

# DATA STRUCTURES AND ALGORITHMS

Stack Data Structure

By  
Zainab Malik

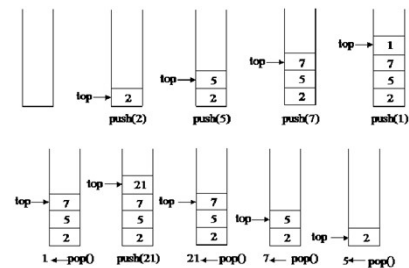
## Content

- Introduction to Stack Data Structures
  - Properties of Stack
  - Operations of Stack
  - Applications of Stack
    - String reversal

## Stack

- Stack is a linear data structure in which elements are added or removed from a single end that is known as the **top** of the stack.
- This single end entry ensures the first-in-last-out (FILO) or last-in-first-out (LIFO) order of insertion and deletion.
- By convention insertion and deletion in stack are termed as Push and Pop, respectively.

## Stack



## Operations of Stack

- The common operations of stack are as follow:
  - Push()
  - Pop()
  - isEmpty()
  - isFull()
  - topValue()

## Operations of Stack-Push(item)

Push(item)

1. If Stack is already full:
  - Display an error of "overflow"
3. Otherwise:
4. Increment top
5. Insert value at top index

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### Operations of Stack-Push(item)

top = -1  
size = 5  
name = stack1

push(5)  
top = 0  
size = 5  
name = stack1

push(11)  
top = 1  
size = 5  
name = stack1

push(13)  
top = 2  
size = 5  
name = stack1

push(1)  
top = 3  
size = 5  
name = stack1

push(12)  
top = 4  
size = 5  
name = stack1

push(9)  
top = 5  
size = 5  
name = stack1

top == size-1  
stack overflow

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### Operations of Stack-Pop()

Pop(stack):

1. If Stack is already empty:
2. Display an error of "underflow"
3. Otherwise:
4. Remove value from top index
5. Decrement top

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### Operations of Stack-Pop()

top = 4  
size = 5  
name = stack1

pop()  
top = 3  
size = 5  
name = stack1

pop()  
top = 2  
size = 5  
name = stack1

pop()  
top = 1  
size = 5  
name = stack1

pop()  
top = 0  
size = 5  
name = stack1

pop()  
top = -1  
size = 5  
name = stack1

top == -1  
stack underflow

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### Operations of Stack-isFull()

isFull():

1. If top is at size-1:
2. Return true
3. Otherwise:
4. Return false

top = 4  
size = 5  
name = stack1

isFull()  
top = 4  
size = 5  
name = stack1

True

top = 3  
size = 5  
name = stack1

isFull()  
top = 3  
size = 5  
name = stack1

False

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### Operations of Stack-isEmpty()

isEmpty():

1. If top is at -1:
2. Return true
3. Otherwise:
4. Return false

top = -1  
size = 5  
name = stack1

isEmpty()  
top = -1  
size = 5  
name = stack1

True

top = 0  
size = 5  
name = stack1

isEmpty()  
top = 0  
size = 5  
name = stack1

False

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### Operations of Stack-topValue()

topValue():

1. If top is at -1:
2. Display error "underflow"
3. Otherwise:
4. Return value at top index

top = -1  
size = 5  
name = stack1

topValue()  
top = -1  
size = 5  
name = stack1

Underflow

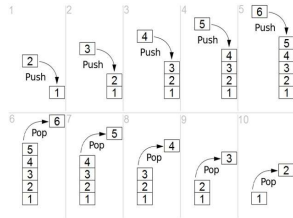
top = 2  
size = 5  
name = stack1

topValue()  
top = 2  
size = 5  
name = stack1

Return 13

## Applications-String Reversal

1. Take input from user e.g. as text
2. Read input character by character till end
3. Push character on to the stack
4. Pop elements from stack till stack becomes empty



Thank You