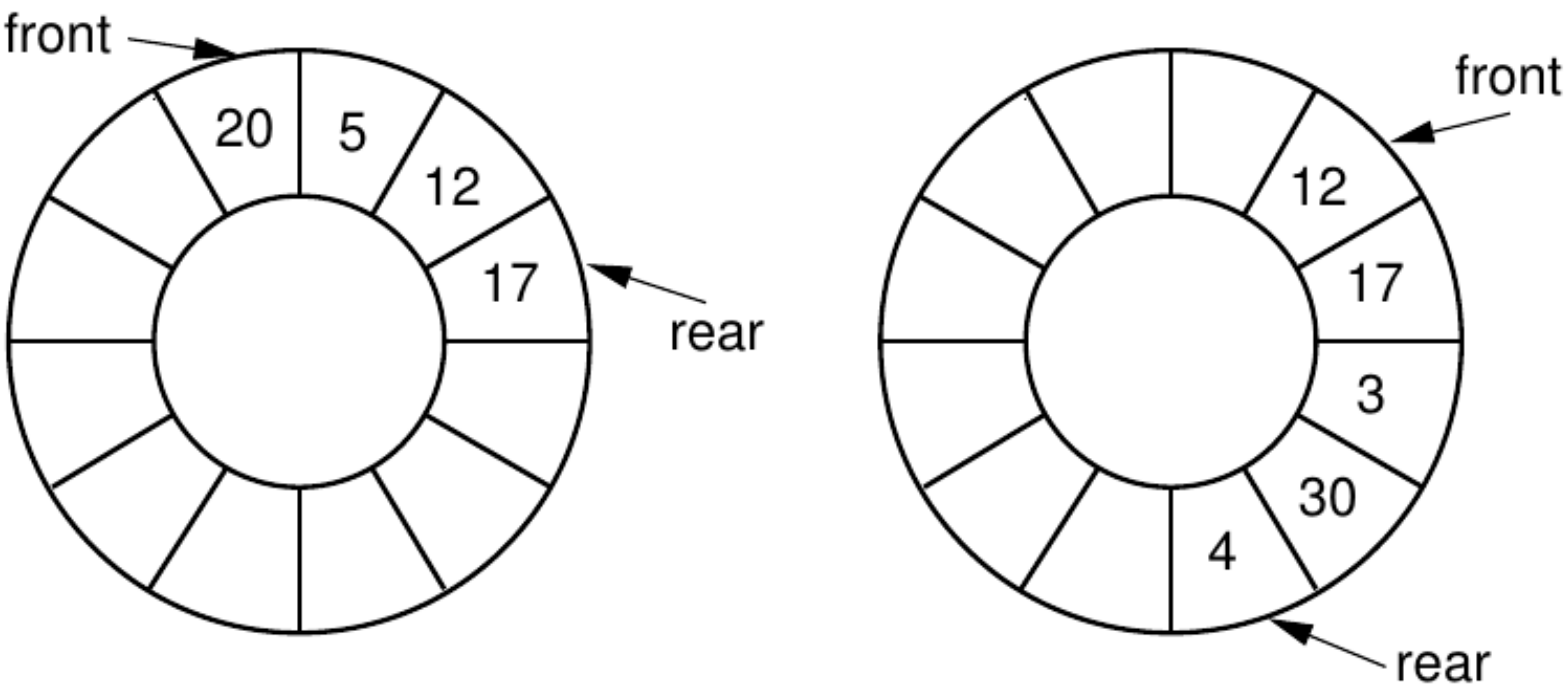

- How do we keep track of the front and back indices?
- What is the state of empty?
- What is the state of full?
- What is our max capacity?

