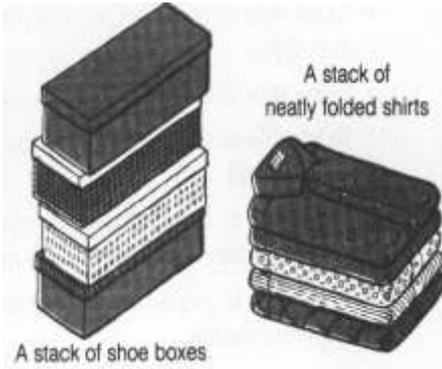


Stacks ADT (LIFO = last-in-first-out)

features of a stack



- Access is allowed at one end (the top of the stack) only. Data are added and removed at this end.
- Action of adding a data element to a stack is called pushing.
- Action of removing a data element from a stack is called popping.
- Stacks handle data in a last-in-first-out fashion: the last item pushed onto the stack is always the First item popped off the stack.

STACK ADT : A stack S stores items of some type in Last-In, First-Out (LIFO) order.

Operations:

stackElementType $S.pop()$

Precondition: $!S.isEmpty()$

Postcondition: $S = S$ with top removed

Returns: item x such that $S.push(x)$ is the most recent invocation of push.

void $S.push(stackElementType)$

Precondition: None

Postcondition: item x is added to stack, such that next $S.pop()$ returns x .

stackElementType $S.top()$

Precondition: $! S.isEmpty()$

Postcondition: None

Returns: item x such that $S.push(x)$ is the most recent invocation of push.

bool $S.isEmpty()$

Precondition: None

Postcondition: None

Returns: true if and only if S is empty, I.e., contains no data items.

Algorithms for PUSH and POP

PUSH

1. If stack is not full then :
2. Add 1 to the stack pointer,
3. Store item at stack pointer location

POP

1. If stack is not empty then :
2. read item at stack pointer location,
3. subtract 1 from the stack pointer

???? Example: Push 5, push 10, push 15, push 20, push 25, pop, pop, pop, pop

stack size =5 ,
top =-1
initially

[0]
[1]
[2]
[3]
[4]

stack size =5 ,
top =0
Push 5

5

[0]
[1]
[2]
[3]
[4]

stack size =5 ,	5	[0]
top = 1	10	[1]
		[2]
Push 10		[3]
		[4]

stack size =5 ,	5	[0]
top = 4	10	[1]
	15	[2]
after all Push	20	[3]
	25	[4]

stack size =5 ,	5	[0]
top = 3	10	[1]
	15	[2]
pop	20	[3]
		[4]

- [1] What is the difference between static and dynamic stacks.
- [2] What is the main features of a stack
- [3] How to implement a stack.
- [4] What is the advantage of linked-list over array-based stack.
- [5] Identify true or False and rewrite the correct version of False one.
 - A- A stacks like lists and arrays are last-in-first-out (LIFO) Structures. (**false → unlike**)
 - B- Elements of Stacks ADT are added and removed from only one end.(**true**)
 - C- A dynamic stack is built on the linked list instead of an array.(**true**)
 - D- Computer systems use stacks while executing programs(**true**).
 - E- The size of a dynamic stack must be known in advance.(**false → need not**)

[6] Write the algorithms for pushing and popping data in stack ADT.

[7] Trace the constructor of static InStack class to build the stack and identify the value of stackArray, top and stackSize with the following operation:-
 stack.push(5). stack.push(10). stack.push(15). stack.push(20). stack.push(25). stack.pop(catch Var) five times.

[8] Explain the main stack operations for static and dynamic stack.

[9] Given an initially empty stack which accepts single characters, the following operations are performed: Push T,
 Push E,
 Push X,
 Pop,
 Push R
 Push V,
 Pop,

Push Y,

Pop,

Pop

- (a) Write out the composition of the stack after these operations.
- (b) What sequence of letters was popped off the stack?

Q. Given an initially empty stack, the following operations are performed:

Push T, Push E, Push X, Pop, Push R, Push V, Pop, Push Y, Pop, Pop

(a) Write out the composition of the stack after these operations.

(b) What sequence of letters was popped off the stack? → XVYR

Q- Fill in the blank

- 1- the _____ element saved onto a stack is the first one retrieved
- 2- two primary stack operations are _____ and _____

Q- True or False

1. a static stack is built around an array
2. the size of a dynamic stack must be known in advance
3. the push operation inserts an element at the end of a stack
4. the pop operation retrieves an element from the top of a stack

Q: with a stack of size 4 try each of the following:

1. push 0, push 9, push 12, push 1
2. push 8, push 7, pop, push 19, push 21, pop
3. push T, push E, push X, pop, push R, push V, pop, push Y, pop, pop