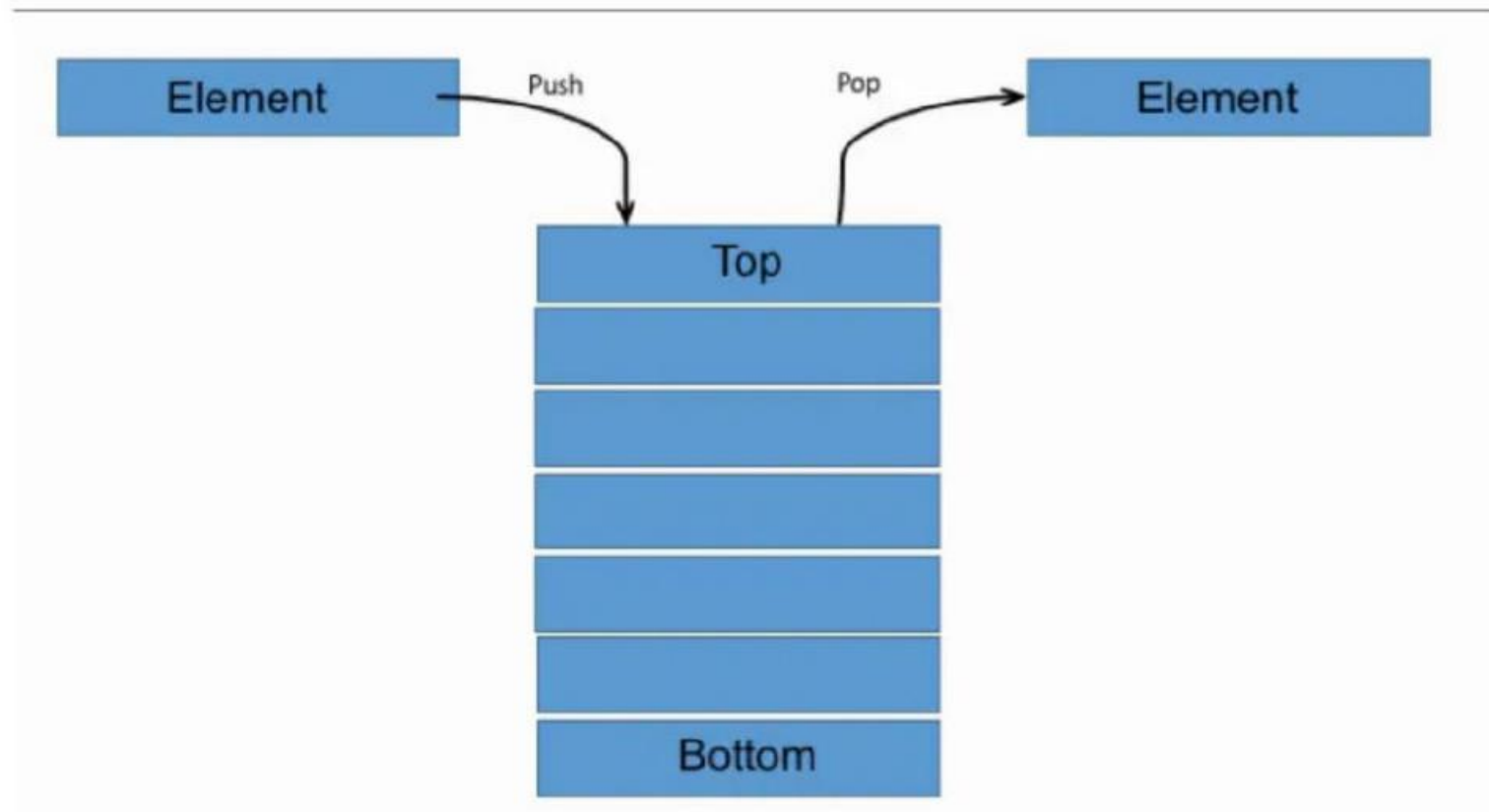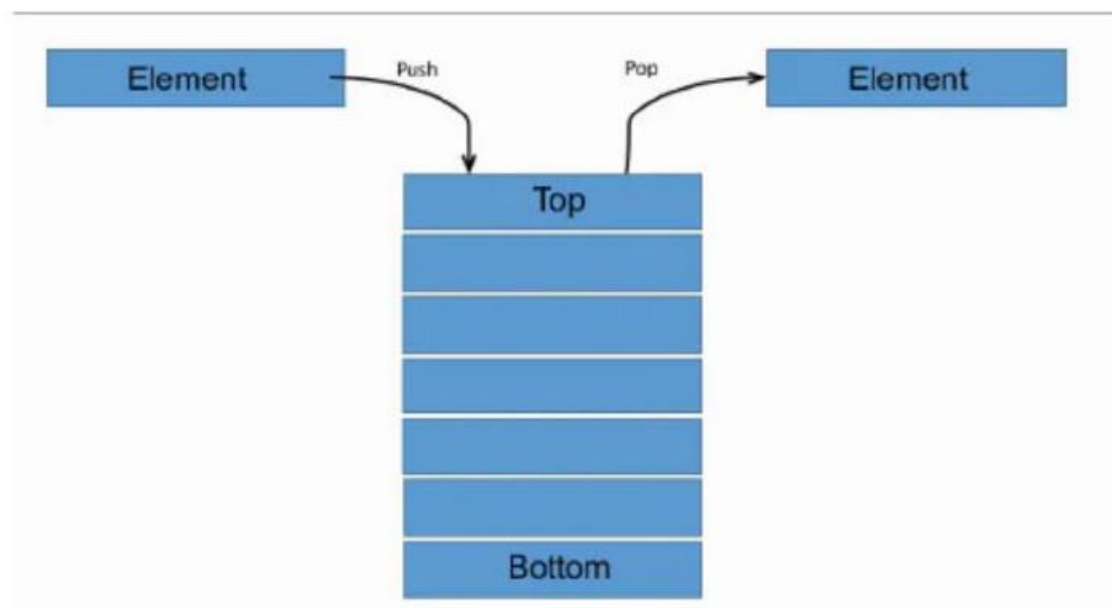# STACK

