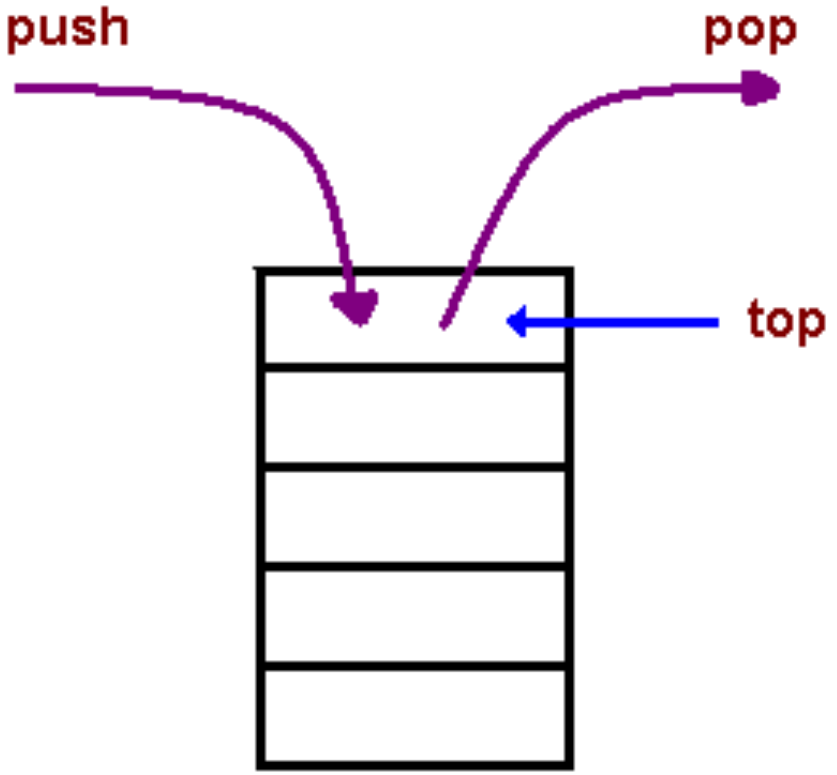
# Stacks and Queues

# Problem Solving Club Oct 19 2016

# Stacks

- A stack is a container of objects that are inserted and removed according to the last-in first-out (LIFO) principle
- Only two operations are allowed: push the item into the stack, and pop the item out of the stack.



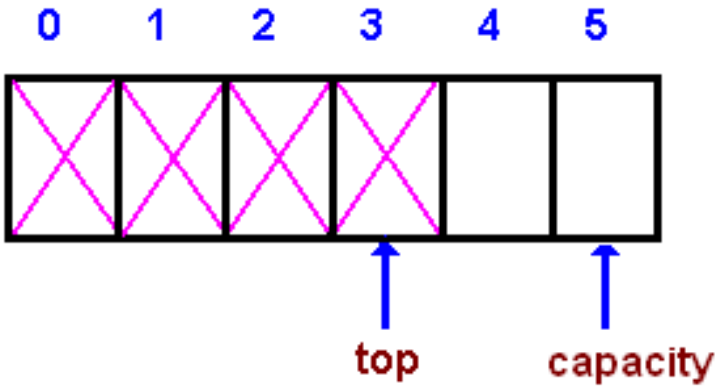
# Usage of stack

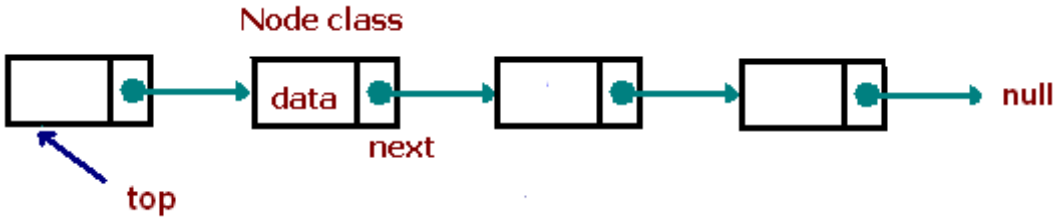
- Undo mechanism
- Function call stack
- Reverse a string
- Depth first search (DFS)