Modular arithmetic

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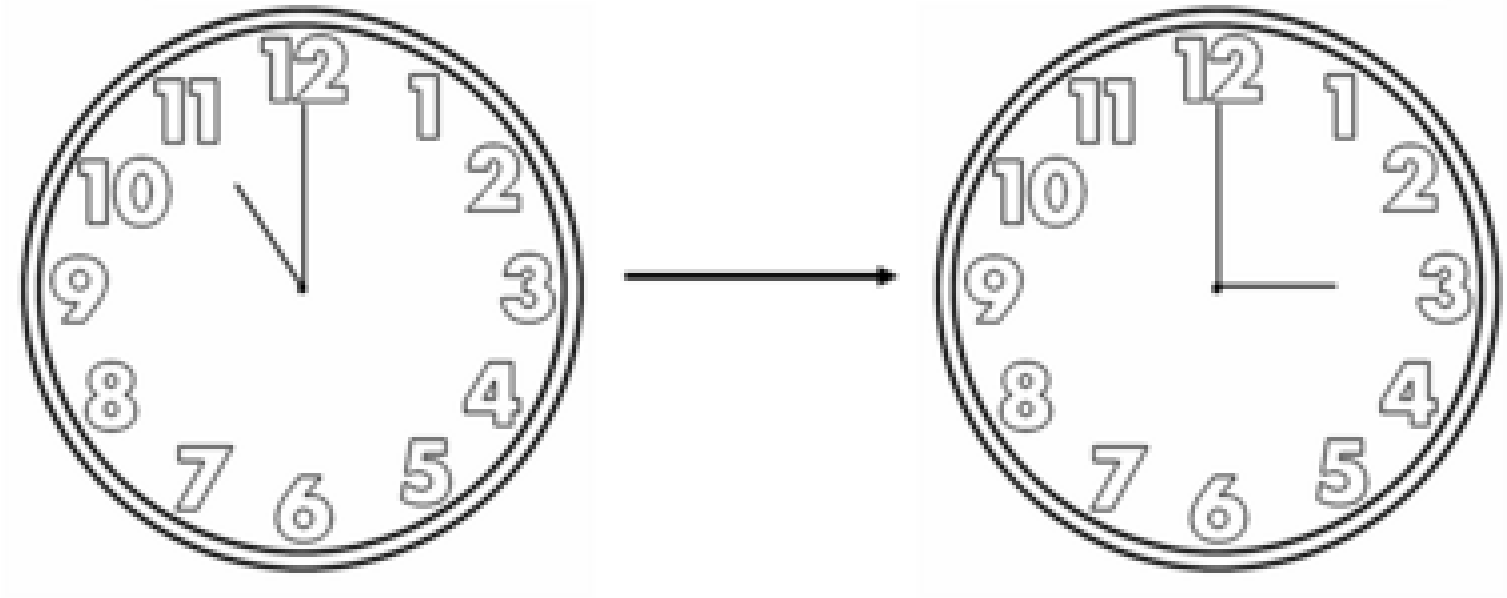
11:00 + 4:00 = 3:00



