CS311 Data Structures
Lecture 03 — Stack, Queue

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September 10, 2017
Stack
   Introduction
   Implementation
   Applications

Queue
   Introduction
   Implementation
   Applications
What is a stack?

- **Last In, First Out (LIFO)**
- In *Java*, it extends class *Vector*
- **Operations**
  - pop
  - push
  - peek
  - empty

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Implementation

- Using Array List
  - pop
  - push
  - peek
  - empty

- Using Linked list
  - pop
  - push
  - peek
  - empty
Applications

- Check balancing
  - \{ ( < > [ { < > } ] ) { } \} vs. \{ ( < [ { < > } ] ) } \{ \}

- Postfix calculation
  - $6523 + 8 \ast +3 + \ast = 288$

- Infix to Postfix Conversion
  - $a + b \ast c + (d \ast e + f) \ast g \rightarrow abc \ast +de \ast f + g \ast +$

- Call stack
  - fib(4)=

- Tree traversal — preorder traversal
- Graph search — depth first search
- ...

What is a queue?

- First In, First Out (FIFO)
- In *java*, it is an interface. `LinkedList` implements this interface.
- Operations
  - enqueue
  - dequeue
  - peek
  - empty
Queue can be implemented easily by linked list

Using Array List (circular array)

- enqueue
- dequeue
- peek
- empty

(image from http://www.javaworld.com/)
Flocking system

- a coordinated group (e.g., school of fish, flock of bird, crowd)
- simulation is based on very simple local rules
  - separation
  - coherence
  - alignment

(http://cmol.nbi.dk/models/boids)

- Question: how do you get a list of neighboring agents efficiently?
  - a brute force method will take $O(n)$ time for each of the $n$ agents
- Answer: Using a regular grid and a queue.