

Lecture 16: Queues

CS 62

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Stack

- Interface Stack<E> {
 - void push(E value)
 - E pop()
 - E peek()
- Example: Trays in cafeteria
- Last In - First Out (LIFO)
No changes to middle of list ever!



Stack Applications

- Run-time stack:
 - See sum program
- Backtracking
 - Solving Maze
- Evaluating expression in postfix form:
 - $(52 - ((5 + 7) * 4)) \Rightarrow 52\ 5\ 7\ +\ 4\ * \ - \Rightarrow 4$
- Tools to parse programs
- Undo

Evaluation of postfix expressions

1. Create a stack to store operands (or values).
2. Scan the given expression and do following for every scanned element.
 1. If the element is a number, push it into the stack
`push(operand)`
 2. If the element is a operator, pop operands for the operator from stack.
Evaluate the operator and push the result back to the stack
`result1 = pop()`
`result2 = pop()`
`result = result2 operator result1`
`push(result)`
3. When the expression is ended, the number in the stack is the final answer
`peek()`

Stack Implementations

- ArrayList:
 - Which end should be head?
 - How complex for push, pop, peek?
- SinglyLinkedList:
 - Which end should be head?
 - How complex for push, pop, peek?
- Space differences?
 - What if there are several stacks?
- `java.util.Stack` based on `Vector` - don't use!
 - `ArrayDeque` is better choice (*more details later*)

Queue

- FIFO: Waiting in line
- Operations:
 - enqueue (at end) – or add
 - dequeue (from beginning) – or remove
- Examples:
 - Simulations
 - Event queue
 - Keeping track when searching

Queue Implementations

- SinglyLinkedList:
 - Which end should be front, rear?
 - How complex for enqueue, dequeue?
- ArrayList:
 - Which end should be front, rear?
 - How complex for enqueue, dequeue?
- Space differences?

Deque

- Steque:
 - Add and remove from one end. Only add from other.
- `java.util.Deque`: Double-Ended Queue
 - Can add or remove from either end.
 - Resizable array implementation
 - Faster than Java Stack class when used as stack, faster than `LinkedList` (doubly-linked) when used as queue.