$$(11 + 4)\%12 = 3$$

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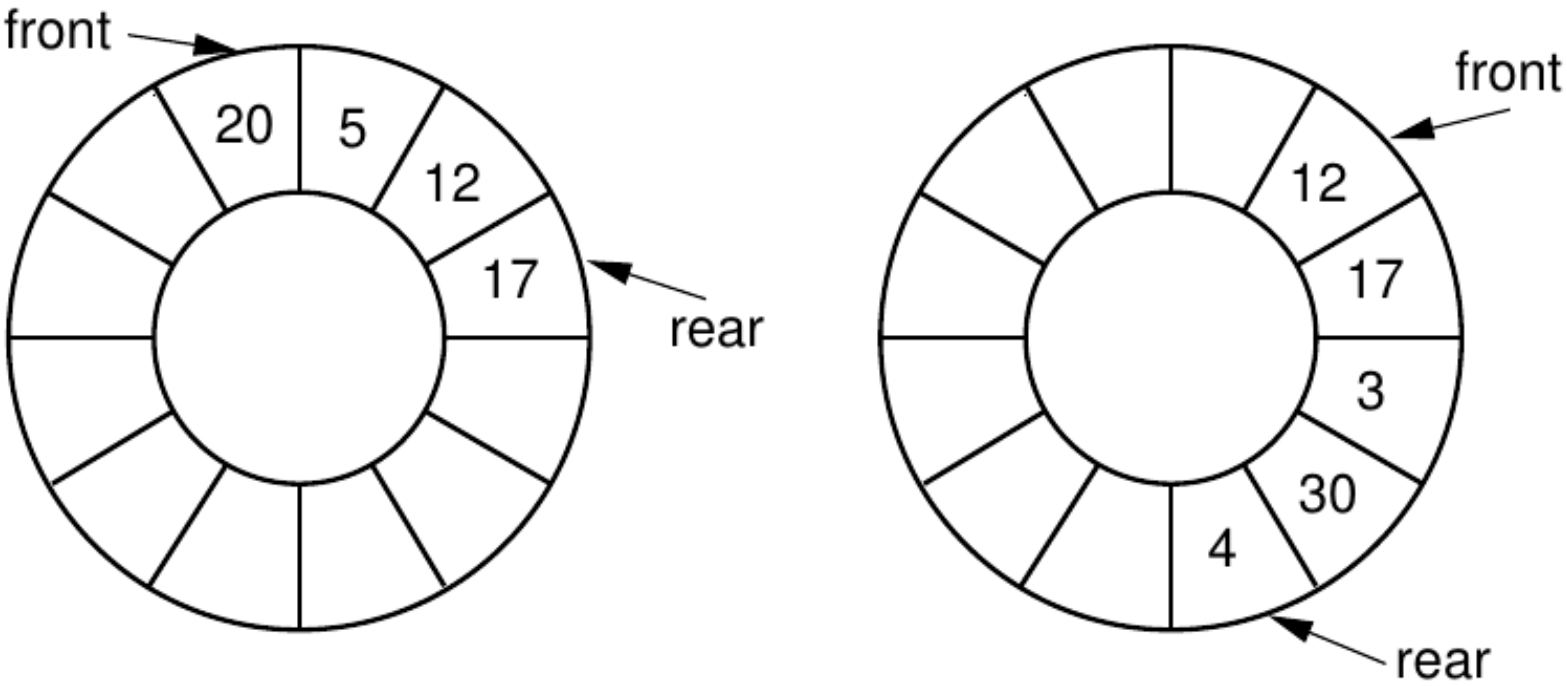

- How do we keep track of the indices?
  $(rear + 1)$ % $maxSize$ and $(front + 1)$ % $maxSize$
- What is the state of empty?
  $rear = 0$; $front = 1$
- What is the state of full?
  $rear = -1$, aka $(n - 1)$; $front = 1$
- What is our max capacity? $n - 1$

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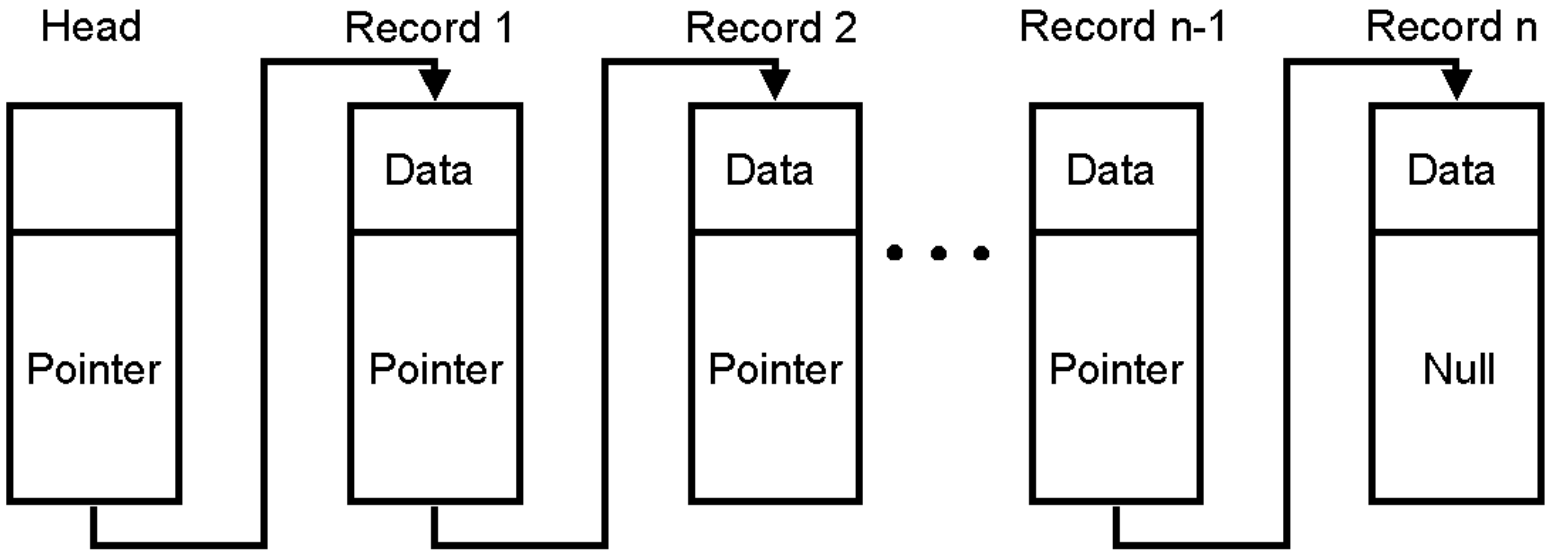

