DSA Lab

Week 4 Assignment Submission

Write a C program to:

1) Evaluate a given prefix expression using stack.

CODE:

```
#include <stdlib.h>
#include <math.h>
#include <string.h>
#include <stdio.h>
#define MAX 80

struct stack
{
  int top;
  double items[MAX];
};

char rev[MAX];

char *
reverse (char *str)
{
  int len = strlen (str);
  for (int i = 0; i < len; i++)
    {
      rev[i] = str[len - i - 1];
    }
  return rev;
}
```

```
int
isDigit (char ch)
{
  int c = (int) (ch);
  c = c - 48;
// printf("%d", c);
  if (c >= 0 && c <= 9)
    return 1;
  else
    return 0;
}

int
isOperand (char ch)
{
  switch (ch)
    {
    case '+':
    case '-':
    case '*':
    case '/':
      return 1;
      break;
    default:
      return 0;
      break;
    }
}

void push (struct stack *, int);
int stackFull (struct stack *);
double pop (struct stack *);
```

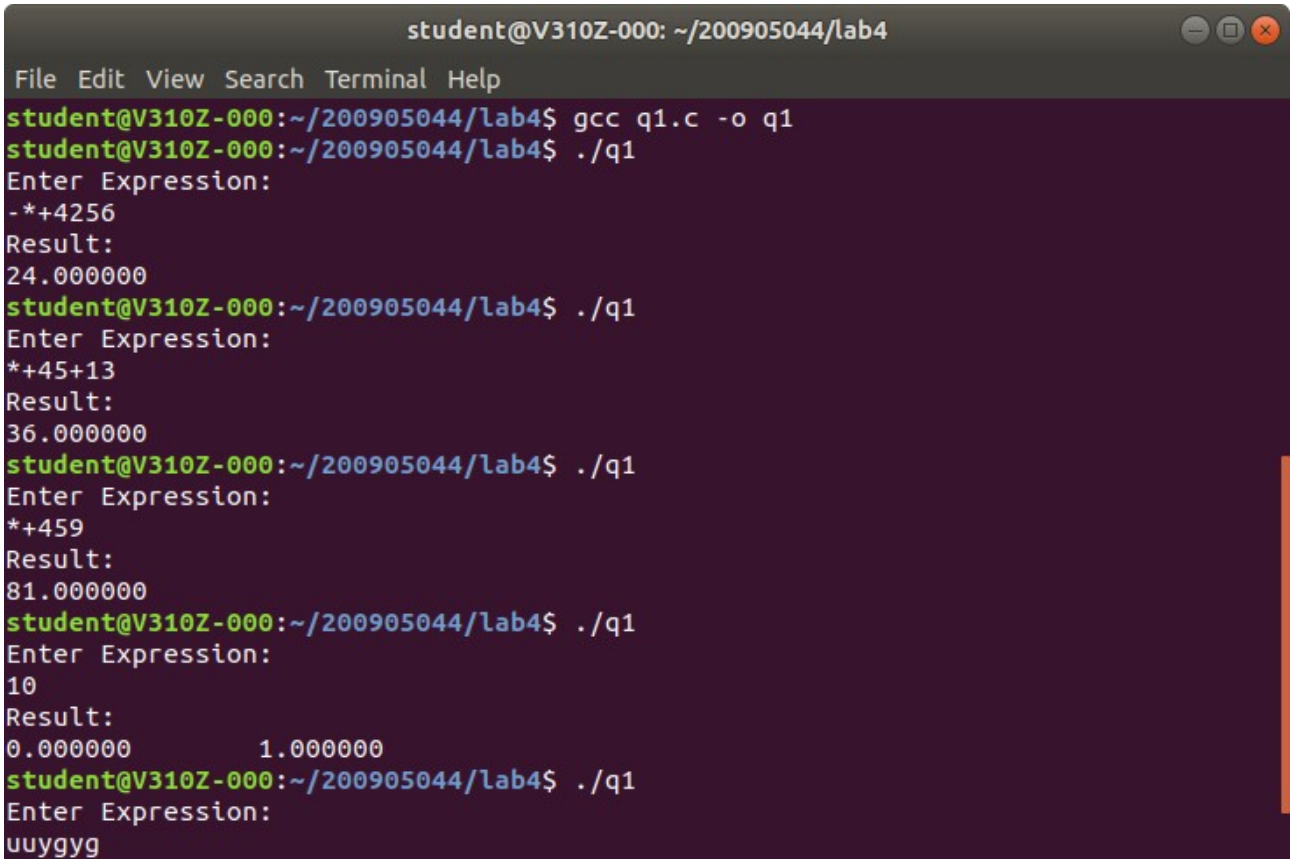
```
int stackEmpty (struct stack *);
double evalexpr (double, double, char);
void display (struct stack *);

void
push (struct stack *Stack, int item)
{
// printf("Item: %d\n", item);
  if (stackFull (Stack) == 1)
    exit (EXIT_FAILURE);
  Stack->items[++Stack->top] = item;
// display(Stack);
}

int
stackFull (struct stack *Stack)
{
  if (Stack->top == MAX)
    {
      return 1;
    }
  return 0;
}

double
pop (struct stack *Stack)
{
  if (stackEmpty (Stack) == 1)
    exit (EXIT_FAILURE);
  double ele = Stack->items[Stack->top];
  Stack->top--;
// display(Stack);
```

