Rajalakshmi Engineering College

Name: Manikandan S
Email: 240801190@rajalakshmi.edu.in
Roll no: 240801190
Phone: 6385356692
Branch: REC
Department: I ECE FB
Batch: 2028
Degree: B.E - ECE

Scan to verify results

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 3_MCQ_Updated

Attempt : 1
Total Mark : 20
Marks Obtained : 19

Section 1 : MCQ

1. The user performs the following operations on the stack of size 5 then at the end of the last operation, the total number of elements present in the stack is

```
push(1);
pop();
push(2);
push(3);
pop();
push(4);
pop();
pop();
push(5);
```

Answer

1

Status : Correct ***Marks : 1/1***

2. Which of the following operations allows you to examine the top element of a stack without removing it?

Answer

Peek

Status : Correct ***Marks : 1/1***

3. In the linked list implementation of the stack, which of the following operations removes an element from the top?

Answer

Pop

Status : Correct ***Marks : 1/1***

4. What will be the output of the following code?

```
#include <stdio.h>
#define MAX_SIZE 5
int stack[MAX_SIZE];
int top = -1;
void display() {
    if (top == -1) {
        printf("Stack is empty\n");
    } else {
        printf("Stack elements: ");
        for (int i = top; i >= 0; i--) {
            printf("%d ", stack[i]);
        }
        printf("\n");
    }
}
void push(int value) {
    if (top == MAX_SIZE - 1) {
```

```
        printf("Stack Overflow\n");
    } else {
        stack[++top] = value;
    }
}
int main() {
    display();
    push(10);
    push(20);
    push(30);
    display();
    push(40);
    push(50);
    push(60);
    display();
    return 0;
}
```

Answer

Stack is emptyStack elements: 30 20 10Stack OverflowStack elements: 50 40 30 20 10

Status : Correct ***Marks : 1/1***

5. Consider the linked list implementation of a stack.

Which of the following nodes is considered as Top of the stack?

Answer

First node

Status : Correct ***Marks : 1/1***

6. In an array-based stack, which of the following operations can result in a Stack underflow?

Answer

Popping an element from an empty stack

Status : Correct ***Marks : 1/1***

7. A user performs the following operations on stack of size 5 then which of the following is correct statement for Stack?

```
push(1);
pop();
push(2);
push(3);
pop();
push(2);
pop();
pop();
push(4);
pop();
pop();
push(5);
```

Answer

Underflow Occurs

Status : Correct ***Marks : 1/1***

8. The result after evaluating the postfix expression 10 5 + 60 6 / * 8 - is

Answer

71

Status : Wrong ***Marks : 0/1***

9. Elements are Added on _____ of the Stack.

Answer

Top

Status : Correct ***Marks : 1/1***

10. When you push an element onto a linked list-based stack, where does the new element get added?

Answer

At the beginning of the list

Status : Correct ***Marks : 1/1***

11. Pushing an element into the stack already has five elements. The stack size is 5, then the stack becomes

Answer

Overflow

Status : Correct ***Marks : 1/1***

12. In a stack data structure, what is the fundamental rule that is followed for performing operations?

Answer

Last In First Out

Status : Correct ***Marks : 1/1***

13. Consider a linked list implementation of stack data structure with three operations:

push(value): Pushes an element value onto the stack.pop(): Pops the top element from the stack.top(): Returns the item stored at the top of the stack.

Given the following sequence of operations:

push(10);pop();push(5);top();

What will be the result of the stack after performing these operations?

Answer

The top element in the stack is 5

Status : Correct *Marks : 1/1*

14. What is the advantage of using a linked list over an array for implementing a stack?

Answer

Linked lists can dynamically resize

Status : Correct *Marks : 1/1*

15. Here is an Infix Expression: 4+3*(6*3-12). Convert the expression from Infix to Postfix notation. The maximum number of symbols that will appear on the stack AT ONE TIME during the conversion of this expression?