- A stack is a non-primitive linear data structure. it is an ordered list in which addition of a new data item and deletion of already existing data item is done from only one end known as top of stack (TOS).

- The element which is added in last will be first to be removed and the element which is inserted first will be removed in last.

- That is why it is called last in first out (LIFO) or first in last out (FILO) type of list.

- Most frequently accessible element in the stack is the top most element, whereas the least accessible element is the bottom of the stack.
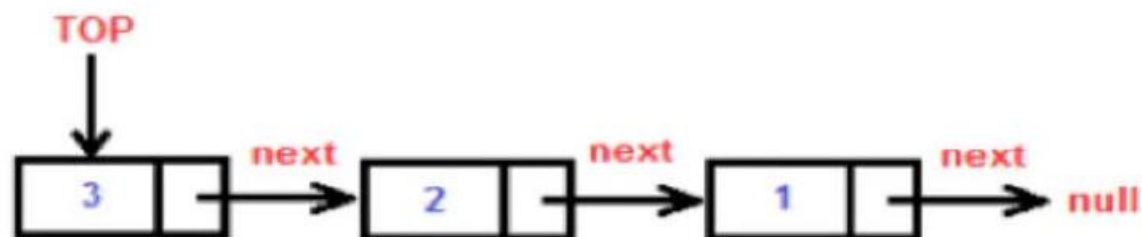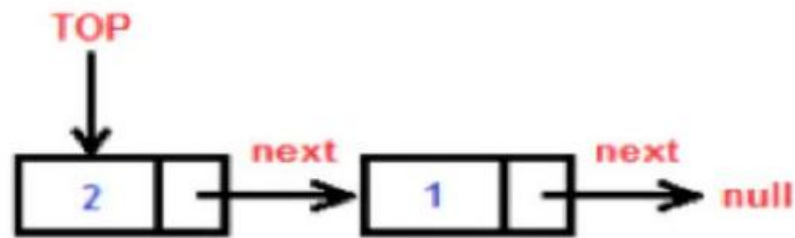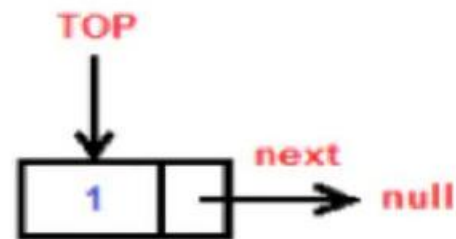
Stack Implementation

Stack is generally implemented in two ways.