```
  return ele;
}

int
stackEmpty (struct stack *Stack)
{
  if (Stack->top == -1)
    return 1;
  return 0;
}

double
evalexpr (double op1, double op2, char opr)
{
  switch (opr)
    {
    case '+':
      return op1 + op2;
      break;
    case '-':
      return op1 - op2;
      break;
    case '*':
      return op1 * op2;
      break;
    case '/':
      return op1 - op2;
      break;
    default:
      break;
    }
}
```

```
void
display (struct stack *Stack)
{
  for (int i = 0; i <= Stack->top; i++)
    {
      printf ("%lf\t", Stack->items[i]);
    }
  printf ("\n");
}

int
main ()
{
  struct stack *Stack;
  Stack = malloc (sizeof (struct stack));
  Stack->top = -1;
  char str[MAX];
  printf ("Enter Expression: \n");
  scanf ("%s", str);
  char *rev;
  rev = reverse (str);
// printf("%s\n", rev);
  for (int i = 0; i < strlen (rev); i++)
    {
      int is_digit = isDigit (rev[i]);
      int is_oper = isOperand (rev[i]);
// printf("%d\t%d\n", is_digit, is_oper);
      if (is_digit == 1)
           {
             push (Stack, rev[i] - '0');
// display(Stack);
```

```
        }
    else if (is_oper == 1)
        {
          double op1 = pop (Stack);
// printf("OP1: %lf\n", op1);
          double op2 = pop (Stack);
// printf("OP2: %lf\n", op2);
          double result = evalexpr (op1, op2, rev[i]);
// printf("%lf\t%lf\t%lf\n", op1, op2, result);
          push (Stack, result);
        }
   }
  printf ("Result: \n");
  display (Stack);
  return 0;
}
```

