CSE 332 Winter 2026
Lecture 1: Intro to ADTs, Stacks, Queues

Nathan Brunelle

http://www.cs.uw.edu/332

Nathan Brunelle

- Born: Virginia Beach, VA
- Ugrad: Math and CS at University of Virginia
- Grad: CS at University of Virginia
- Taught at UVA for 6 years
  - Intro to programming (e.g. 121)
  - Discrete Math (e.g. 311)
  - Algorithms (e.g. 421)
  - Theory of Computation (e.g. 431)
- Year 3 at UW
  - CSE123
  - CSE332
  - CSE373
  - CSE417
  - CSE421

About this course

Topics covered:

- Data Structures
  - Specific “classic” data structures
- Introduction to Algorithms and Analysis
- Parallelism and Concurrency
  - Parallelism: Use multiple processors to finish sooner
  - Concurrency: Correct access to shared resources

Warm Up!

Put up one hand (you can switch if it gets tired)!
Set your counter to 1
While (you and at least one other person have a hand up){
    Make a partnership with someone whose hand is still raised
    Share your name with your partner
    Add together your counter and your partner's counter
    Identify which of you woke up earliest this morning
    Release partnership
    If you woke up later, then put your hand down and return to your seat
}

Course Staff

- Instructor:
  - Nathan Brunelle
- TAs:
  - http://www.cs.uw.edu/332/staff.html#tas

Course Info

- Text (optional):
  - Data Structures & Algorithm Analysis in Java, (Mark Allen Weiss), 3rd edition, 2012
    (2nd edition also o.k.)
- Course Page:
  - http://www.cs.uw.edu/332

Communication

- Ed STEM Discussion board
  - Your first stop for questions about course content & assignments

Course Meetings

- Lecture
  - Materials posted (slides before class, inked slides after)
  - Recorded using Panopto
  - Ask questions, focus on key ideas (rarely coding details)

- Section
  - Practice problems!
  - Answer Java/homework questions, etc.
  - Occasionally may introduce new material
  - An important part of the course (not optional)

- Office hours
  - Use them: *please visit us!*

Grading

- 13 ≥Weekly homework exercises (4.5% each, 54% total)
  - The lowest 1 will be dropped
    - Except for EX12, which cannot be dropped
- Midterm and final exam (40% total)
  - Midterm weighted 15%
  - Final weighted 25%
  - In-person
  - Midterm in class on Friday 11/1
  - Final at 8:30am on Thursday 12/2
- Concept Checks (0.33% each, 6% total)
  - One per “concept” in the course
  - We instantly tell you whether you got each question correct
  - Unlimited submissions, so keep at it!

Collaboration

- Try it yourself first
- Collaborate with classmates (no external interactive help on assignments permitted)
  - Collaboration is “whiteboard only”
  - Looking for a collaborator?
    - Post on the Ed Discussion board
    - Go to the CSE study room (Allen Center 006, there’s a table specifically for 332!)
- Cite your sources!

Terminology

- Abstract Data Type (ADT)
  - Mathematical description of a “thing” with set of operations on that “thing”
- Algorithm
  - A high level, language-independent description of a step-by-step process
- Data structure
  - An organization of data and family of algorithms for implementing an ADT
- Implementation of a data structure
  - The data organization and algorithms written in a programming language

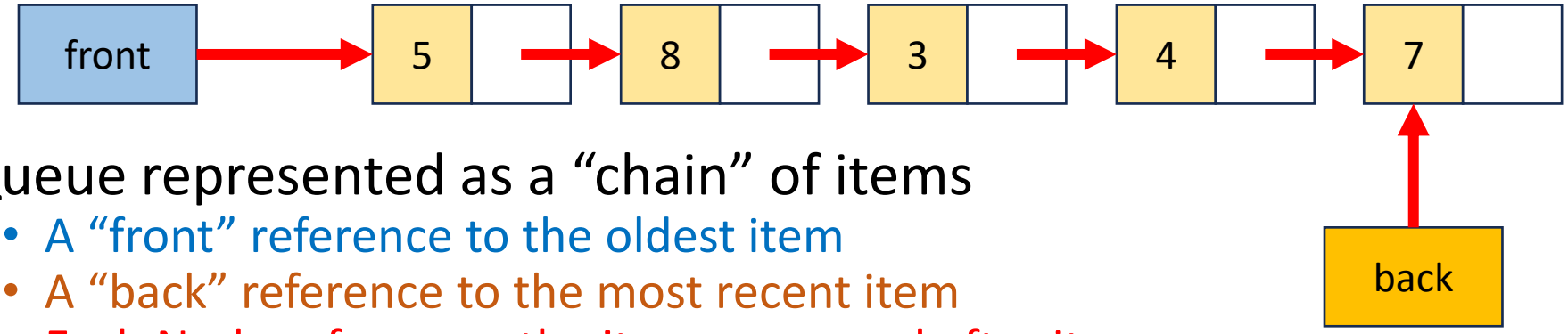
ADT: Queue (Activity)

