LEC 07

CSE 122

Stacks & Queues Practice

BEFORE WE START

Talk to your neighbors: What's your favorite animal? And why?

Music: 122 24wi Lecture Tunes ❄

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TAs

Ailsa	Chaafen	Helena	Megana	Sahej
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Questions during Class?

Raise hand or send here

sli.do #cse122

Lecture Outline

- **Announcements**
- Quick Recap
- `copyStack` Review
- Exceptions
- Structured Example: `spliceStack`

Announcements

- Creative Project 1 was due yesterday, how'd it go?
- Programming Assignment 1 releasing later tonight
  - Focusing on Stacks and Queues
- Resubmission Cycle 1 form posted
  - Due January 30th by 11:59pm
  - Eligible assignments: C0, P0

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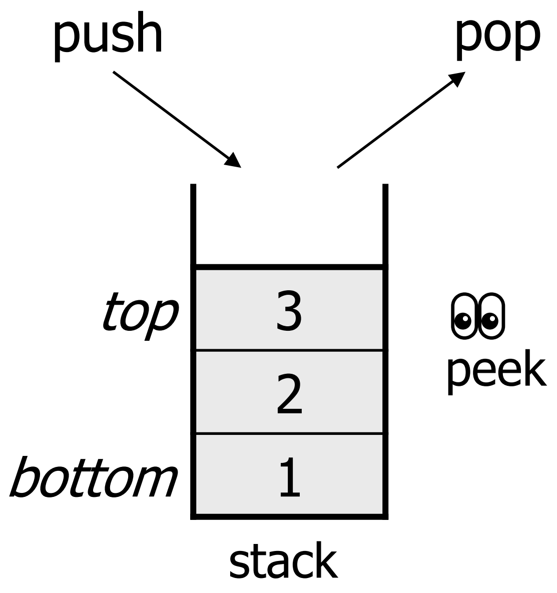
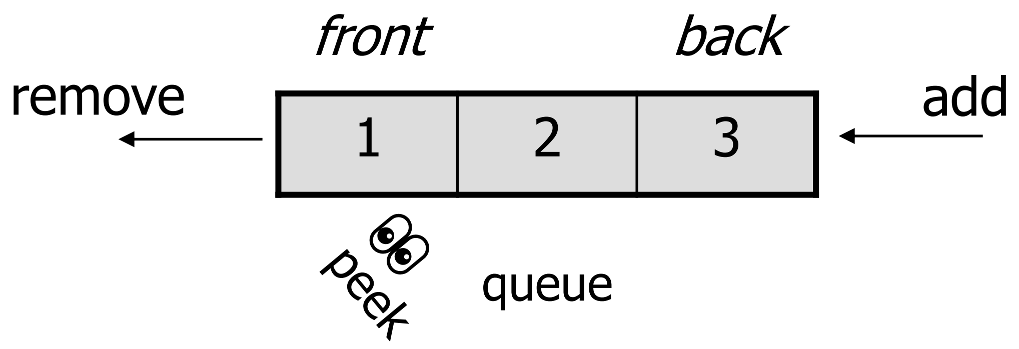
Stacks & Queues

