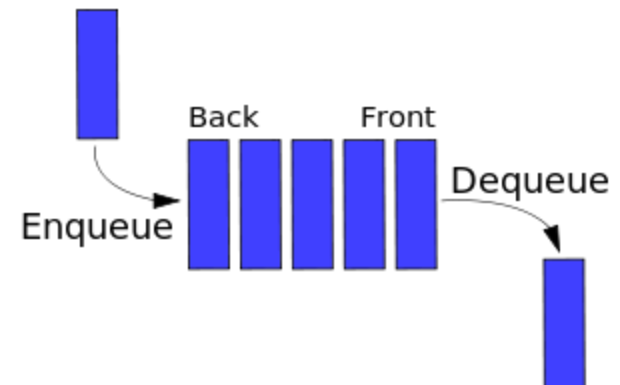# QUEUES

Queue

- The queue is a FIFO (First-in First-out) data structure

- Elements are added at the rear of the queue and removed from the front

- The only data element that can be removed is the least recently added element

Queue ADT: Specification

- Elements:
  - Queue elements can be of any type, but we will assume QueueElement

- Structure:
  - Any mechanism for determining the elements order of arrival into the queue

Queue ADT Continued

- Domain:
  - The number of queue elements is bounded. A queue is considered full if the upper-bound is reached. A queue with no elements is considered empty.

Queue ADT Continued

Operations: There are six operations as follows:

- function create (q: Queue, isCreated: boolean)
  - **results**: if q cannot be created, isCreated is false; otherwise, isCreated is true,the queue is created and is empty

- function terminate (q: Queue)
  - **results**: queue q no longer exists

Queue ADT Continued

- function isFull (q: Queue)
  - **results**: returns true if the queue is full; otherwise false is returned

- function isEmpty (q: Queue)
  - **results**: returns true if the queue is empty; otherwise, false is returned

- function enqueue (q: Queue, e: QueueElement)
  - **requires**: isFull (q) is false
  - **results**: element e is added to the rear of the queue as the most recently added element

Queue ADT Continued

- function dequeue (q: Queue, e: QueueElement)
  - **requires**: isEmpty(q) is false
  - **results**: The least recently added element is removed from the front of the queue and assigned to e

Queue Implementation

- How would you implement a queue?

Queue Implementation

- Using an array

  - How would this work?

  - What are the drawbacks?

Queue Implementation

- Using an array (circular queue)

  - How would this work?

  - What are the drawbacks?

Queue Implementation

- Using a singly linked list

    - How would this work?

    - What are the drawbacks?

Queue Implementation

- Using a singly linked circular list

    - How would this work?

    - What are the drawbacks?

Queue Implementation

• Problem: Write queue.h assuming we are implementing a queue as a singly linked circular list. Assume that the queue holds chars.

• Problem: Write create, terminate, isFull, isEmpty, enqueue, and dequeue.

• Problem: Can you think of an application that requires a queue?