Experiment No.1
Implement Stack ADT using array.
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Experiment No. 1: To implement stack ADT using arrays

Aim: To implement stack ADT using arrays.

Objective:

1) Understand the Stack Data Structure and its basic operators.

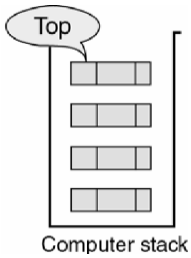
2) Understand the method of defining stack ADT and implement the basic operators.

3) Learn how to create objects from an ADT and invoke member functions.

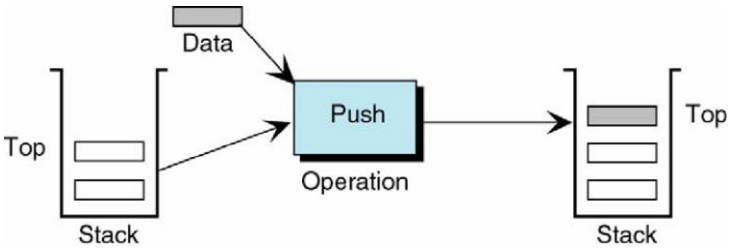
Theory:

A stack is a data structure where all insertions and deletions occur at one end, known as the top. It follows the Last In First Out (LIFO) principle, meaning the last element added to the stack will be the first to be removed. Key operations for a stack are "push" to add an element to the top, and "pop" to remove the top element. Auxiliary operations include "peek" to view the top element without removing it, "isEmpty" to check if the

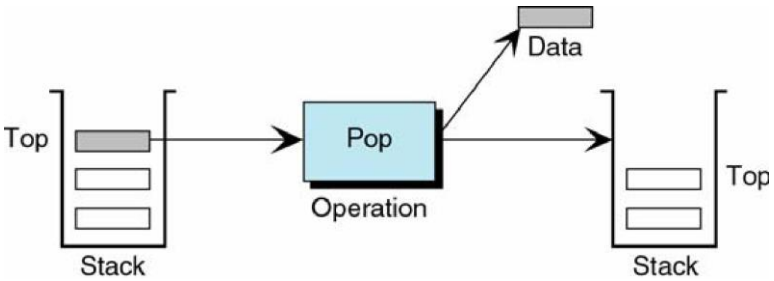
stack is empty, and "isFull" to determine if the stack is at its maximum capacity. Errors can occur when pushing to a full stack or popping from an empty stack, so "isEmpty" and "isFull" functions are used to check these conditions. The "top" variable is typically initialized to -1 before any insertions into the stack.



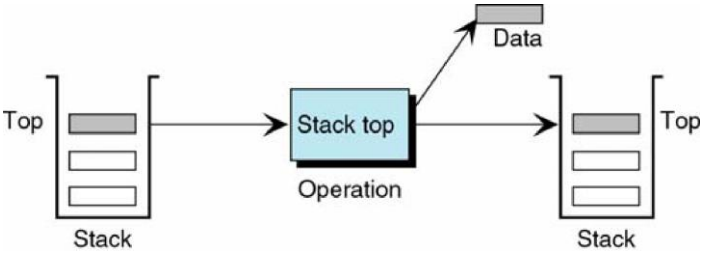
Push Operation



Pop Operation



Peek Operation



Algorithm:

PUSH(item)

1. If (stack is full)

   Print "overflow"

2. top = top + 1
3. stack[top] = item

   Return

POP()

1. If (stack is empty)

   Print "underflow"

2. Item = stack[top]
3. top = top – 1
4. Return item

PEEK()

1. If (stack is empty)

   Print "underflow"

2. Item = stack[top]
3. Return item

ISEMPTY()

1. If(top = -1)then

return 1

2. return 0

ISFULL()

1. If(top = max)then

return 1

2. return 0

Code:

```
#include<stdio.h>
#include<stdlib.h>

int stack[100],choice,n,top,x,i;
void push(void);
void pop(void);
void display(void);
void peek();

int main()
{
top=-1;
clrscr();
printf("Enter the size of stack[max=100]:");
scanf("%d",&n);
printf("Stack operation using array\n");
printf("\n\t 1.PUSH \n\t 2.POP \n\t 3.PEEK \n\t 4.DISPLAY \n\t 5.EXIT");
```

```
do
{
        printf("\nEnter your choice:");
        scanf("%d",&choice);

        switch(choice)
        {
                case 1:
                {
                        push();
                        break;
                }
                case 2:
                {
                        pop();
                        break;
                }
                case 3:
                {
                        peek();
                        break;
                }
                case 4:
                {
                        display();
```

```
                        break;
                }
                case 5:
                {
                        printf("\n\tEXIT POINT");
                        break;
                }
                default:
                {
                        printf("\n\t Please enter a valid choice(1/2/3/4)");
                }
            }
        }
        while(choice!=5);
return 0;
}

void push()
{
        if(top>=n-1)
        {
            printf("\n\t Stack is 'OVERFLOW' ");
        }
        else
        {
```

```
                printf("\n Enter a value to be pushed:");
                scanf("%d",&x);
                top++;
                stack[top]=x;
        }
}
void pop()
{
        if(top<=-1)
        {
                printf("\nStack is 'UNDERFLOW' ");
        }
        else
        {
                printf("\n\t The poped elements is %d:",stack[top]);
                top--;
        }
}
void display()
{
        if(top>=0)
        {
                printf("\n The element in stack:");
                for(i=top;i>=0;i--)
                {
```

```
                printf("\n%d",stack[i]);
                printf("\nPress next choice");
            }
        }
        else
        {
            printf("\nThe stack is empty");
        }

}
void peek()
{
        if(top<=-1)
        {
            printf("\n stack is Underflow");
        }
        else
        {
            printf("\n The peek element is %d:",stack[top]);
        }

}
```

Output:

```
Enter the size of stack[max=100]:4
Stack operation using array

        1.PUSH
        2.POP
        3.PEEK
        4.DISPLAY
        5.EXIT
Enter your choice:1

 Enter a value to be pushed:23

Enter your choice:2

        The poped elements is 23:
Enter your choice:5_
```

Conclusion:

1) What is the structure of Stack ADT?

   The Stack Abstract Data Type (ADT) can be described as a straightforward data structure that follows the Last-In-First-Out (LIFO) principle. It comprises a data container, a reference to the top element, and a size indicator. A Stack ADT primarily supports five main operations: push (to add an element), pop (to remove the top element), peek (to view the top element without removing it), isEmpty (to check if the stack is empty), and size (to determine the number of elements in the stack). The key characteristic of a stack is that the most recently added element is the first one to be removed.

2) List various applications of stack?

1. Expression evaluation

2. Function call management

3. Backtracking algorithms

4. Undo functionality

5. Memory management

6. Syntax parsing

7. Browser history

8. Task management

9. Expression matching

10. Postfix calculations

11. Undo/redo in text editors

12. Playlists

13. Call history

14. Task scheduling

15. Routing algorithms

16. Symbol balancing

17. Navigation systems

3)Which stack operation will be used when the recursive function call is returning to the calling function?

In the context of recursive function calls, the stack operation involved when a function returns to the caller is known as "pop." The "pop" operation is responsible for eliminating the top element from the stack. In the realm of function calls, the stack serves as a vital tool for tracking the sequence of function calls and their associated local variables. After a function has completed its execution and is prepared to return, it is "popped" from the stack. This action allows the program to seamlessly resume execution within the calling function, preserving the critical Last-In-First-Out (LIFO) order of function calls..