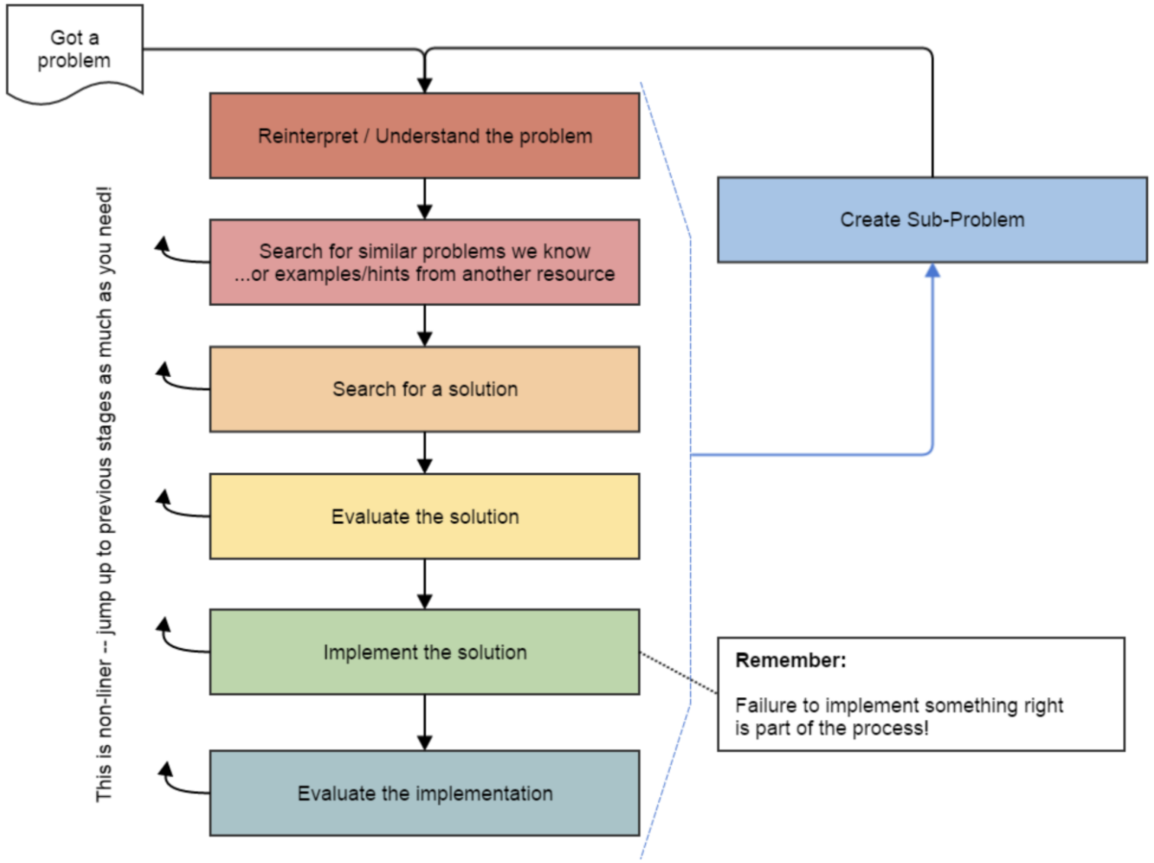
- Some collections are constrained, only use optimized operations
  - **Stack:** retrieves elements in reverse order as added
  - **Queue:** retrieves elements in same order as added





Fundamental Data Structures ➔ Problem Solving

- On their own, Stacks & Queues are quite simple with practice (few methods, simple model)
- Some of the problems we ask are complex *because* the tools you have to solve them are restrictive
  - sum(Stack) is hard with a Queue as the auxiliary structure
- We challenge you on purpose here to practice **problem solving**


Got a problem
Reinterpret / Understand the problem
Search for similar problems we know ...or examples/hints from another resource
Search for a solution
Evaluate the solution
Implement the solution
Evaluate the implementation
Create Sub-Problem
This is non-liner -- jump up to previous stages as much as you need!
Remember:
Failure to implement something right is part of the process!

Source: Oleson, Ko (2016) - Programming, Problem Solving, and Self-Awareness: Effects of Explicit Guidance

Common Problem-Solving Strategies

- **Analogy** – Is this similar to a problem you've seen?
  - sum(Stack) is probably a lot like sum(Queue), start there!
- **Brainstorming** – Consider steps to solve problem before writing code
  - Try to do an example "by hand" → outline steps
- **Solve Sub-Problems** – Is there a smaller part of the problem to solve?
  - Move to queue first
- **Debugging** – Does your solution behave correctly on the example input.
  - Test on input from specification
  - Test edge cases ("What if the Stack is empty?")
- **Iterative Development** – Can we start by solving a different problem that is easier?
  - Just looping over a queue and printing elements

Metacognition

- **Metacognition**: asking questions about your solution process.