- What is it?
- What operations do we need?
- Suggested data structures?

ADT: Queue

- What is it?
  - A collection of items that we interact with in a “First In First Out” (FIFO) way
- What operations do we need?
  - Enqueue
    - Add a new item to the queue
  - Dequeue
    - Remove the “oldest” item from the queue
  - IsEmpty
    - Indicate whether or not there are items still on the queue

Linked Queue Data Structure (Idea)

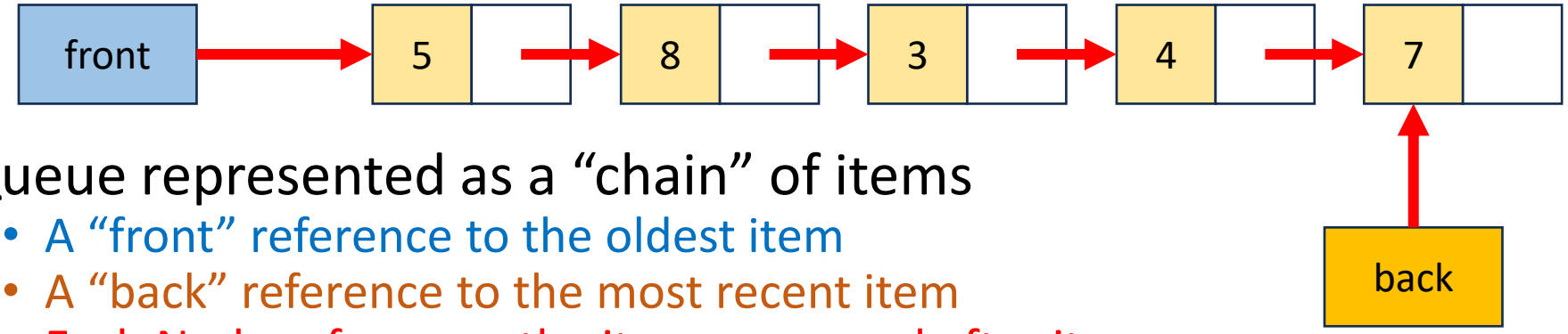


- Queue represented as a “chain” of items
  - A “front” reference to the oldest item
  - A “back” reference to the most recent item
  - Each Node references the item enqueued after it
- enqueue Procedure:

- dequeue Procedure:

- isEmpty Procedure:

Linked Queue Data Structure (Algorithms)



- Queue represented as a “chain” of items
  - A “front” reference to the oldest item
  - A “back” reference to the most recent item
  - Each Node references the item enqueued after it
- enqueue Procedure:

```
enqueue(x){
    last = new ListNode(x);
    back.next = last;
    back = last;
}
```

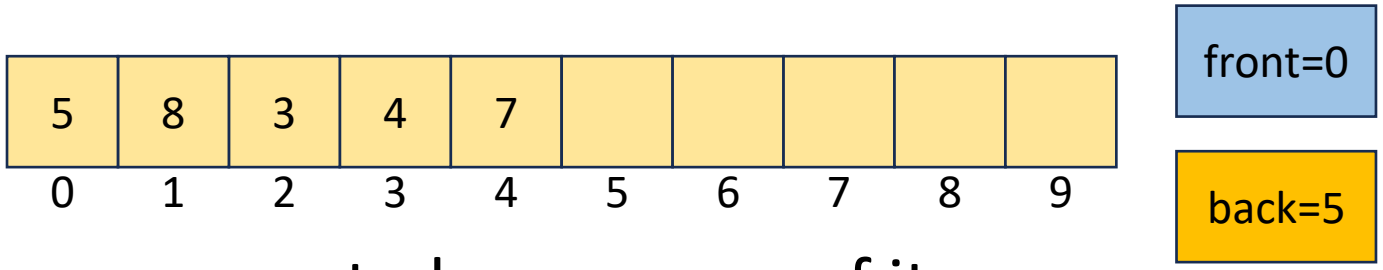
- dequeue Procedure:

```
dequeue(){
    first = front.value;
    front = front.next;
    if (front == null) {back = null;}
    return first
}
```