- With a singly-linked node, which end should be the front and which the back?
- Draw each option
- Check the code

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- Buffering, e.g., circular buffers in multimedia
- Simulation of real-world queues
- Actual queues like printer queues

Toy problem: palindrome detection

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- How do you design a palindrome detector with 1 stack and 1 queue?
- Check out the code

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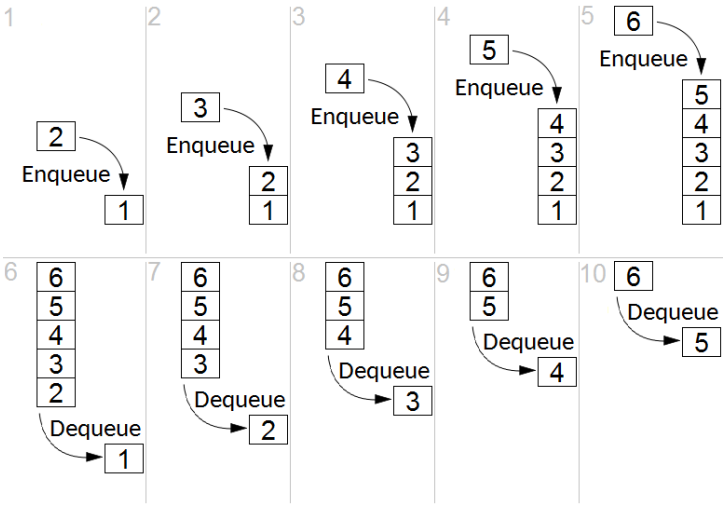
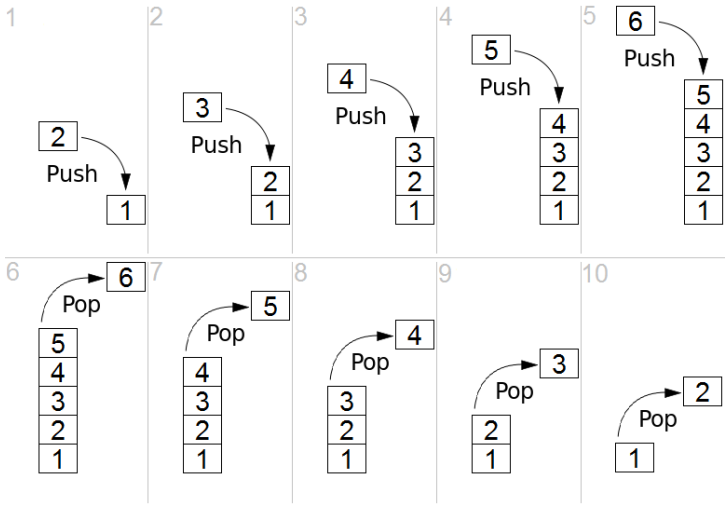
Queues vs Stacks





Insert and remove from different ends	Insert and remove from the same end
Two pointers used, for front and rear ends	One pointer is used (top of stack)
First In First Out (FIFO) order	Last In First Out (LIFO) order
Operations called enqueue and dequeue	Operations called push and pop