LEC 07

CSE 122

Stacks & Queues Practice

BEFORE WE START

Slido vote & chat with neighbors:
What food could you only eat happily for the rest of your life?

Music: [122 26Wi Lecture Tunes](#) ⛄

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Questions during Class?

Raise hand or send here

sli.do   #cse122

Lecture Outline

- **Announcements** ◀

- Quick Recap

- `copyStack` Review

- Exceptions
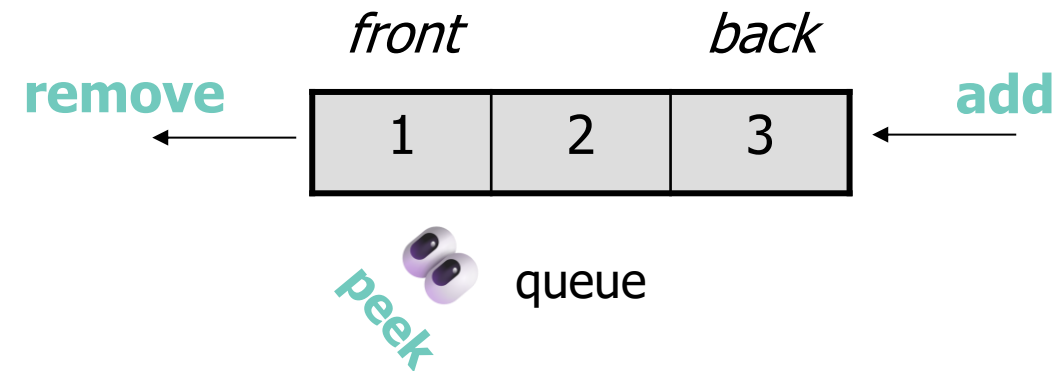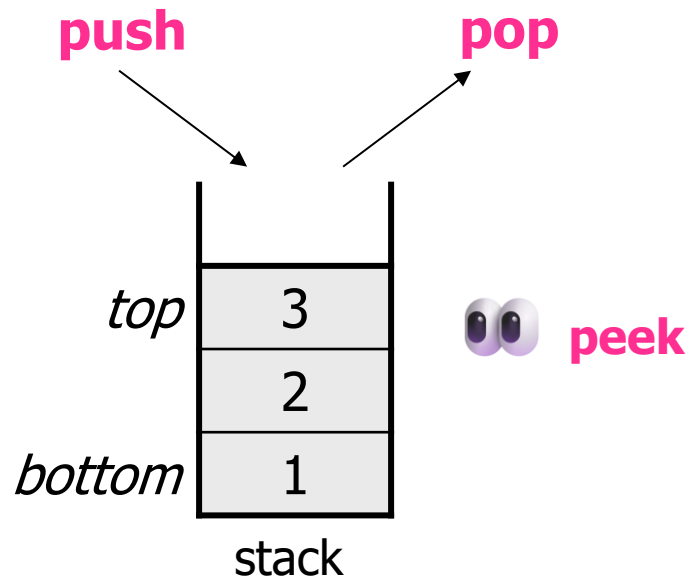
- Structured Example: `spliceStack`

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 February 3rd by 11:59pm PT

  - Eligible assignments: C0, P0

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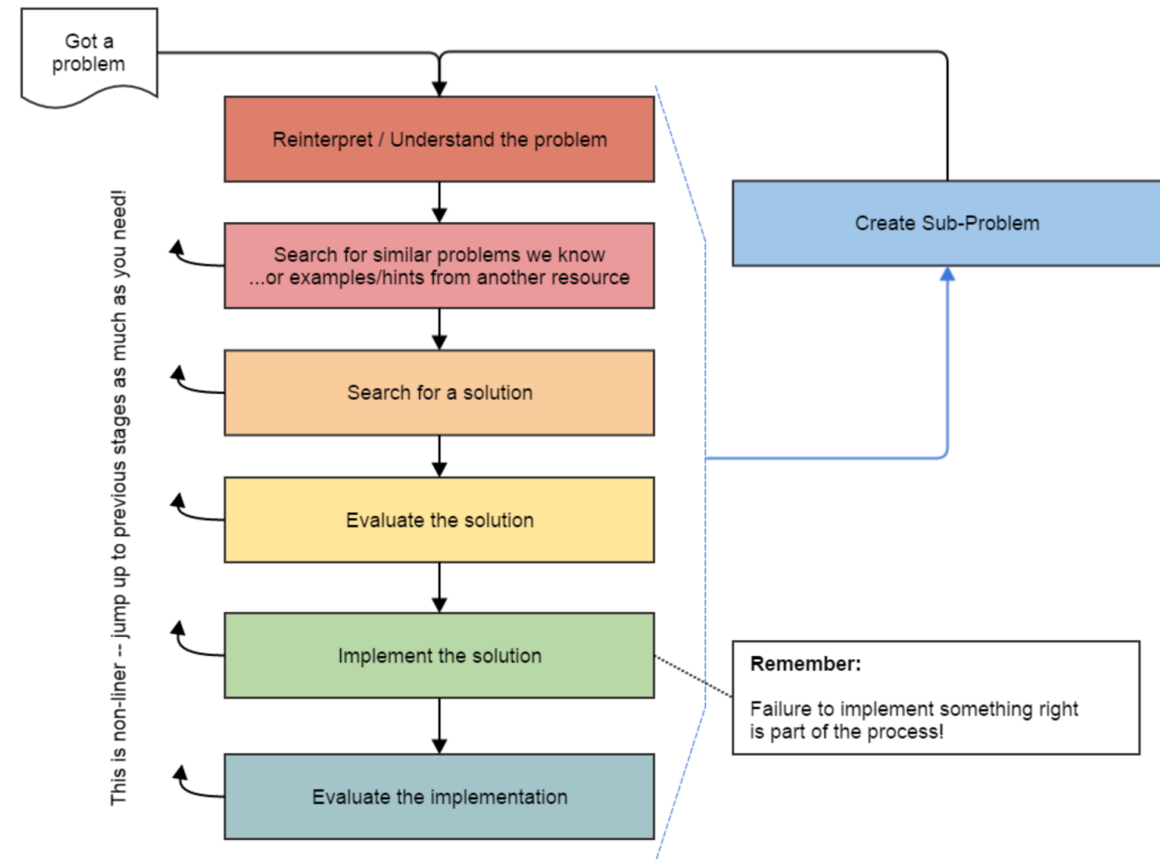
Stacks & Queues

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

push   **pop**

top | 3 | 👀 **peek**
      | 2 |
bottom| 1 |

stack

front   *back*

remove | 1 | 2 | 3 | **add**

👀
peek   queue

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 <u>because</u> 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**

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 these on problems

- Reverse a Stack with a S→Q move & then a Q→S move

- "Cycling" a queue: Inspect each element by repeatedly removing and adding to back a total of `size` times

  - Careful: Watch your loop bounds when a queue's size changes

- A "splitting" loop that moves some values to the Stack and others to the Queue

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- **copyStack Review** ◀

- Exceptions

- Structured Example: `spliceStack`

`copyStack`

Write a method `copyStack` that takes a stack, `s`, of integers as a parameter and returns a copy, `s2`, 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 <u>must</u> create, fill, and return a new stack.

You may alter the stack parameter throughout your method, but by the end, it must have the same elements in the same order.

You may use one queue as auxiliary storage.

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- **Exceptions** ◀

- Structured Example: spliceStack

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

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

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- Exceptions

- **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 <u>not including</u>) 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, `s2`. The ordering of elements in both stacks should be preserved.

`spliceStack(s, 1, 3)`

New stack `s2` returned by method