FIFO Queues

CSE 2320 – Algorithms and Data Structures
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FIFO Queues

- *First-in first-out (FIFO)* queues.

- Examples of uses of FIFO queues:
  - Program execution:
    - Requests for access to memory, disk, network...
  - Resource allocation:
    - Forwarding network traffic in network switches and routers.
  - Search algorithms.
    - More details later in the course

Put and Get

- The FIFO queue supports **insert** and **delete** as follows:
  - ~~**insert,**~~ **put** - puts an item "at the end of the line".
  - ~~**delete,**~~ **get**: - removes the item from "the head of the line".

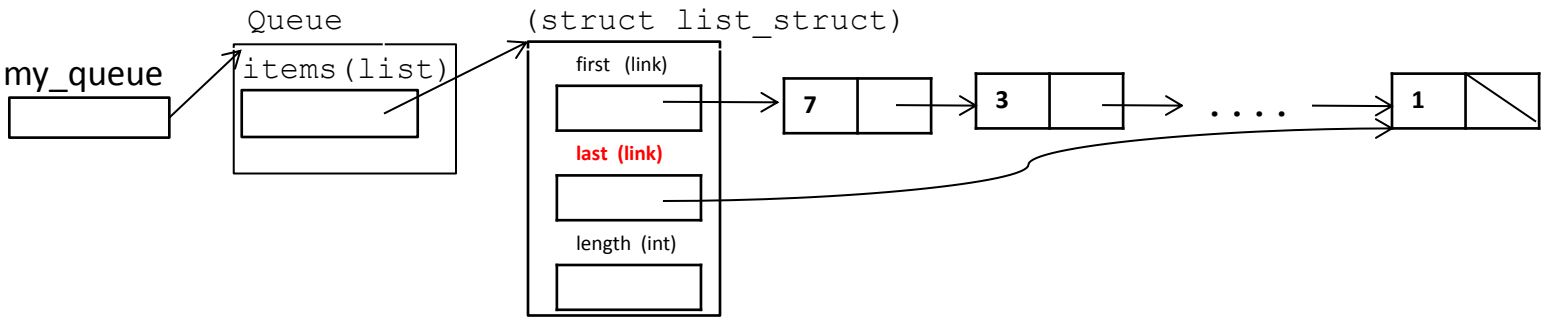
- How can we implement FIFO queues?

FIFO Queues Using Lists

- A FIFO queue is essentially a list.
- **put(queue, item)** inserts that item at the **end** of the list.
- **get(queue)** removes (and returns) the item at the **beginning** of the list.
- What is the running time of these operations?

FIFO Queues Using Lists

- A FIFO queue is essentially a list.
- **put(queue, item)** inserts that item at the **end** of the list.
- **get(queue)** removes (and returns) the item at the **beginning** of the list.
- Both operations take O(1) time.
  - Assumption: the list data type contains a pointer to the last element.



FIFO Queues Using Arrays

- How do we implement queues using arrays?
- A queue can be defined like this:

```
typedef struct queue_struct * queue;
struct queue_struct
{
    int max_size;
    int start_index;
    int end_index;
    int * items;
};
```

- **end_index** tells us where to put a new item.
- **start_index** tells us where to remove an item from.

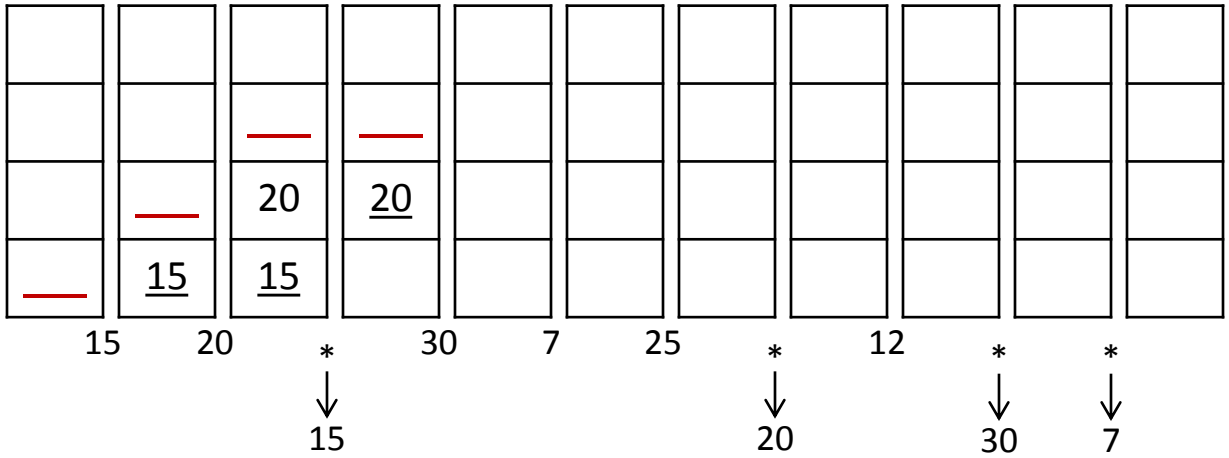
Array-Based Queue: Example

```
typedef struct queue_struct * queue;
struct queue_struct {
   int max_size;
   int start_index;
   int end_index;
   int * items;
};
```

Conventions:

- ___ place where the new item will be added (end_index).
- underline: first item in the queue (start_index).
- x – put(x)
- * – get()

put(15)
put(20)
get()
put(30)
put(7)
put(25)
get()
put(12)
get()
get()



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