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:

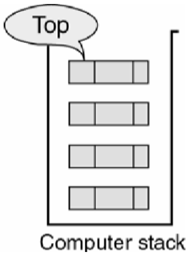
1) Understand the Stack Data Structure and its basic operators.

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

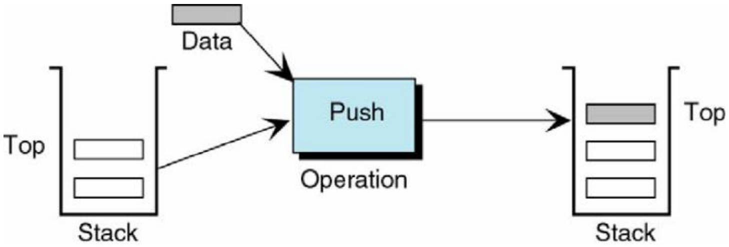
3) Learn how to create objects from an ADT and invoke member functions.

Theory:

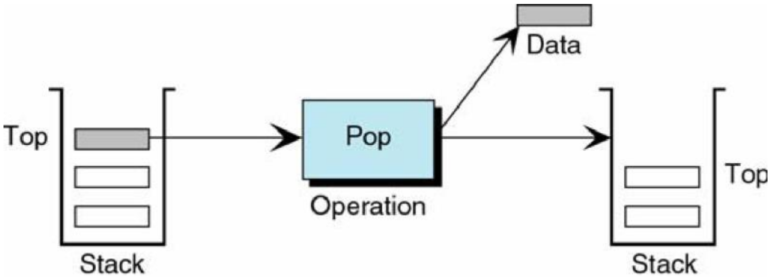
A stack is a data structure where all insertions and deletions occur at one end, known as the top. It follows the Last In First Out (LIFO) principle, meaning the last element added to the stack will be the first to be removed. Key operations for a stack are "push" to add an element to the top, and "pop" 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.



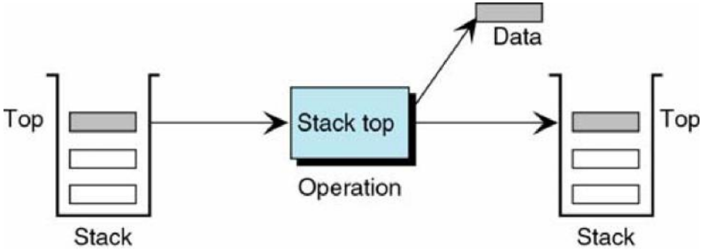
Push Operation



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:
```

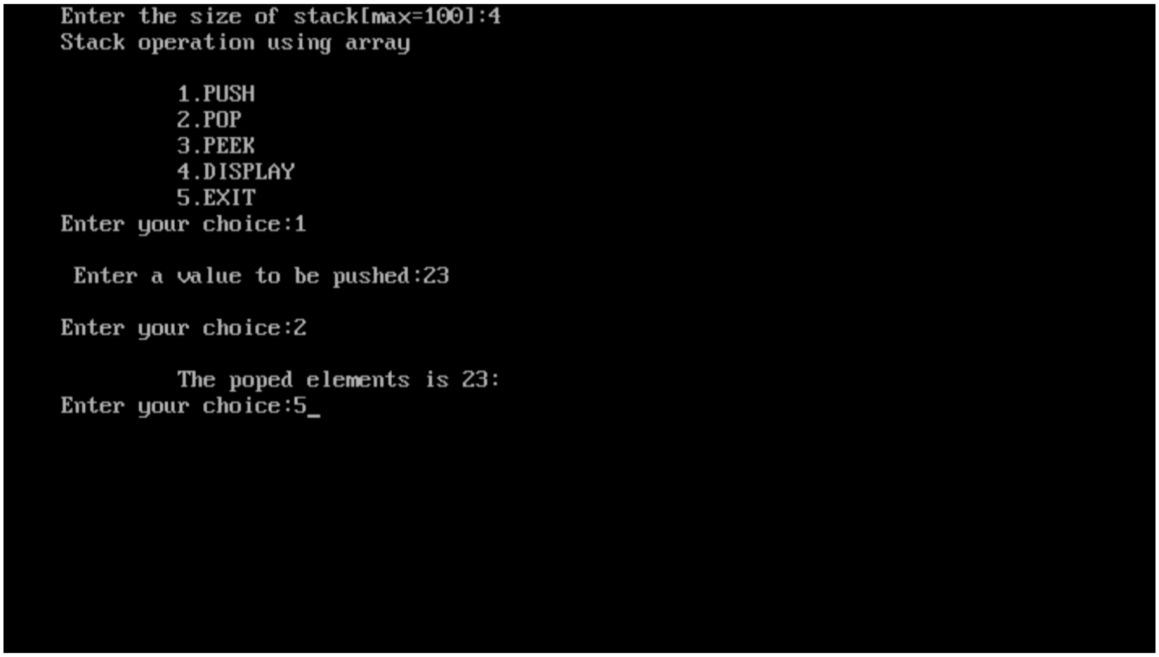
```
            {
                display();
                break;
            }
            case 5:
            {
                printf("\n\tEXIT POINT");
                break;
            }
            default:
            {
                printf("\n\t Please enter a valid choice(1/2/3/4)");
 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

Stack Abstract Data Type (ADT) is a data structure with the following characteristics:

- It follows the Last-In-First-Out (LIFO) principle.

- It supports the following operations:

  - Push: Add an element to the top of the stack.

  - Pop: Remove and return the element from the top of the stack.

  - Peek (or Top): View the element at the top without removing it.

  - isEmpty: Check if the stack is empty.

It can be implemented using an array, linked list, or other data structures, with the essential operations providing access to the top of the stack and maintaining the LIFO behavior.

2)List various applications of stack?

- Various applications of stacks include:

1. Expression Evaluation
2. Function Call Management
3. Backtracking
4. Browser History
5. Text Editors (Undo/Redo)
6. Parsing and Compiler Design
7. Symbol Matching (e.g., parentheses balancing)
8. History Management in Applications

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

When a recursive function call is returning to the calling function, the stack operation used is "Pop." This operation involves removing the context of the current function call from the call stack. Each recursive function call pushes its context onto the stack, and when the base case is reached or the recursion is complete, the function begins to return, popping each level's context off the stack. This process allows the program to resume execution at the point where the recursive call was made in the calling function.