Answer

4

Status : Correct *Marks : 1/1*

16. What is the value of the postfix expression 6 3 2 4 + - *?

Answer

-18

Status : Correct *Marks : 1/1*

17. What will be the output of the following code?

```
#include <stdio.h>
#define MAX_SIZE 5
void push(int* stack, int* top, int item) {
   if (*top == MAX_SIZE - 1) {
      printf("Stack Overflow\n");
      return;
   }
   stack[++(*top)] = item;
```

```
}
int pop(int* stack, int* top) {
    if (*top == -1) {
        printf("Stack Underflow\n");
        return -1;
    }
    return stack[(*top)--];
}

int main() {
    int stack[MAX_SIZE];
    int top = -1;
    push(stack, &top, 10);
    push(stack, &top, 20);
    push(stack, &top, 30);
    printf("%d\n", pop(stack, &top));
    printf("%d\n", pop(stack, &top));
    printf("%d\n", pop(stack, &top));
    printf("%d\n", pop(stack, &top));
    return 0;
}
```

Answer

302010Stack Underflow-1

Status : Correct ***Marks : 1/1***

18. Which of the following Applications may use a Stack?

Answer

All of the mentioned options

Status : Correct ***Marks : 1/1***

19. What is the primary advantage of using an array-based stack with a fixed size?

Answer

Efficient memory usage

Status : Correct ***Marks : 1/1***

20. What will be the output of the following code?

```
#include <stdio.h>
#define MAX_SIZE 5
int stack[MAX_SIZE];
int top = -1;
int isEmpty() {
    return (top == -1);
}
int isFull() {
    return (top == MAX_SIZE - 1);
}
void push(int item) {
    if (isFull())
        printf("Stack Overflow\n");
    else
        stack[++top] = item;
}
int main() {
    printf("%d\n", isEmpty());
    push(10);
    push(20);
    push(30);
    printf("%d\n", isFull());
    return 0;
}
```

Answer

10

Status : Correct ***Marks : 1/1***

Rajalakshmi Engineering College

Name: Manikandan S
Email: 240801190@rajalakshmi.edu.in
Roll no: 240801190
Phone: 6385356692
Branch: REC
Department: I ECE FB
Batch: 2028
Degree: B.E - ECE

Scan to verify results

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 3_COD_Question 1

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

In a coding competition, you are assigned a task to create a program that simulates a stack using a linked list.

The program should feature a menu-driven interface for pushing an integer to stack, popping, and displaying stack elements, with robust error handling for stack underflow situations. This challenge tests your data structure skills.

Input Format

The input consists of integers corresponding to the operation that needs to be performed:

Choice 1: Push the integer value onto the stack. If the choice is 1, the following input is a space-separated integer, representing the element to be pushed onto

the stack.

Choice 2: Pop the integer from the stack.

Choice 3: Display the elements in the stack.

Choice 4: Exit the program.

Output Format

The output displays messages according to the choice and the status of the stack:

If the choice is 1, push the given integer to the stack and display the following: "Pushed element: " followed by the value pushed.

If the choice is 2, pop the integer from the stack and display the following: "Popped element: " followed by the value popped.

If the choice is 2, and if the stack is empty without any elements, print "Stack is empty. Cannot pop."

If the choice is 3, print the elements in the stack: "Stack elements (top to bottom): " followed by the space-separated values.

If the choice is 3, and there are no elements in the stack, print "Stack is empty".

If the choice is 4, exit the program and display the following: "Exiting program".

If any other choice is entered, print "Invalid choice".

Refer to the sample input and output for the exact format.

Sample Test Case

Input: 1 3
1 4
3
2
3
4
Output: Pushed element: 3
Pushed element: 4
Stack elements (top to bottom): 4 3
Popped element: 4
Stack elements (top to bottom): 3
Exiting program

Answer

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

struct Node {
    int data;
    struct Node* next;
};

struct Node* top = NULL;

void push(int value) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    if (newNode == NULL) {
        printf("Memory allocation failed. Cannot push element.\n");
        return;
    }

    newNode->data = value;
```

```
    newNode->next = top;

    top = newNode;


    printf("Pushed element: %d\n", value);
}

void pop() {
    if (top == NULL) {
        printf("Stack is Empty. Cannot pop.\n");
        return;
    }

    struct Node* temp = top;

    int poppedValue = temp->data;

    top = top->next;

    free(temp);

    printf("Popped element: %d\n", poppedValue);
}

void displayStack() {
    if (top == NULL) {
        printf("Stack is empty\n");
        return;
    }

    struct Node* current = top;
    printf("Stack elements (top to bottom): ");
    while (current != NULL) {
        printf("%d ", current->data);
        current = current->next;
    }
    printf("\n");
}
int main() {
    int choice, value;
    do {
```

