

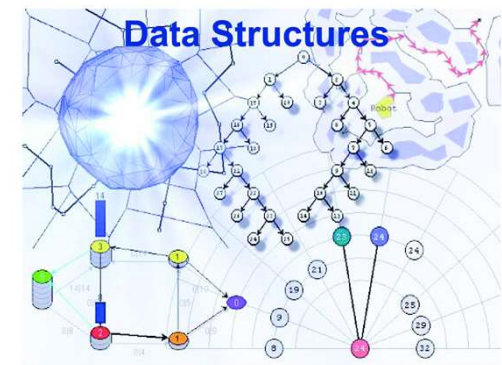
BBM 201

DATA STRUCTURES

Lecture 7: Multiple Stacks and Queues



2015-2016 Fall

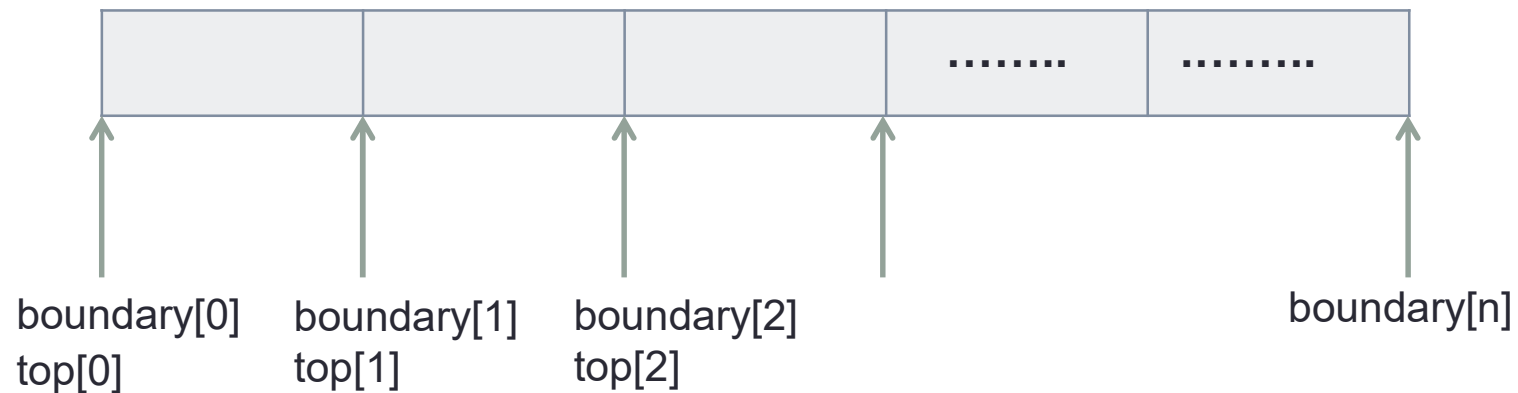


Multiple Stacks and Queues



Multiple Stacks and Queues

- A one dimensional array can be used for building **n stacks**.



Multiple Stacks and Queues

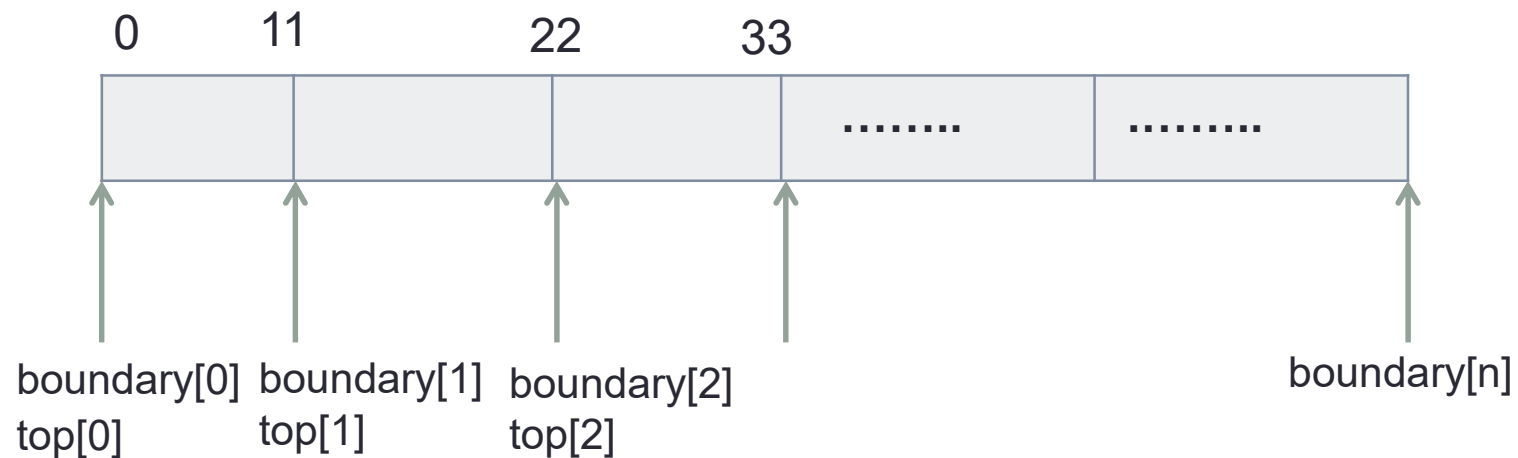
```
#define STACK_SIZE 100
#define MAX_STACK 10 //stack number+1

element stack[STACK_SIZE];
int top[MAX_STACK];
int boundary[MAX_STACK];
int n; //n<MAX_STACK (number of stacks)
```

Multiple Stacks and Queues

```
top[0]=boundary[0]=-1;
for(i=1; i<n; i++)
    top[i]=boundary[i]=(STACK_SIZE/n)*i;
boundary[n]=STACK_SIZE-1;
```

Multiple Stacks and Queues



| | | | | | |
|-----|----|----|----|----|----|
| top | -1 | 11 | 22 | 33 | 44 |
|-----|----|----|----|----|----|

| | | | | | |
|----------|----|----|----|----|----|
| boundary | -1 | 11 | 22 | 33 | 44 |
|----------|----|----|----|----|----|

*if $top[i] == boundary[i+1]$, then the **stack i** is completely full.*

*if $top[i] == boundary[i]$, then the **stack i** is empty.*

PUSH

```
void push(int i, element item)
{
    if(top[i]==boundary[i+1]) //is there any space in the ith stack?
        stack_full();
    stack[++top[i]]=item;
}
```

POP

```
element pop(int i)
{
    if(top[i]==boundary[i] //is the stack empty?
        return stack_empty();
    return stack[top[i]--];
}
```


Is the stack completely full?

--Recovery

In order to create some space for the a new stack:

1. $\text{stack_no} < j < n$, such that there is free space between stacks j and $j+1$

move stacks $\text{stack_no}+1, \text{stack_no}+2, \dots j$ one position right.
this creates a space between stack_no and $\text{stack_no}+1$.

2. $0 \leq j < \text{stack_no}$, such that there is free space between stacks j and $j+1$

move stacks $j+1, j+2, \dots \text{stack_no}$ one position left.
this also creates a space between stack_no and $\text{stack_no}+1$.

3. No j satisfying either condition 1 or condition 2, then there is no free space.

References

- Data Structures Notes, Mustafa Ege.
- Fundamentals of Data Structures in C. Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed, 1993.