



# Stack

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# ***Stacks***

- Stack
- Representation of Stack
- Stack Operations
- ADT



# Stack

- A stack is a list of elements in which an element may be inserted or deleted only at one end, called top of the stack (TOS).

This means that, elements are removed from a stack in the reverse order of that in which they are inserted into the a stack.

Two basic operations are used

1. empty
2. full
3. Push
4. Pop

These terms are used only with stack, not with other data structure.

**Example:**

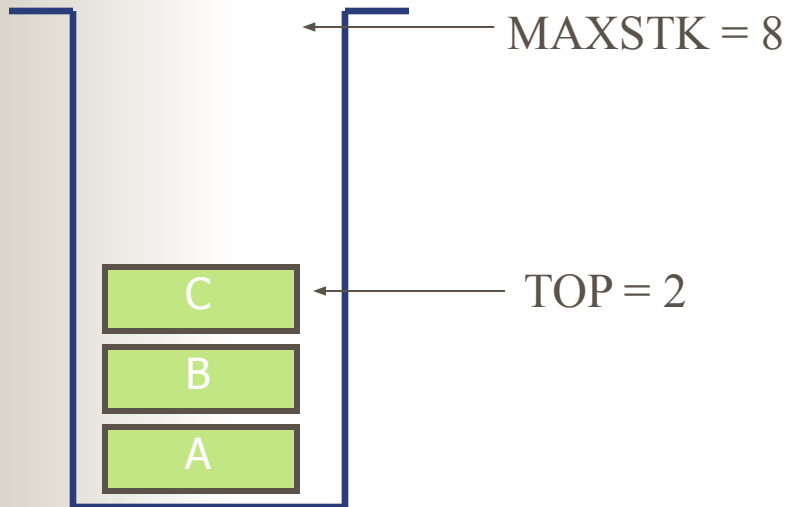
1. Suppose the following six elements are pushed onto an empty stack.  
A, B, C, D, E, F



# Representation of Stack

- Stack may be represented in the computer in various ways, usually by means of a one way list or a linear array.
- Each of our stack will be maintained by a linear array STACK;
  - a pointer variable TOP, which contain the location of the top element of the stack and a variable MAXSTK which gives the maximum number of elements that can be held by the stack.
  - the condition  $TOP = -1$  will indicate that the stack is empty.

## Consider the following example



- In executing the procedure PUSH, One must first test whether there is Room in stack for new item; If not, then put condition “**Overflow**”
- In executing POP, one must first Test whether there is an element in the stack to be deleted; If not, put the condition “**Underflow**”



## PUSH ( STACK, TOP, MAXSYK, ITEM)

1. [ Stack already filled ]  
if ( TOP = MAXSTK , then  
    print “ Overflow “ and return
2. Set TOP = TOP + 1   [ increase TOP by 1 ]
3. Set STACK [TOP] = ITEM  
    [ Insert ITEM in new TOP Position ]
4. Return

## POP ( STACK, TOP, ITEM)

1. [ Stack has an item to be removed ]  
if ( TOP = 0 , then  
    print “ Underflow “ and return
2. Set ITEM = STACK [TOP]  
    [ Assign top element to item ]
3. Set TOP = TOP - 1  
    [ DECREASE TOP by 1]
4. Return

Frequently TOP and MAXSTK are global variables, hence the procedure may be called using only

PUSH ( STACK, ITEM )

POP (STACK, ITEM )



ADT stack is

**Object** : a finite ordered list with zero or more elements.

**Functions** :

for all,  $s \in \text{stack}$ ,  $\text{item} \in \text{element}$ ,  $\text{maxstk} \in \text{positive integers}$

**Stack create (maxstk)** : create an empty stack whose maximum size is maxstk

**Boolean empty (s)** : A Boolean function which returns a value “ 1 “ if stack ‘s’ is empty.

**Stack push ( s, item)** : a function which place an item on the stack. This function before placing an item on to stack, must ensure that there is a place for item in the stack (i.e. stack is not full )

**Boolean full ( s, maxstk )** : A Boolean function which return a value true “1” if ‘s’ is full.

**Element pop (s)** : A function which takes out an item from the top of stack and again before we call this function we must ensure that stack ‘s’ is not empty.