Stacks AND Queues

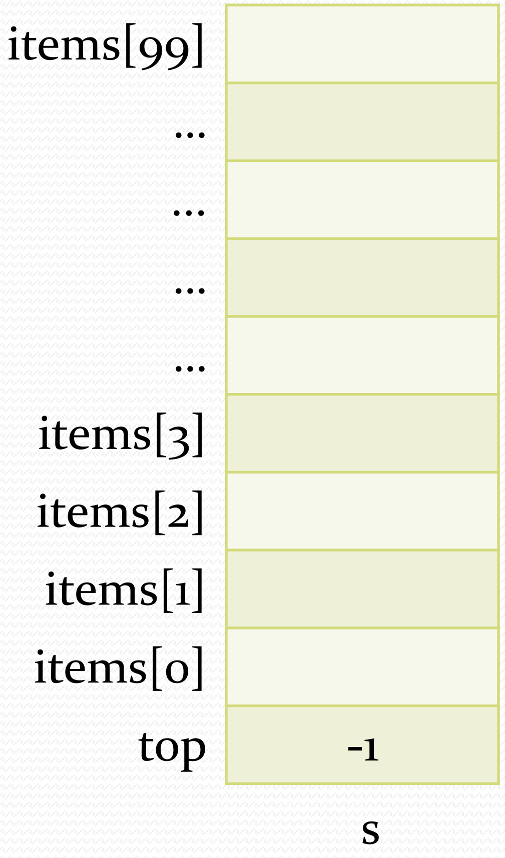
Data Structures and Algorithms

Stacks

- First In Last Out(FILO) or Last In First Out(LIFO) data structure
- Associated with top
- Operations defined:
    - PUSH
    - POP
    - PEEK
- Conditions to be tested:
    - Overflow
    - Underflow

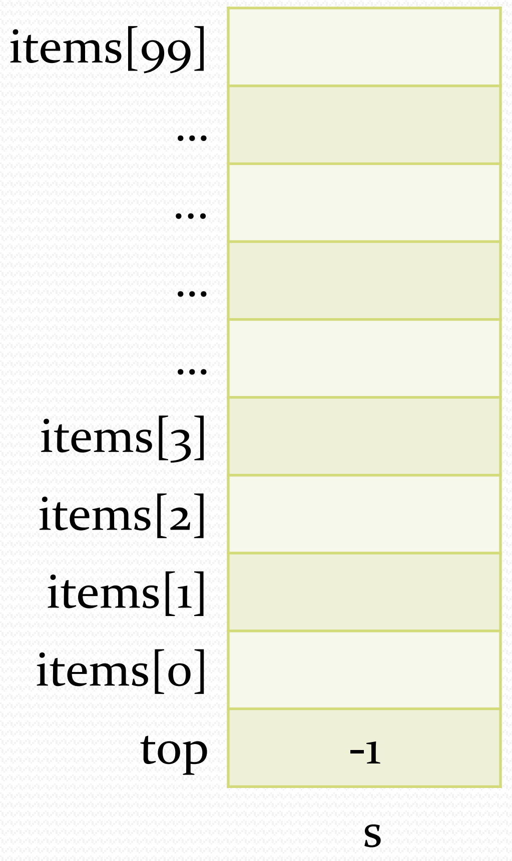
Defining a Stack structure

```
#define STACKSIZE 100
struct stack
{
    int top;
    int items[STACKSIZE];
};

typedef struct stack STACK;

STACK s;
s.top = -1
```