- isEmpty Procedure:

```
isEmpty(){
    return front == null;
}
```

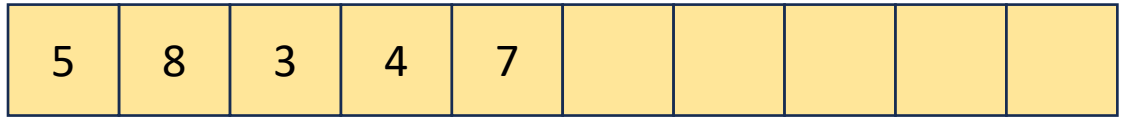
“Circular” Array Queue (Idea)



- Queue represented as an array of items
  - A “front” index to indicate the oldest item in the queue
  - A “back” index to indicate the most recent item in the queue
    - Actually, the first “open” slot in the array
- enqueue Procedure:
- dequeue Procedure:
- isEmpty Procedure:

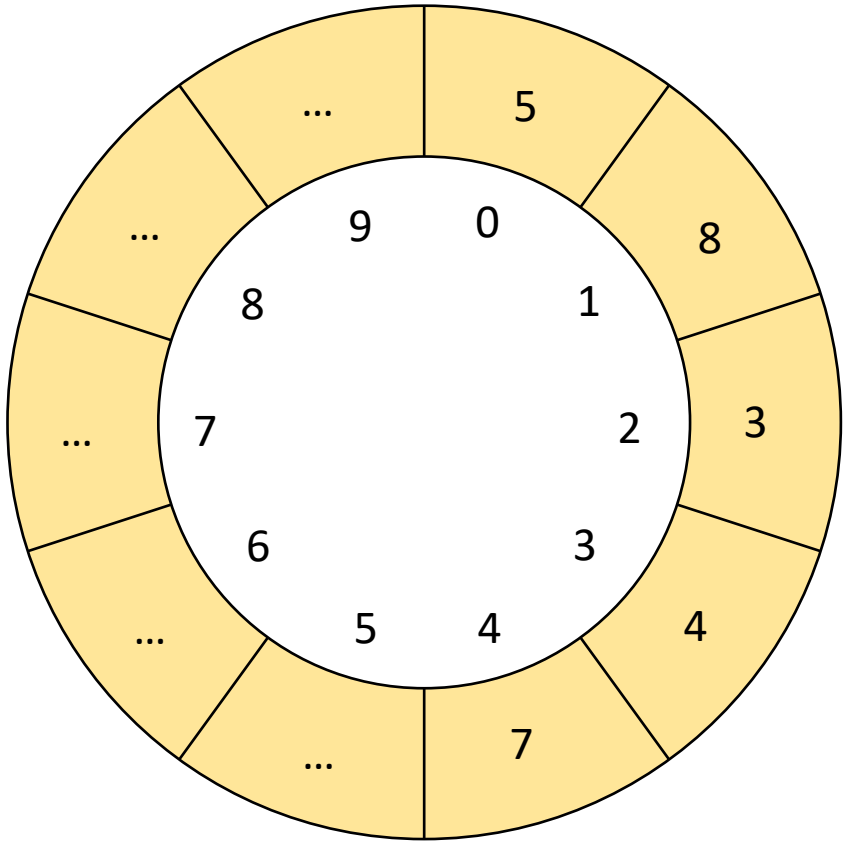
“Circular” Array

- Intuitively, An array of values arranged in a “circle” rather than a line
  - If you go beyond the last index, to wrap back around to 0