# Stack implementation

- Array stack implementation
- Java ArrayList/Stack
- C++ std::vector/stack

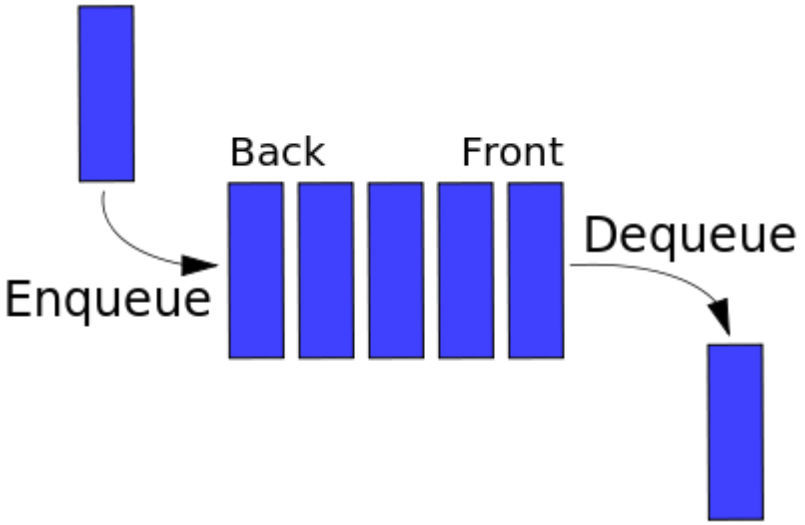
- Linked list stack implementation
- Java LinkedList
- C++ std::list



# Queues

- A queue is a container of objects (a linear collection) that are inserted and removed according to the first-in first-out (FIFO) principle.
- An excellent example of a queue is a line of students in the food court



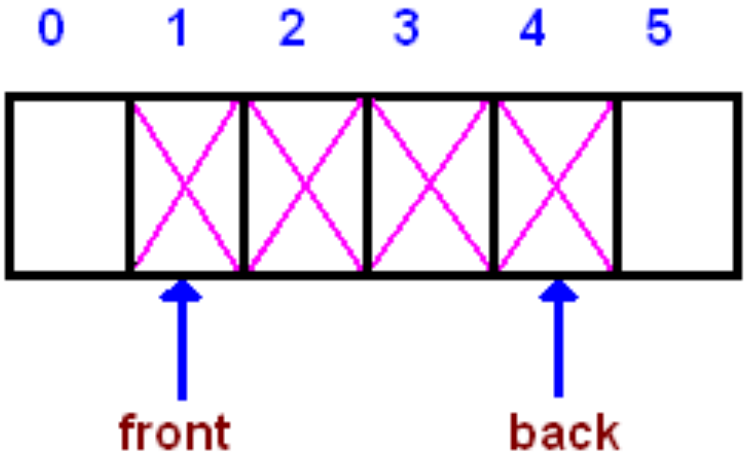
# Usage of queues

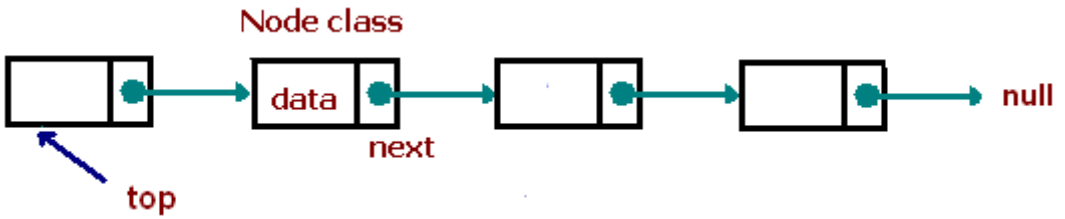
- Job processing / scheduling
- Breadth first search (BFS) – single source shortest paths in an undirected graph

