Previously ...
More on Pointers
Linked Lists

Today ...
More on Linked Lists
Stacks
Queues

Singly Linked List

Doubly Linked List

Circular Lists
Can also have a circular doubly linked list

Basic Methods
InsertKey
- front, end, by index, by value

DeleteKey
- front, end, by index, by value

GetKey/Search
- by value, by index

Traverse
- visit all nodes (e.g. print)

Destroy

Stacks
LIFO Last In First Out

Push 5
Push 3
Push 9
Push 8
Push 2
Pop
Pop
Push 5

Stack Implementation

Arrays
- can be fixed-size or dynamic array
  - push and pop at the end of array
  - O(1) amortized cost for dynamic arrays

Linked Lists
- push — insert at one end
- pop — delete from the same end (needs to return value)
Considerations

Underflow happens when pop from an empty stack
Overflow might happen with fixed-length stacks better use dynamic arrays or linked lists

Applications

Undo in software applications
Navigation buttons in browsers
Stack in compilers/programming languages
Parsing expressions

Example

Try with fully parenthesized infix expressions
((3 + ((10 - 4) * (3+2))) + 25)

Two-Stack Algorithm (Dijkstra)
value? push onto s1
operator? push onto s2
left parenthesis? ignore
right parenthesis? pop two values from s1 and one operator from s2, apply operator and push resulting value to s1

Queue Implementation

Enqueue 5
Enqueue 3
Enqueue 9
Enqueue 8
Enqueue 2
Dequeue
Dequeue
Dequeue
Dequeue

FIFO First In First Out

Enqueue
Dequeue
Enqueue
Dequeue
Enqueue
Dequeue

Arrays can be fixed-size or dynamic array
enqueue and dequeue (tricky to implement)
Linked Lists
enqueue — insert at one end
dequeue — delete from the other end (needs to return value)

Applications

Media Playlists (Youtube, Spotify, Music, etc.)
Process management in Operating Systems
Simulations
Used in other algorithms

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