SAMPLE INPUT/OUTPUT:



2) Convert an infix expression to prefix.

CODE:

```
#include <limits.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#define MAX 80
struct Stack
{
  int top;
  int array[MAX];
};
struct Stack *
create ()
{
  struct Stack *stack = (struct Stack *) malloc (sizeof (struct Stack));
  stack->top = -1;
  return stack;
}

int
isFull (struct Stack *stack)
{
  if (stack->top == MAX - 1)
    {
      printf ("Overflow\n");
```

```
    }
  return stack->top == MAX - 1;
}

int
isEmpty (struct Stack *stack)
{
  return stack->top == -1;
}

void
push (struct Stack *stack, int item)
{
  if (isFull (stack))
    return;
  stack->array[++stack->top] = item;
}

int
pop (struct Stack *stack)
{
  if (isEmpty (stack))
    return INT_MIN;
  return stack->array[stack->top--];
}

int
peek (struct Stack *stack)
```

```
{
  if (isEmpty (stack))
    return INT_MIN;
  return stack->array[stack->top];
}

int
checkIfOperand (char ch)
{
  return (ch >= 'a' && ch <= 'z') || (ch >= 'A' && ch <= 'Z');
}

int
precedence (char ch)
{
  switch (ch)
    {
    case '+':
    case '-':
      return 1;
    case '*':
    case '/':
      return 2;
    case '^':
      return 3;
    }
  return -1;
}
```