# Queue implementation

- Array-based double ended queue
- Java ArrayDeque
- C++ std::deque/ queue

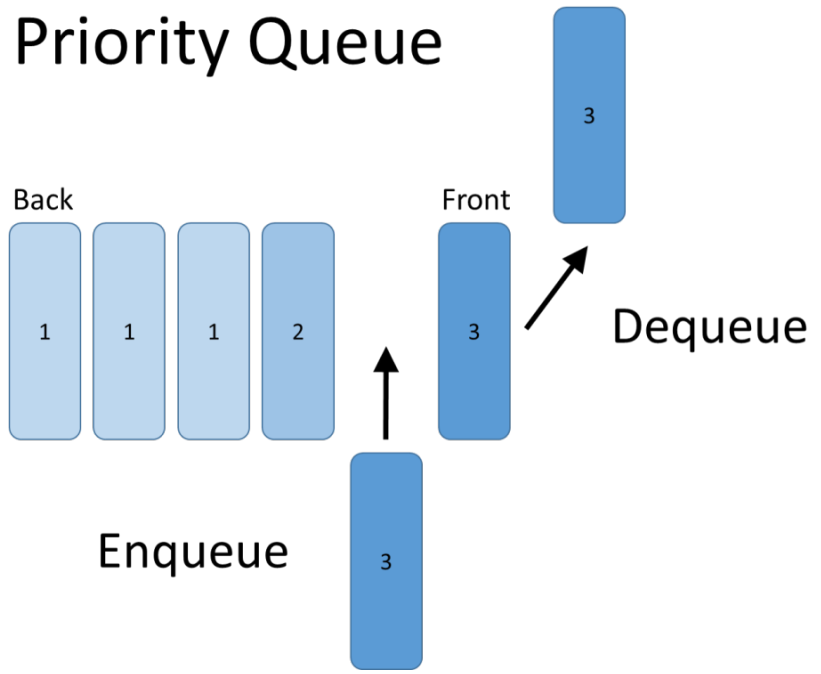
- Linked list based queue
- Java LinkedList
- C++ std::list



# Priority queues

- A priority queue is like a regular queue or stack data structure
- But additionally each element has a "priority" associated with it.
- In a priority queue, an element with high priority is served before an element with low priority.

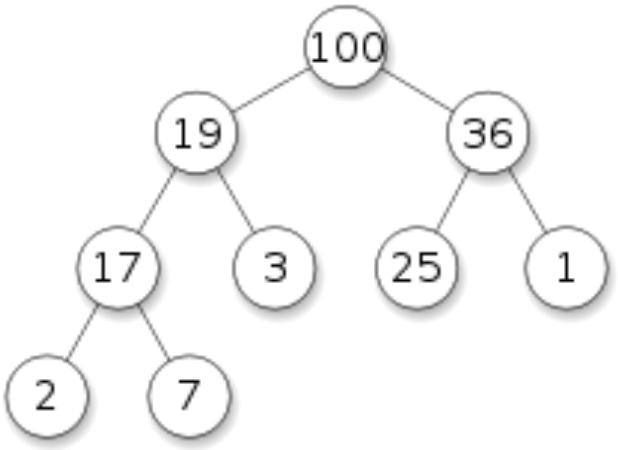


# Usage of priority queues

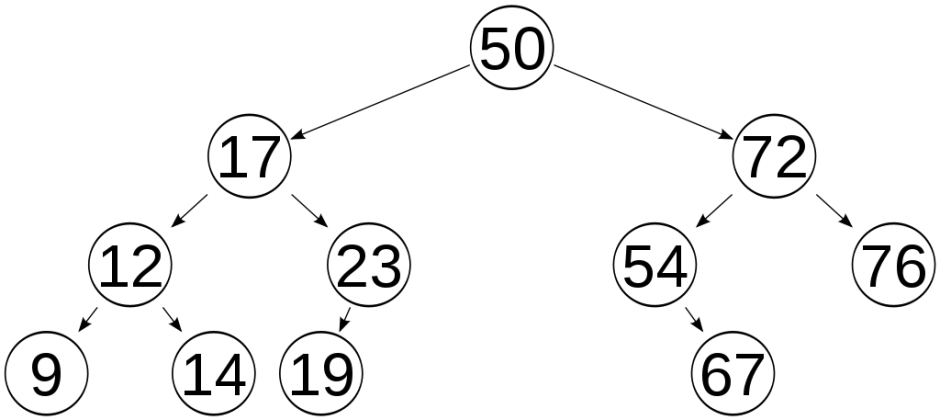
- Sorting (heapsort)
- Caching
- Dijkstra's algorithm – singles source shortest paths in a directed graph

# Priority queue implementation

- Binary heap based priority queue
- Java PriorityQueue
- C++ std::priority_queue




- Self-balancing binary search tree based priority queue
- Java TreeSet
- C++ std::set



# Recap

- **Stack – last-in first-out (LIFO).**
- *What is the complexity of push/pop?*
- Answer: O(1) – constant time
- *What is the preferred data structure for implementation?*
- Answer: Array – faster and uses less memory than linked list
- **Queue - first-in first-out (FIFO)**
- *What is the complexity of enqueue/dequeue?*