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?
- Define the data structure in C
- Write qCreate, qIsFull, qEnqueue
Queue Implementation

• Using an array (circular queue)
  • How would this work?
  • What are the drawbacks?

• Define the data structure in C

• Write qCreate, qIsFull, qEnqueue
Queue Implementation

• Using a singly linked list
  • How would this work?
  • What are the drawbacks?

• Define the data structure in C

• Write qCreate, qIsFull, qEnqueue
Queue Implementation

- Using a singly linked circular list
  - How would this work?
  - What are the drawbacks?
- Define the data structure in C
- Write qCreate, qIsFull, qEnqueue