- Examples:
  - **While debugging**: explain to yourself why you're making this change to your program.
  - **Before running your program**: make an explicit prediction of what you expect to see.
  - **When coding**: be aware when you're not making progress, so you can take a break or try a different strategy.
  - **When designing**:
    - Explain the tradeoffs with using a different data structure or algorithm.
    - If one or more requirements change, how would the solution change as a result?
    - Reflect on how you ruled out alternative ideas along the way to a solution.
  - **When studying**: what is the relationship of this topic to other ideas in the course?

Common Stack & Queue Patterns

- Stack → Queue and Queue → Stack
  - We give you helper methods for this on problems
- Reverse a Stack with a S→Q + Q→S
- "Cycling" a queue: Inspect each element by repeatedly removing and adding to back `size` times
  - Careful: Watch your loop bounds when queue's size changes
- A "splitting" loop that moves some values to the Stack and others to the Queue

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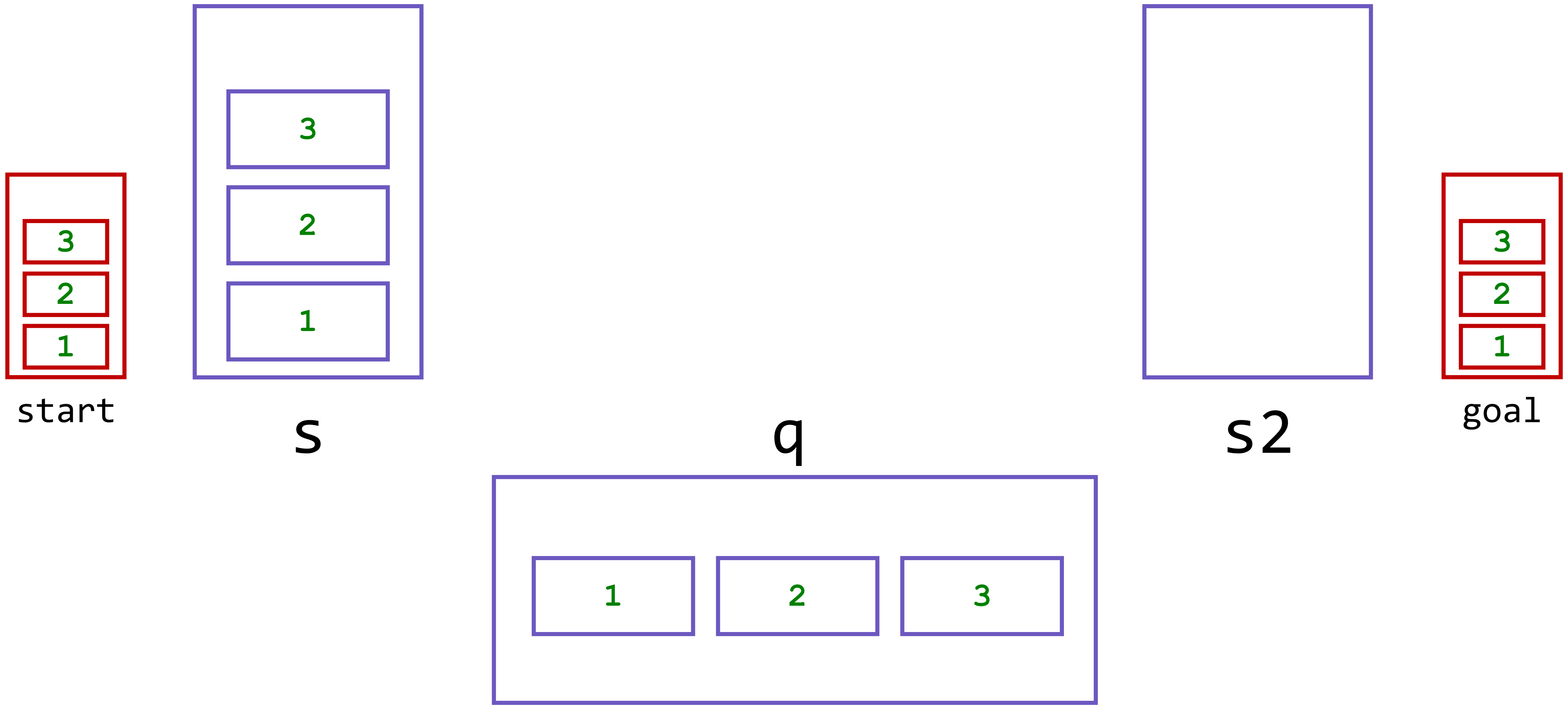
`copyStack`

