Data Structure

Queue

Shin Hong

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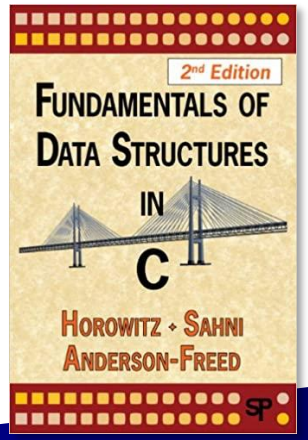
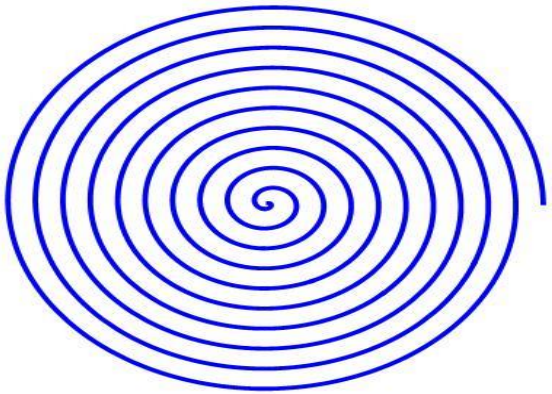
Chapter 3.
Stack and Queue



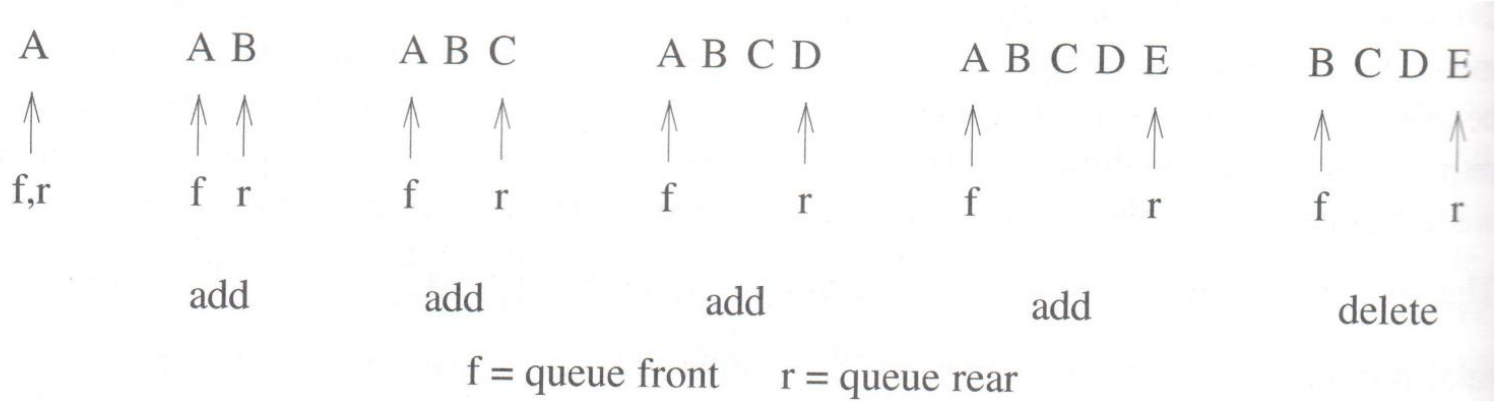
Queue

- A queue is an ordered list where insertion and deletion take place at different ends
  - insertion at the rear, deletion at the front

- A queue is also known as a First-In-First-Out (FIFO) list



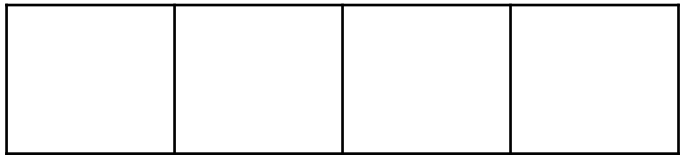
Example


A
A B
A B C
A B C D
A B C D E
B C D E
f,r
f r
f r
f r
f r
f r
add
add
add
add
delete
f = queue front
r = queue rear

Queue Abstract Data Type

- Structure
  - **elements**: an array to hold elements
  - **capacity**: the maximum number of elements that the queue can hold
    - a queue can be bounded or unbounded

- Operations
  - **add(e)**: insert a new element **e** to if the queue is not full (i.e., enqueue)
  - **delete()**: return the least recently inserted element if the queue is not empty (i.e., dequeue)
  - **isEmpty()** : return whether the queue has at least one element or not
  - **isFull()** : return whether the queue is full or not



Circular Queue

- Implement a queue as an arraylist
  - maintain the indices of the front and the rear
  - the indices rotates around the indices of the element array

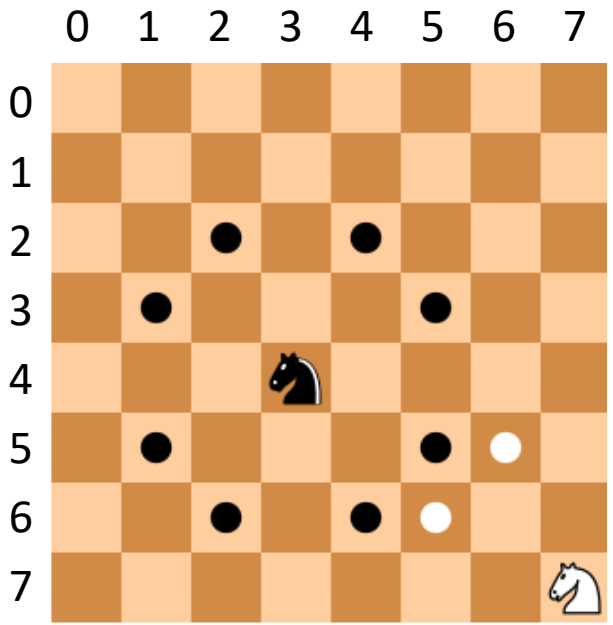
- Two designs for distinguishing empty and full states
  1. keep at least one array element between the front and the rear
     - front indicates the next element to be removed if it is the same as rear (i.e., there exists at least one element)
     - rear indicates the empty slot for the next coming element
  2. store the number of elements that a queue currently holds (or whether the queue is full/empty or not)
     - front indicates the next element to be removed if there exists at least one element
     - rear indicates the empty slot for the next coming element if the queue is not full

Implementations

- Version 1. keeping at least one array element between the front and the rear
  - https://github.com/hongshin/DataStructure/tree/queue/ver1
- Version 2. marking whether a queue is full/empty or not
  - https://github.com/hongshin/DataStructure/tree/queue/ver2
- Version 3. storing the number of elements that a queue currently holds

Case 1. Knight (1/2)

- A Knight can move to one of the cells that are two squares vertically and one square horizontally away, or
  one square vertically and two squares hortizontally away.
- For given two chessboard positions, find the minimum number of moves for a Knight to reach one position from the other position if possible



Case 1. Knight (2/2)