LEC 06

CSE 122

Stacks & Queues Practice

Questions during Class?

Raise hand or send here

sli.do #cse122

BEFORE WE START

Slido vote & chat with neighbors:

What food could you only eat happily for the rest of your life?

Music: 122 26sp Lecture Jams 🎧

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Lecture Outline

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

Announcements

- Creative Project 1 due tomorrow!
- Resubmission Cycle 1 form posting tomorrow, April 23rd
  - Due April 23rd by 11:59pm PT
  - Eligible assignments: C0, P0
- Programming Assignment 1 releasing Friday, April 24th
  - Due April 30th by 11:59pm PT
  - Focusing on Stacks and Queues!
- Lecture on Friday with be recording only—no in-class lecture!

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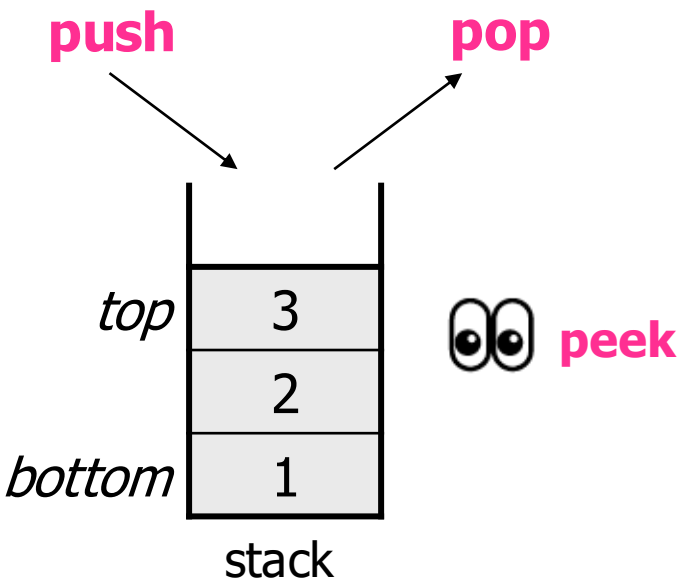
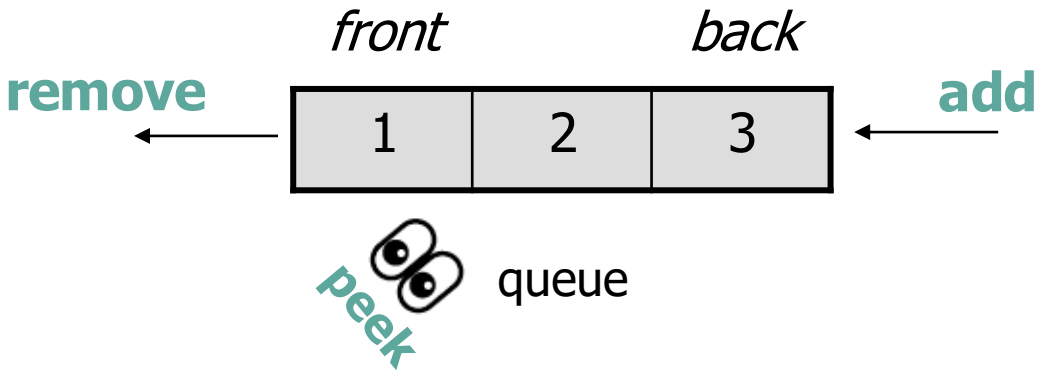
Stacks & Queues

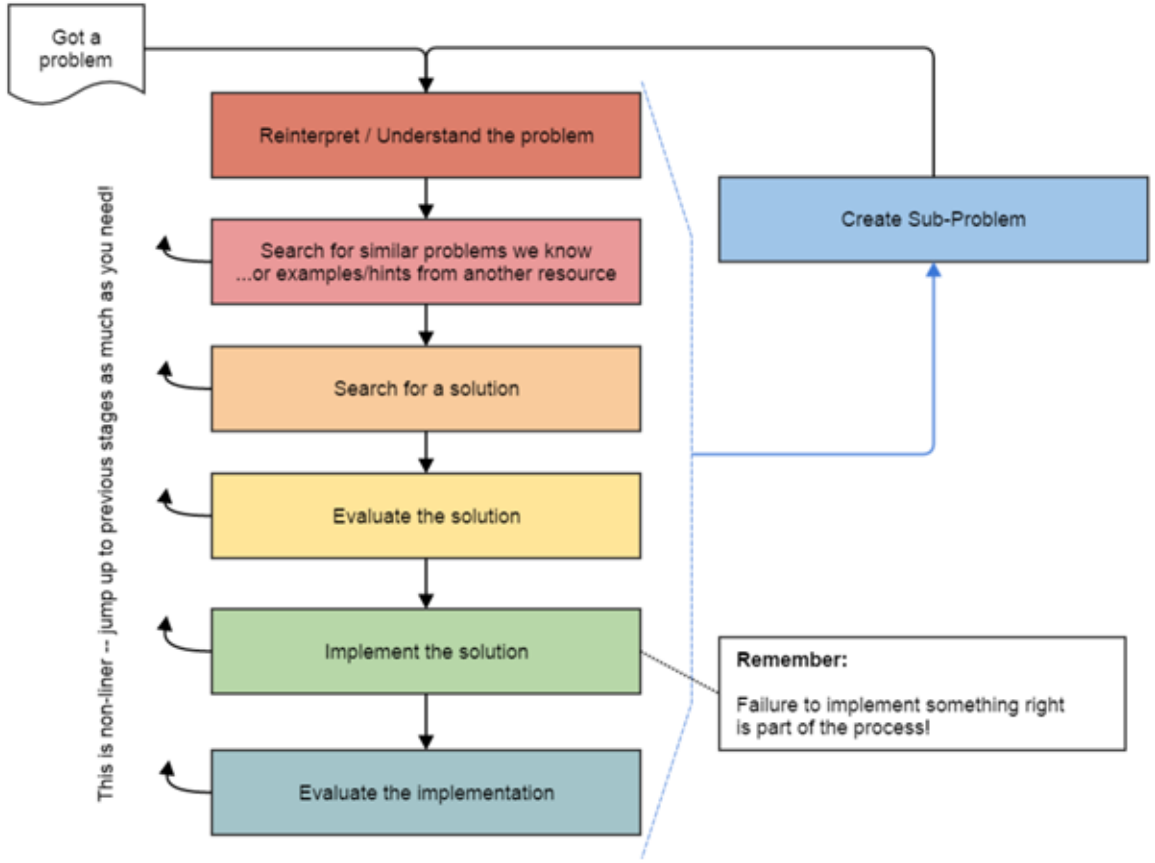
- Some collections are constrained, only use optimized operations
  - **Stack:** retrieves elements in reverse order as added, LIFO
  - **Queue:** retrieves elements in same order as added, FIFO





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 the 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

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 must 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

```
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, `s2`. The ordering of elements in both stacks should be preserved.