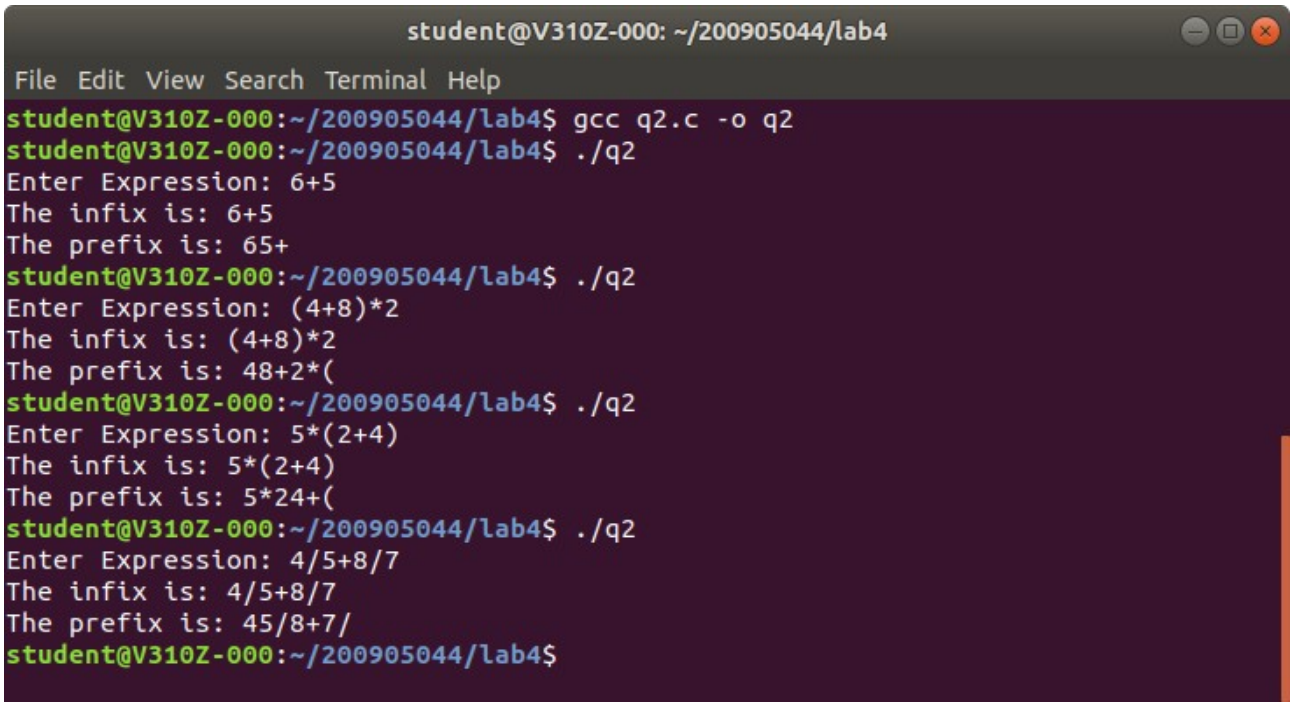
```
int
getPostfix (char *expression)
{
  int i, j;
  struct Stack *stack = create ();
  if (!stack)
    return -1;
  for (i = 0, j = -1; expression[i]; ++i)
    {
      if (checkIfOperand (expression[i]))
          expression[++j] = expression[i];
      else if (expression[i] == '(')
          push (stack, expression[i]);
      else if (expression[i] == ')')
          {
            while (!isEmpty (stack) && peek (stack) != '(')
              expression[++j] = pop (stack);
            if (!isEmpty (stack) && peek (stack) != '(')
              return -1;
            else
              pop (stack);
          }
      else
          {
            while (!isEmpty (stack)
                   && precedence (expression[i]) <= precedence (peek (stack)))
              expression[++] = pop (stack);
```

```
            push (stack, expression[i]);
          }
    }
  while (!isEmpty (stack))
    expression[++j] = pop (stack);
  expression[++j] = '\0';
}

void
reverse (char *exp)
{
  int size = strlen (exp);
  int j = size, i = 0;
  char temp[size];
  temp[j--] = '\0';
  while (exp[i] != '\0')
    {
      temp[j] = exp[i];
      j--;
      i++;
    }
  strcpy (exp, temp);
}

void
brackets (char *exp)
{
  int i = 0;
```

```
  while (exp[i] != '\0')
    {
      if (exp[i] == '(')
          exp[i] = ')';
      else if (exp[i] == ')')
          exp[i] = '(';
      i++;
    }
}

void
InfixtoPrefix (char *exp)
{
  int size = strlen (exp);
  reverse (exp);
  brackets (exp);
  getPostfix (exp);
  reverse (exp);
}


int
main ()
{
  char expression[80];
  printf ("Enter Expression: ");
  scanf ("%s", expression);
  printf ("The infix is: ");
```

```
  printf ("%s\n", expression);
  InfixtoPrefix (expression);
  printf ("The prefix is: ");
  printf ("%s\n", expression);
  return 0;
}
```