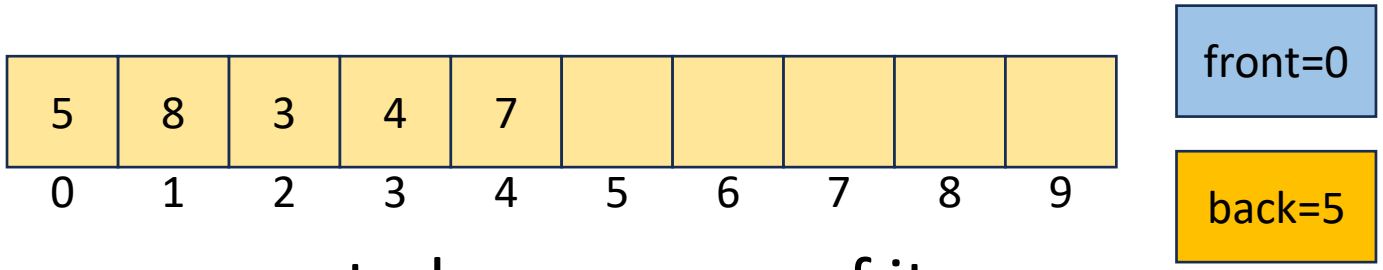


front=0

back=5



“Circular” Array Queue (Algorithms)



- Queue represented as an array of items
  - A “front” index to indicate the oldest item in the queue
  - A “back” index to indicate the most recent item in the queue
- enqueue Procedure:

```
enqueue(x){
    queue[back] = x;
    back = (back + 1) % queue.length;
    size++;
}
```

- dequeue Procedure:

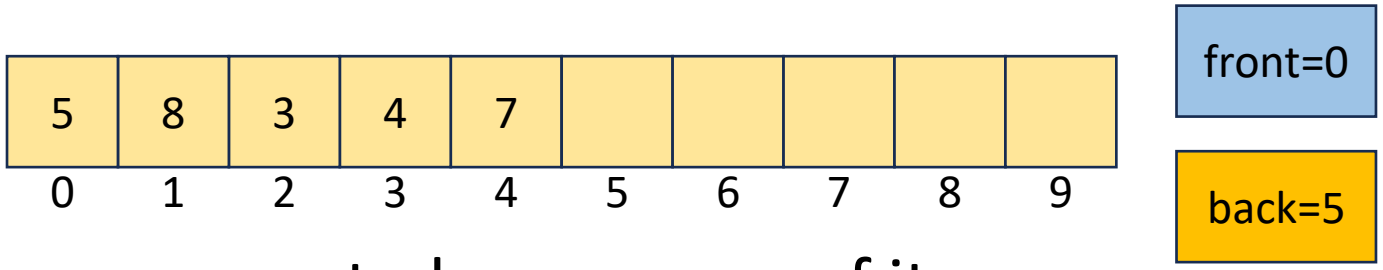
```
dequeue(){
    // Assumes queue is not empty
    first = queue[front];
    front = (front + 1) % queue.length;
    size--;
    return first;
}
```

What if we run out of space?!

- isEmpty Procedure:

```
isEmpty(){
    return size == 0;
}
```

Resizing “Circular” Array Queue



How do you resize?

That’s for Exercise 0!

- Queue represented as an array of items
  - A “front” index to indicate the oldest item in the queue
  - A “back” index to indicate the most recent item in the queue
- enqueue Procedure:

```
enqueue(x){
    if (size == queue.length-1) {resize();}
    queue[back] = x;
    back = (back + 1) % queue.length;
    size++;
}
```

- dequeue Procedure:

```
dequeue(){
    // Assumes queue is not empty
    first = queue[front];
    front = (front + 1) % queue.length;
    size--;
    return first;
}
```

- isEmpty Procedure:

```
isEmpty(){
    return size == 0;
}
```

Linked List vs. Circular Array

- Let’s Summarize the benefits and drawbacks of each

ADT: Stack (Activity)

- What is it?
- What operations do we need?
- Suggested data structures?

ADT: Stack

- What is it?
  - A “Last In First Out” (LIFO) collection of items (sometimes called FILO)
- What operations do we need?
  - push
    - Add a new item onto the stack
  - peek
    - Return the value of the most recently pushed item
  - pop
    - Return the value of the most recently pushed item and remove it from the stack
  - isEmpty
    - Indicate whether or not there are items still on the stack