Write a method `copyStack` that takes a stack of integers as a parameter and returns a copy of the original stack (i.e., a new stack with the same values as the original, stored in the same order as the original).

Your method should create the new stack and fill it up with the same values that are stored in the original stack. It is not acceptable to return the same stack passed to the method; you must create, fill, and return a new stack.

You may use one queue as auxiliary storage.

copyStack



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Exceptions

- Sometimes we want to limit someone's input into our method to "valid" options we define
  - Previously printed out "hey don't do that" messages which isn't great…

- Allow us to "fail fast" and immediately halt execution
- No longer need to wrap code in conditionals
- Can include custom error messages about what went wrong

```
if (/* invalid input */) {
    throw new IllegalArgumentException("Error Message");
}
```

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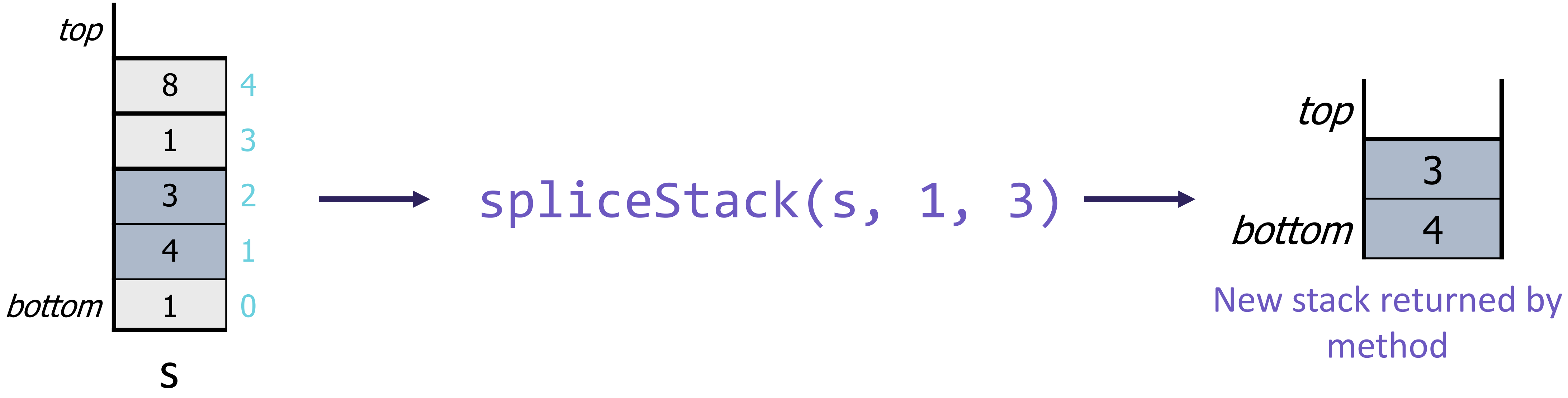
- **Structured Example: `spliceStack`**

spliceStack

Write a method called `spliceStack` that takes as parameters a stack of integers `s`, a start position `i`, and an ending position `j`, and that removes a sequence of elements from `s` starting at the `i`'th element from the bottom of the stack up to (but not including) the `j`'th element from the bottom of the stack (where position 0 is the bottom of the stack), returning these values in a new stack. The ordering of elements in both stacks should be preserved.


top
8
1
3
4
1
4
3
2
1
0
bottom
s
spliceStack(s, 1, 3)
top
3
4
bottom
New stack returned by method