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:

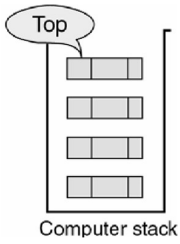
1) Understand the Stack Data Structure and its basic operators.

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

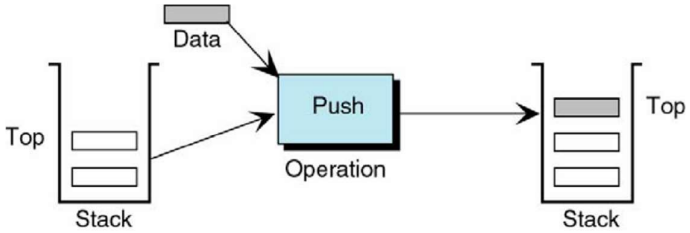
3) Learn how to create objects from an ADT and invoke member functions.

Theory:

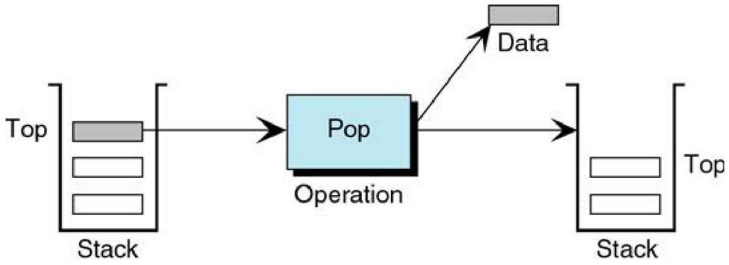
A stack is a data structure where all insertions and deletions occur at one end, known as the top. It follows the Last In First Out (LIFO) principle, meaning the last element added to the stack will be the first to be removed. Key operations for a stack are "push" to add an element to the top, and "pop"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



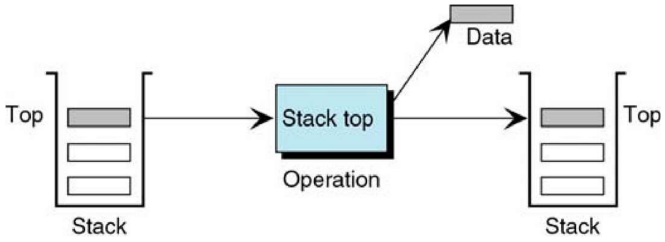
Push Operation



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()
{
```

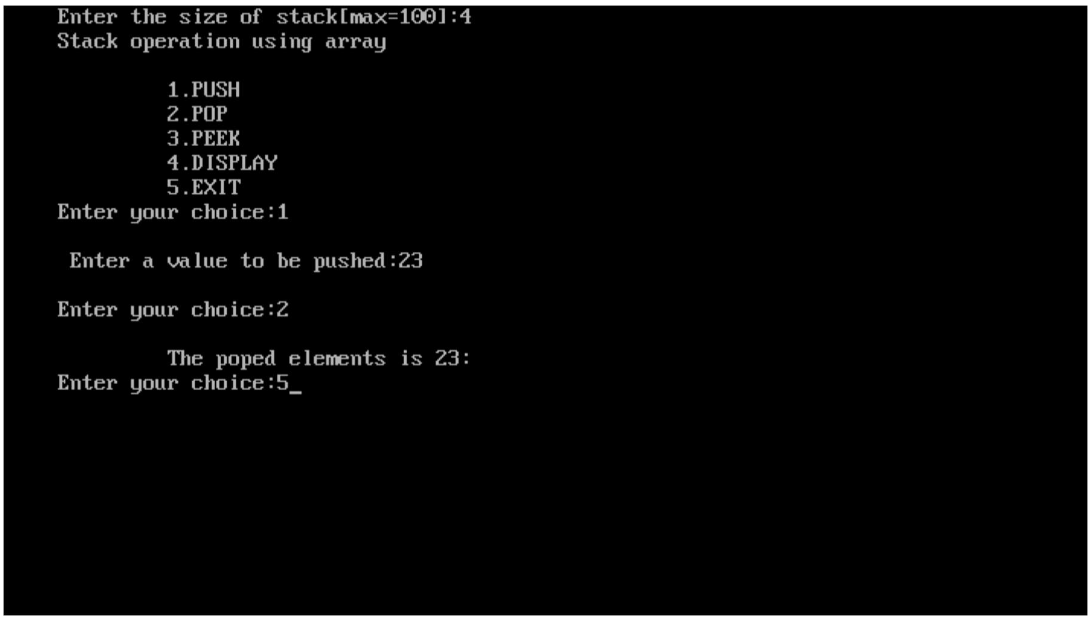
```
top=-1;
clrscr();
printf("Enter the size of stack[max=100]:");
scanf("%d",&n);

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:



Conclusion:

1) What is the structure of Stack ADT?

   The Stack Abstract Data Type (ADT) is characterized by a simple structure that adheres to the Last-In-First-Out (LIFO) principle. It typically includes a data container, a reference to the top element, and a size indicator. The primary operations associated with a Stack ADT are push , pop ,peek, isEmpty and size . The key property of a stack is that the most recently added element is the first to be removed.

2) List various applications of stack?
   - Function Call Management: Stacks are used to manage function calls in a program, enabling recursion and ensuring that the program returns to the correct point after a function call is complete.
   - Expression Evaluation: Stacks are utilized in evaluating and parsing arithmetic expressions, ensuring the correct order of operations is maintained.
   - Memory Management: Stacks are used in memory management to allocate and deallocate memory for local variables and function call data.
   - Postfix to Infix Conversion: Stacks are employed to convert postfix (reverse Polish notation) expressions to infix expressions for better human readability.

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

When a recursive function is returning to the calling function, the stack operation used is called "pop." The pop operation removes the top element from the stack. In the context of function calls, the stack is used to keep track of the order of function calls and their local variables. When a function completes its execution and is ready to return, it is "popped" from the stack, allowing the program to continue executing the calling function from where it left off. This is a crucial part of managing function call frames and maintaining the Last-In-First-Out (LIFO) order of function calls.