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Q.1] What is meant by Stack ? Write down the Steps for PUSH() and POP() operation.

= ] A Stack is a linear data structure that follows the LIFO (Last-In-First-Out) principle. Stack has one end and an element is added in the stack, it is added on the top of the stack, and element can be deleted only from the stack. ] a stack can be defined as a container in which insertion and deletion can be done from the one end known as the top of the stack.

Steps involved in the PUSH operation is given below,

- Before inserting an element in a stack, we check whether the stack is full.
- If we try to insert the element in a stack, and the stack is full, then the overflow condition occurs.
- when we initialize a stack, we get / set the value of top as -1 to check that the stack is empty.
- when the new element is pushed in a stack first, the value of top as -1 to check that the stack is empty.

- When the new element is pushed in a stack, first, the value of the top gets incremented, i.e.  $\text{top} = \text{top} + 1$ , and the element will be placed at the new position of the top.
- The elements will be inserted until we reach the max size of the stack.

The steps involved in the pop operation is given below:

- Before deleting the element from the stack, we check whether the stack is empty.
- If we try to delete the element which is from the stack, then the underflow condition occurs.
- If the stack is not empty, we first access the element which is pointed by the top.
- Once the top operation is performed, the top is decremented by 1, i.e.  $\text{top} = \text{top} - 1$ .

Q.2] Write down the application of stack?

with Example.

- Applications of Stack Data Structure,
- To reverse a word — put all the letters in a stack and pop them out. Because of the LIFO order of stack, you will get the letters in reverse order.

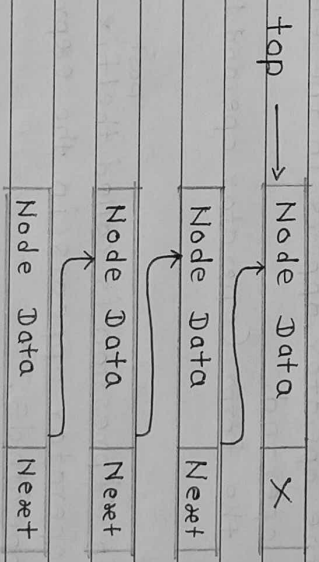
- In compilers — Compilers use the stack to calculate the value of expressions like  $2 + 4 / 5 * (7 - 9)$  by converting the expression to prefix or postfix form.

- In browsers — The back button in a browser saves all the URLs you have visited previously in a stack. Each time you visit a new page, it is added on top of the stack. When you press the back button, the current URL is removed from the stack, and the previous URL is accessed.

Q.3] Explain the Representation of stack using Linked-list.

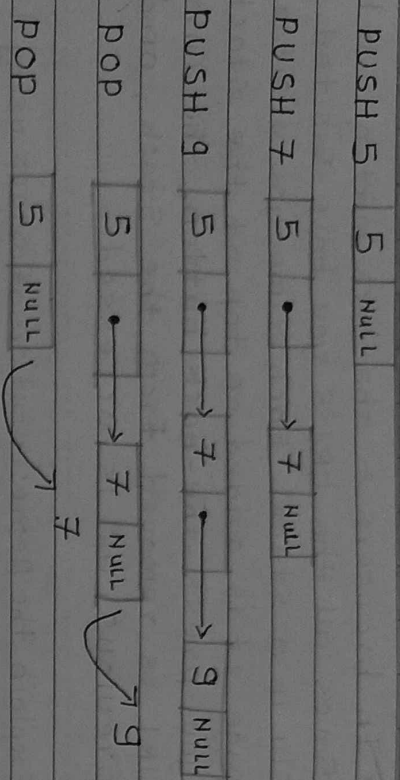
Array and linked representation of stack:

In linked list implementation of stack, the nodes are maintained non-contiguously in the memory. Each node contains a pointer to its immediate successor node in the stack.



Stack

They have dynamic length, it means there is no limit on the number of elements we can add. It is convenient to use a linked list in place of an array when the number of elements is unknown.



Q.4] Explain the Conversion of Infix expression to postfix expression with the example.

i] Prefix - an expression is called the prefix expression if the operator appears in the expressions before the operand.

Simply of the form (operator operand 1 operand 2)

e.g.  $+AB$

ii] ~~Prefix~~ Postfix - An expression is called the postfix expression if the operator appears in the expressions after the operands.

Simply of the form (operand 1 operand 2 operator),

e.g.  $AB+$

Example of Infix to Postfix Conversion  
Infix Expression:  $A + (B * C + D) / E$

Input Token      Stack      Post Expression      Action

A		A	add A into expression string
+	+	A	push '+' into stack
C	+C	A	PUSH C into stack
B	+C	AB	Add B into expression string
*	+C*	AB	Push '*' into stack
C	+C*	HBC	add C into expression string
+	+C+	HBC*	'+' operator has less precedence than '*', so pop* and add to expression string
D	+C+	ABC*D	Add D into expression string
)	+	HBC*D+	) has higher precedence than + so push/into stack
E	+ /	HBC*D+E /	Add E into expression string and pop all operators one by one from stack and add it to expression string

Q.5] Explain the Conversion of Evaluation of postfix Expression with the example?

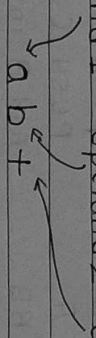
A postfix expression is a collection of operators and operands in which the operator is placed after the operands. that means, in a postfix expression the operator follows the operands.



postfix Expression has following general Structure.....

e.g

operand1 operand2 operator



• example,

Infix Expression  $(5+3) * (8-2)$

postfix Expression  $53 + 82 - *$

Reading Symbol	Stack operations	Evaluated part of Expression
Initially	Stack is empty	Nothing
5	push (5)	Nothing
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">5</div>	
3	push (3)	Nothing
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">3 5</div>	
+	value 1 = pop () value 2 = pop () result = value 1 + value 2 push (result)	value 1 = pop (); // 3 value 2 = pop (); // 5 result = 5 + 3; // 8 push (8)
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">8</div>	$(5 + 3)$

8 Push (8)

8

$(5 + 3)$

2 push (2)

2  
8

- value 1 = pop (); // 2

value 2 = pop (); // 8

result = value 2 - value 1

push (result)

push (6)

$(5 + 3), (8 - 2)$

6  
8

\* value 1 = pop ();

value 2 = pop ();

result = value 1 \* value 2

push (result)

48

$(5 + 3) * (8 - 2)$

End of Expression

result = pop ();

48

As final result