- **Static Implementation**: - Here array is used to create stack. it is a simple technique but is not a flexible way of creation, as the size of stack has to be declared during program design, after that size implementation is not efficient with respect to memory utilization.
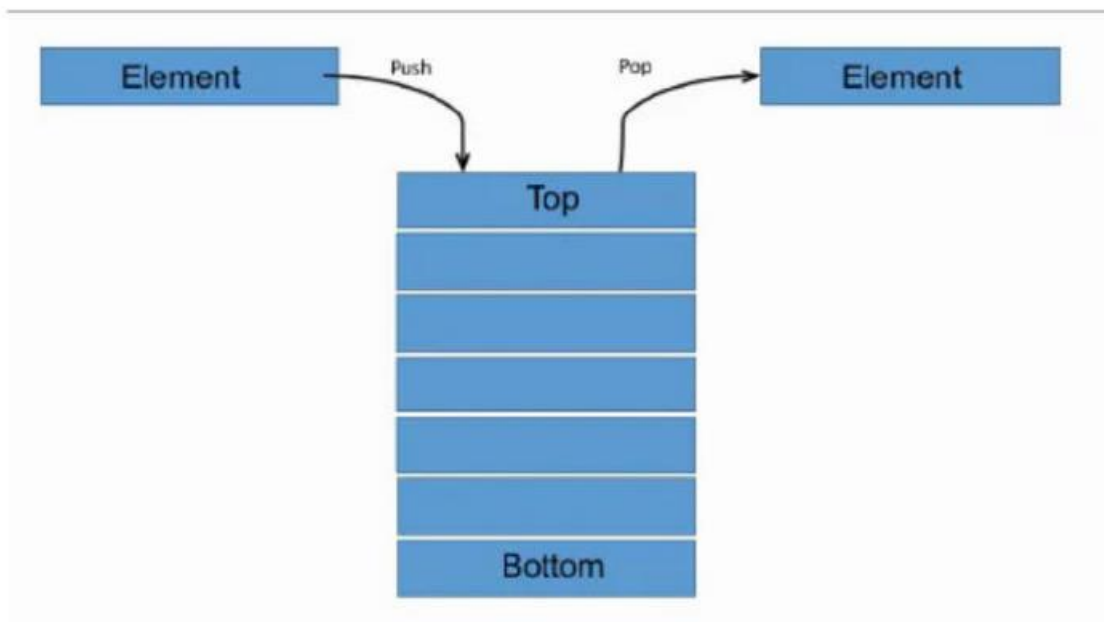
- **Dynamic implementation**: - It is also called linked list representation and uses pointer to implement the stack type of data structure.

TOP

next

| 1 | | → null

TOP

next   next

| 2 | | → | 1 | | → null

TOP

next   next   next

| 3 | | → | 2 | | → | 1 | | → null

Q Which of the following is true about linked list implementation of stack?

(A) In push operation, if new nodes are inserted at the beginning of linked list, then in pop operation, nodes must be removed from end.

(B) In push operation, if new nodes are inserted at the end, then in pop operation, nodes must be removed from the beginning.

(C) Both of the above

(D) None of the above

Q Which data structure is used for balancing of symbols?
(A) Stack   **(B)** Queue   **(C)** Tree   **(D)** Graph

Basics operations on stack

- Push

- Pop

Push operation: - The process of adding new element to the top of stack is called push operation. the new element will be inserted at the top after every push operation the top is incremented by one. in the case the array is full and no new element can be accommodated it is called over-flow condition.
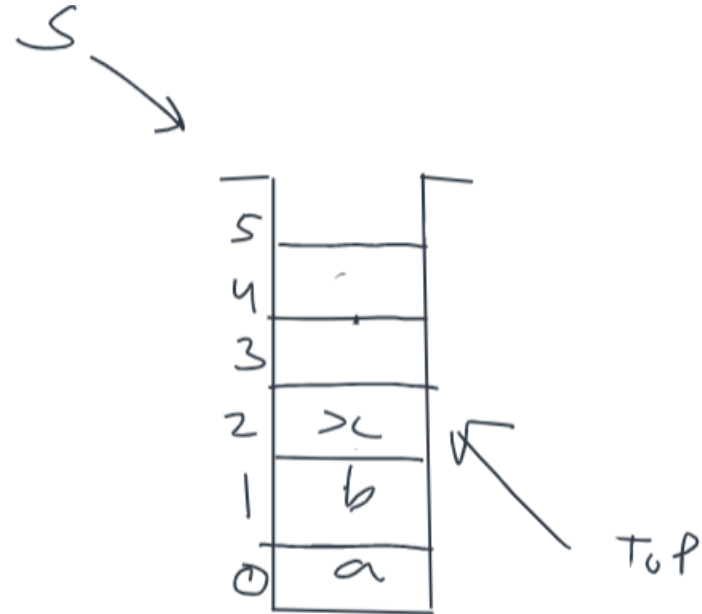
$$PUSH(S, N, TOP, X)$$
{

  if (TOP == N-1)

    Print stack overflow and exit

  TOP = TOP + 1

  S[TOP] = X

}

$$N = 6$$

S

5	
4	
3	
2	x
1	b
0	a

Top

Pop: - The process of deleting an element. from the top of stack is called POP operation, after every POP operation the stack is decremented by one if there is no element in the stack and the POP operation is requested then this will result into a stack underflow condition.

POP (S, N, TOP)
{
      if (TOP==-1)
          print underflow and exit
      y = S[TOP]
      TOP=TOP-1
      return(y) and exit
}

Application of Stack

Q Which one of the following is an application of Stack Data Structure?

(A) Managing function call

(B) recursion

(C) Arithmetic expression evaluation

(D) All of the above

Stack Permutation

The following sequence of operations is performed on a stack:

PUSH (10), PUSH (20), POP, PUSH (10), PUSH (20), POP, POP, POP, PUSH (20), POP

The sequence of values popped out is:

(a) 20, 10, 20, 10, 20 (b) 20, 20, 10, 10, 20
(c) 10, 20, 20, 10, 20 (d) 20, 20, 10, 20, 10