Experiment 15
Implementation Of Stack Using Linked List

Date: 10-11-2020

Aim: Implementation of Stack using Linked List

Data Structure Used: Stack

Operation Used: Comparisons

Algorithm:

Algorithm for Push

Input: The Stack (S) implemented using Linked List, the pointer to the element at the top (TOP), ITEM to be inserted

Output: The Stack (S) with ITEM inserted at the top.

Data Structure: Stack and linked list

Steps:

Step 1: Start
Step 2: new = GetNode(Node)
Step 3: if(new!=NULL) then
    Step 1: new→data = ITEM
    Step 2: new→link = NULL
    Step 3: if(Top!=NULL) then
        Step 1: new→link = Top→Link
    Step 4: endif
    Step 5: Top = new
Step 4: else
    Step 1: print("Insertion not possible")
    Step 2: exit(1)
Step 5: endif
Step 6: Stop

Description of the algorithm

This algorithm places a new Node 'new' with the value of ITEM and the link part pointing to the previous Top element in the Stack (S) making it the new Top element

Algorithm for Pop

Input: The Stack (S) implemented using Linked List, the pointer to the element at the top (TOP)

Output: The Stack (S) with , ITEM to be removed and the ITEM

Data Structure: Stack and Linked list

Steps:

Step 1:Start
Step 2: if(Top == NULL)
    Step 1: print("The Stack is empty")
    Step 2: exit
Step 3: else
    Step 1: ITEM = Top→data
    Step 2: remove = Top
    Step 3: Top= Top→link
    Step 4: RetrunNode(remove)
    Step 5: return ITEM

Step 4:endif
Step 5: Stop

Description of the algorithm:

This algorithm stores the value of the current Top item in a variable, and stores the value in a variable remove. Then it assigns Top to Top→Link and returns the remove variable to the memory.

Program Code:

```
/*****************************************
 * Stack Implementation using a Linked List
 * Done By: Rohit Karunakaran
 * ***************************************/

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

typedef struct Linked_List_Node
{
    struct Linked_List_Node *link;
    int data;
}Node;

typedef struct Linked_Stack
{
    Node *Top;
}Stack;

Stack* initStack()
{
    Stack *s = (Stack*) malloc (sizeof(Stack));
    s->Top = NULL;
    return s;
}


//Insertion Algorithms
void push(Stack *s,int val)
{
    Node *new_node = (Node*) malloc(sizeof(Node));

    if(new_node!=NULL)
    {
        new_node->data = val;
        new_node->link = s->Top;
        s->Top = new_node;
    }
    else
    {
        printf("Stack Is Full");
        exit(1);
    }
    return ;
}
```

```
//Deletion Algorithms
int pop(Stack *s)
{
    if(s->Top == NULL)
    {
        printf("Stack Is Empty");
        exit(0);
        return 0;
    }
    else
    {
        Node* ptr = s->Top;
        s->Top = s->Top->link;
        int elem = ptr->data;
        free(ptr);
        return elem;
    }
}

void displayStack(Stack *s)
{
    Node* ptr = s->Top;
    if(ptr!=NULL)
    {
        printf("The Stack is: Top -> ");
        while(ptr!=NULL)
        {
            if(ptr==s->Top){
                printf("%d\n",ptr->data);
            }
            else{
                printf("                    %d\n",ptr->data);
            }
            ptr=ptr->link;
        }
        printf("\n");
    }
    else
    {
        printf("The Stack is empty\n");
    }
}

int menu(Stack* s)
{
    int RUN = 1;
    while(RUN)
    {
        printf("\n");
        printf("============================\n");
        printf("            MENU            \n");
        printf("============================\n");
        printf("1.Push\n");
        printf("2.Pop\n");
        printf("3.Display the stack\n");
```

```
        printf("4.Exit\n");
        printf("Enter Choice: ");
        int choice;
        int elem;
        scanf("%d%*c",&choice);

        switch(choice)
        {
            case 1: printf("Enter the element to be inserted: ");
                    scanf("%d%*c",&elem);
                    push(s,elem);
                    printf("\n");
                    break;
            case 2: elem = pop(s);
                    printf("The Element removed is %d",elem);
                    printf("\n");
                    break;
            case 3: displayStack(s);
                    break;
            case 4: RUN=0;
                    break;
            default: printf("Enter a valid choice\n");
                     printf("\n");
                     break;

        }

    }
    printf("Exiting........");
    return RUN;
}


int main()
{
    Stack *s = initStack();
    return menu(s);
}
```

Result: The Program is successfully compiled and the desired result is obtained

Sample Input/Output