Condition: Underflow

When the top is -1



Condition: Overflow

When the top is

STACKSIZE - 1

items[99]	X100
…	…
…	…
…	…
…	…
items[3]	X4
items[2]	X3
items[1]	X2
items[0]	X1
top	99

s

Operation: PUSH

items[99]	
…	
…	
…	
…	
items[3]	
items[2]	
items[1]	
items[0]	
top	-1

Initially, s

items[99]	
…	
…	
…	
…	
items[3]	
items[2]	
items[1]	
items[0]	
top	0

s.top++

items[99]	
…	
…	
…	
…	
items[3]	
items[2]	
items[1]	
items[0]	x
top	0

s.items[s.top] = x

The operation is performed after checking overflow condition

Operation: POP

items[99]	
…	
…	
…	
…	
items[3]	
items[2]	
items[1]	
items[0]	x
top	0

Initially, s

items[99]	
…	
…	
…	
…	
items[3]	
items[2]	
items[1]	
items[0]	x
top	0

x = s.items[s.top]

items[99]	
…	
…	
…	
…	
items[3]	
items[2]	
items[1]	
items[0]	
top	-1

s.top--

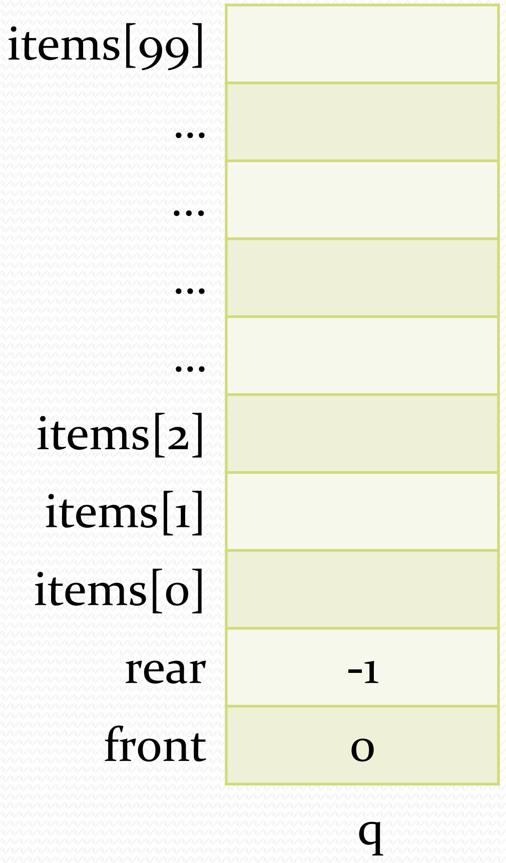
The operation is performed after checking underflow condition

Queues

- First In First Out(FIFO) or Last In Last Out(LILO) data structure
- Associated with front and rear
- Operations defined:
  - ENQUEUE
  - DEQUEUE
- Conditions to be tested:
  - Overflow
  - Underflow

Defining a Queue structure

```
#define MAXQUEUE 100
struct queue
{
    int front;
    int rear;
    int items[MAXQUEUE];
};

typedef struct queue QUEUE;

QUEUE q;
q.front = 0;
q.rear = -1;
```



Condition: Underflow

Operation	Front	Rear
Initial Condition	0	-1
After inserting and Deleting ‘**1**’ item	1	0
After inserting and Deleting ‘**2**’ items	2	1
…	…	…
After inserting and Deleting ‘**n**’ items	n	n-1

Condition is When the front > rear

Condition: Overflow

When the rear is MAXQUEUE- 1

items[99]	X100
…	…
…	…
…	…
…	…
items[2]	X3
items[1]	X2
items[0]	X1
rear	99
front	0 *

q

* *Could be any value between 0 to 99*

Operation: ENQUEUE

	Initially, q	q.rear++	q.items[q.rear] = x
items[99]			
…			
…			
…			
…			
items[2]			
items[1]			
items[0]			x
rear	-1	0	0
front	0	0	0

The operation is performed after checking overflow condition

Operation: DEQUEUE

	Initially, q	x=q.items[q.front]	q.front++
items[99]			
…			
…			
…			
…			
items[2]			
items[1]			
items[0]	x	x	
rear	0	0	0
front	0	0	1

The operation is performed after checking overflow condition

Thank you.