SAMPLE INPUT/OUTPUT:



3) Implement two stacks in an array.

CODE:

```
#include <stdio.h>
#include <stdlib.h>
#define MAX (100)
#define TRUE (1)
#define FALSE (0)
#define SUCCESS (1)
#define FAILED (0)
typedef struct stack
```

```
{
  char item[MAX];
  int top;
} stack;
int isEmpty (stack *);
int isFull (stack *);
int push (stack *, char);
char pop (stack *);
void display (stack *);
stack *new_stack ();
int
isEmpty (stack * s)
{
  if (s->top == -1)
    return TRUE;
  return FALSE;
}

int
isFull (stack * s)
{
  if (s->top == MAX - 1)
    return TRUE;
  return FALSE;
}

int
push (stack * s, char elem)
{
  if (isFull (s))
    return FAILED;
  s->item[++s->top] = elem;
```

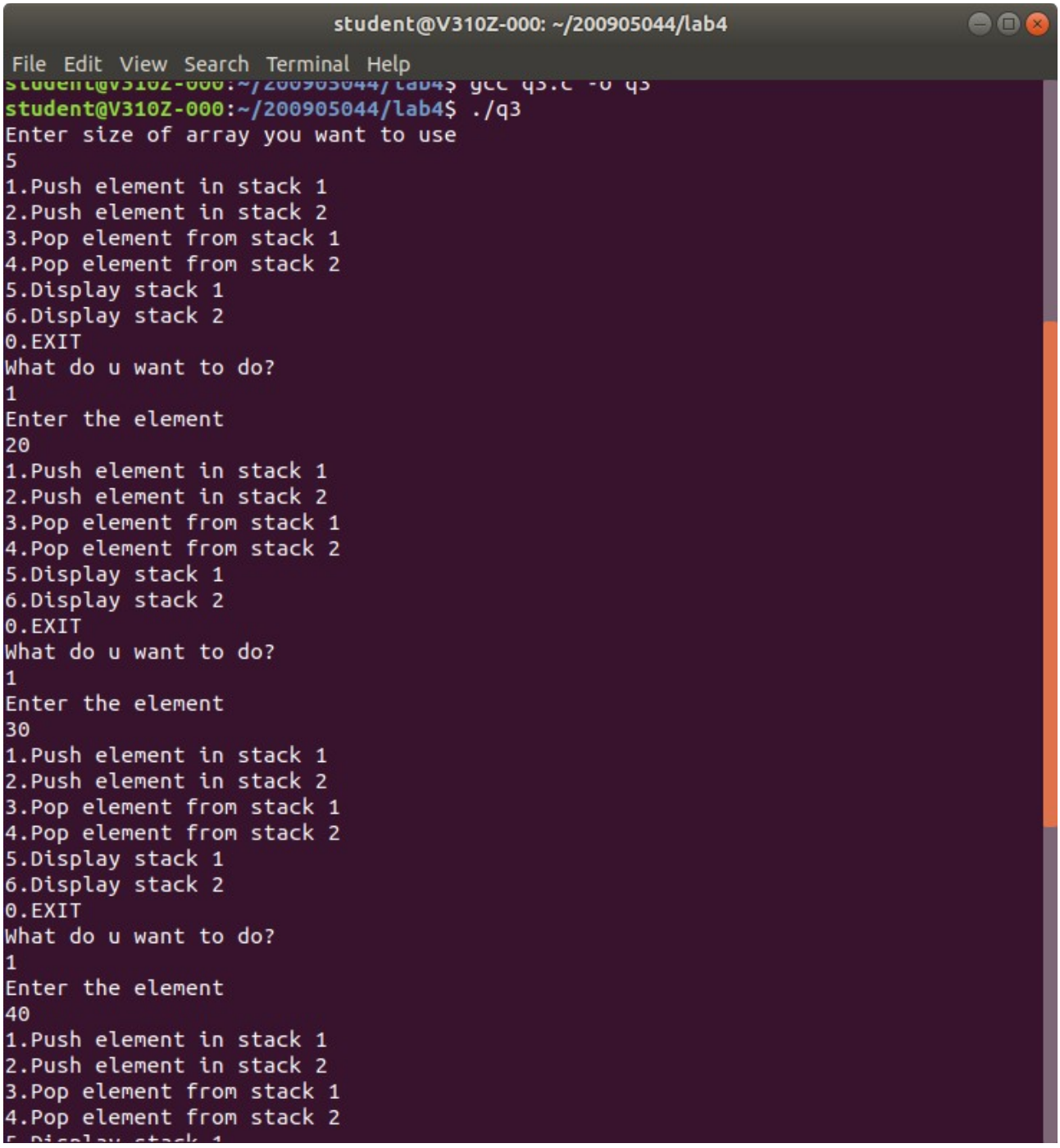
```
  return SUCCESS;
}

char
pop (stack * s)
{
  if (isEmpty (s))
    return FAILED;
  return (s->item[s->top--]);
}

void
display (stack * s)
{
  if (isEmpty (s))
    return;
  int i;
  for (i = 0; i <= s->top; i++)
    printf ("%c ", s->item[i]);
  printf ("\n");
}

stack *
new_stack ()
{
  stack *s = (stack *) malloc (sizeof (stack));
  s->top = -1;
  return s;
}

void
main ()
```

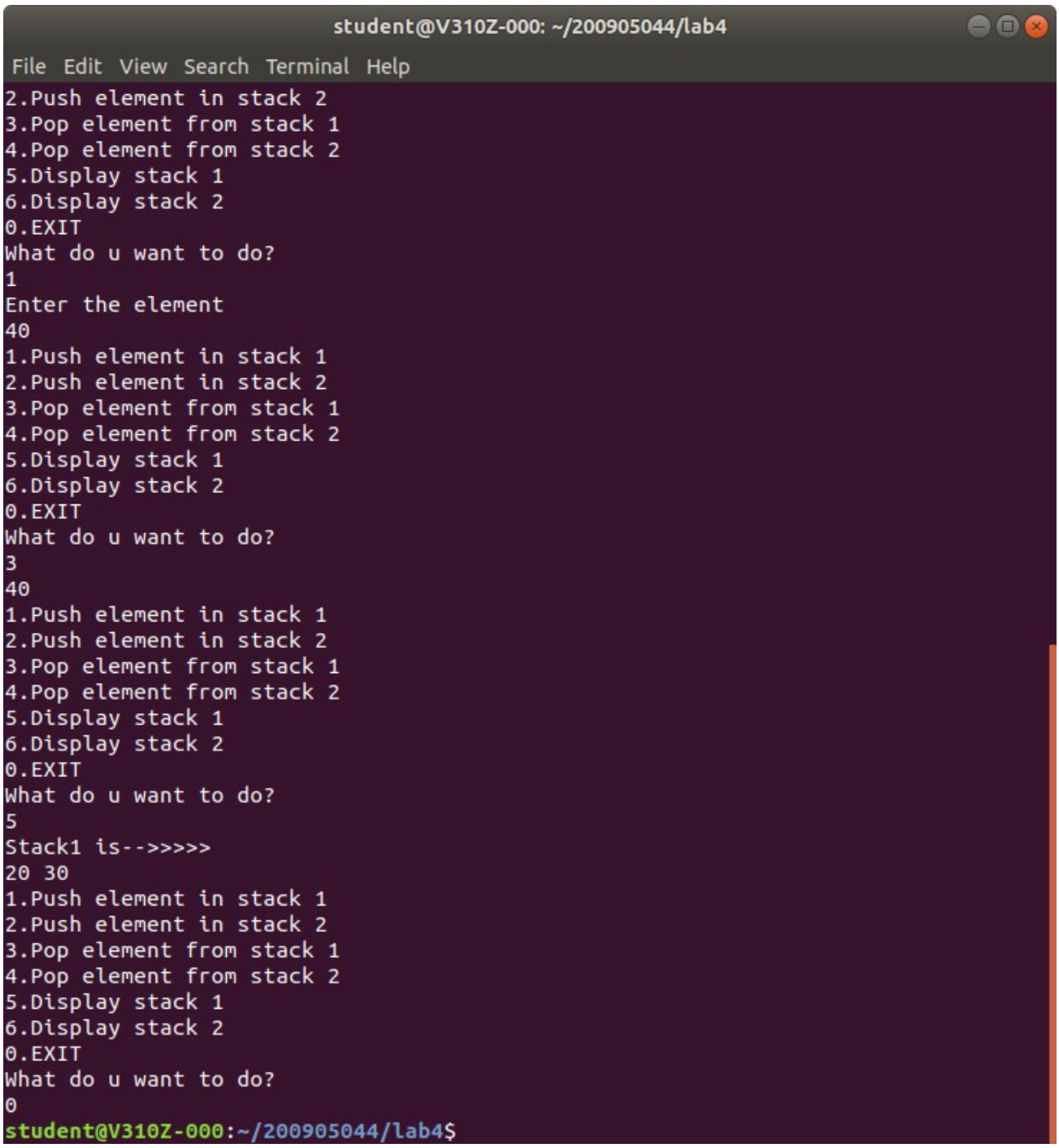
```
{
  int n, top1, top2, ch = 1, a, i, arr[100];
  printf ("Enter size of array you want to use\n");
  scanf ("%d", &n);
  top1 = -1;
  top2 = n;
  while (ch != 0)
    {
      printf ("1.Push element in stack 1\n");
      printf ("2.Push element in stack 2\n");
      printf ("3.Pop element from stack 1\n");
      printf ("4.Pop element from stack 2\n");
      printf ("5.Display stack 1\n");
      printf ("6.Display stack 2\n");
      printf ("0.EXIT\n");
      printf ("What do u want to do?\n");
      scanf ("%d", &ch);
      switch (ch)
          {
          case 1:
            {
              printf ("Enter the element\n");
              scanf ("%d", &a);
              if (top1 != (top2 - 1))
                arr[++top1] = a;
              else
                printf ("Overflow\n");
              break;
            }
          case 2:
            {
              printf ("Enter the element\n");
```

```
    scanf ("%d", &a);
    if (top2 != (top1 + 1))
      arr[--top2] = a;
    else
      printf ("Overflow\n");
    break;
  }
case 3:
  {
    if (top1 == -1)
      printf ("Stack1 is empty\n");
    else
      {
          a = arr[top1--];
          printf ("%d\n", a);
      }
    break;
  }
case 4:
  {
    if (top2 == n)
      printf ("Stack2 is empty\n");
    else
      {
          a = arr[top2++];
          printf ("%d\n", a);
      }
    break;
  }
case 5:
  {
    if (top1 == -1)
```

```
            printf ("Stack1 is empty\n");
          else
           {
               printf ("Stack1 is-->>>>>\n");
               for (i = 0; i <= top1; i++)
                 printf ("%d ", arr[i]);
               printf ("\n");
           }
          break;
        }
      case 6:
        {
          if (top2 == n)
            printf ("Stack2 is empty\n");
          else
           {
               printf ("Stack2 is-->>>>>>\n");
               for (i = (n - 1); i >= top2; i--)
                 printf ("%d ", arr[i]);
               printf ("\n");
           }
          break;
        }
      case 0:
       break;
      }
   }
}
```

SAMPLE INPUT/OUTPUT:




student@V310Z-000: ~/200905044/lab4
File Edit View Search Terminal Help
2.Push element in stack 2
3.Pop element from stack 1
4.Pop element from stack 2
5.Display stack 1
6.Display stack 2
0.EXIT
What do u want to do?
1
Enter the element
40
1.Push element in stack 1
2.Push element in stack 2
3.Pop element from stack 1
4.Pop element from stack 2
5.Display stack 1
6.Display stack 2
0.EXIT
What do u want to do?
3
40
1.Push element in stack 1
2.Push element in stack 2
3.Pop element from stack 1
4.Pop element from stack 2
5.Display stack 1
6.Display stack 2
0.EXIT
What do u want to do?
5
Stack1 is-->>>>>
20 30
1.Push element in stack 1
2.Push element in stack 2
3.Pop element from stack 1
4.Pop element from stack 2
5.Display stack 1
6.Display stack 2
0.EXIT
What do u want to do?
0
student@V310Z-000:~/200905044/lab4$

THANK YOU!