```
        scanf("%d", &choice);
        switch (choice) {
            case 1:
                scanf("%d", &value);
                push(value);
                break;
            case 2:
                pop();
                break;
            case 3:
                displayStack();
                break;
            case 4:
                printf("Exiting program\n");
                return 0;
            default:
                printf("Invalid choice\n");
        }
    } while (choice != 4);

    return 0;
}
```

Status : Correct ***Marks : 10/10***

Rajalakshmi Engineering College

Name: Manikandan S
Email: 240801190@rajalakshmi.edu.in
Roll no: 240801190
Phone: 6385356692
Branch: REC
Department: I ECE FB
Batch: 2028
Degree: B.E - ECE

Scan to verify results

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 3_COD_Question 2

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Sanjeev is in charge of managing a library's book storage, and he wants to create a program that simplifies this task. His goal is to implement a program that simulates a stack using an array.

Help him in writing a program that provides the following functionality:

Add Book ID to the Stack (Push): You can add a book ID to the top of the book stack. Remove Book ID from the Stack (Pop): You can remove the top book ID from the stack and display its details. If the stack is empty, you cannot remove any more book IDs.Display Books ID in the Stack (Display): You can view the books ID currently on the stack.Exit the Library: You can choose to exit the program.

Input Format

The input consists of integers corresponding to the operation that needs to be performed:

Choice 1: Push the book onto the stack. If the choice is 1, the following input is a space-separated integer, representing the ID of the book to be pushed onto the stack.

Choice 2: Pop the book ID from the stack.

Choice 3: Display the book ID in the stack.

Choice 4: Exit the program.

Output Format

The output displays messages according to the choice and the status of the stack:

1. If the choice is 1, push the given book ID to the stack and display the corresponding message.
2. If the choice is 2, pop the book ID from the stack and display the corresponding message.
3. If the choice is 2, and if the stack is empty without any book ID, print "Stack Underflow"
4. If the choice is 3, print the book IDs in the stack.
5. If the choice is 3, and there are book IDs in the stack, print "Stack is empty"
6. If the choice is 4, exit the program and display the corresponding message.
7. If any other choice is entered, print "Invalid choice"

Refer to the sample output for the exact text and format.

Sample Test Case

Input: 1 19
1 28
2
3
2
2
4
Output: Book ID 19 is pushed onto the stack
Book ID 28 is pushed onto the stack

Book ID 28 is popped from the stack
Book ID in the stack: 19
Book ID 19 is popped from the stack
Exiting the program

Answer

```
// You are using GCC
#include <stdio.h>
#include <stdlib.h>

struct Node {
    int data;
    struct Node* next;
};

struct Node* top = NULL;

void push(int value) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    if (newNode == NULL) {
        printf("Memory allocation failed. Cannot push element.\n");
        return;
    }

    newNode->data = value;

    newNode->next = top;

    top = newNode;

    printf("Book ID %d is pushed onto the stack\n", value);
}

void pop() {
    if (top == NULL) {
        printf("Stack Underflow\n");
        return;
    }

    struct Node* temp = top;

    int poppedValue = temp->data;
```

```
    top = top->next;

    free(temp);

    printf("Book ID %d is popped from the stack\n", poppedValue);
}

void displayStack() {
    if (top == NULL) {
        printf("Stack is empty\n");
        return;
    }

    struct Node* current = top;
    printf("Book ID in the stack: ");
    while (current != NULL) {
        printf("%d ", current->data);
        current = current->next;
    }
    printf("\n");
}

int main() {
    int choice;
    int bookID;
    while (1) {

        if (scanf("%d", &choice) != 1) {
            printf("Invalid input. Please enter a number.\n");
            while (getchar() != '\n');
            continue;
        }


        switch (choice) {
            case 1:
                if (scanf("%d", &bookID) != 1) {
                    printf("Invalid input for Book ID.\n");
                    while (getchar() != '\n');
                    continue;
                }
```

```
            push(bookID);
            break;
        case 2:
            pop();
            break;
        case 3:
            displayStack();
            break;
        case 4:
            printf("Exiting the program\n");
            while (top != NULL) {
                struct Node *temp = top;
                top = top->next;
                free(temp);
            }
            return 0;
        default:
            printf("Invalid choice\n");
            break;
    }
  }

  return 0;
}
```

Status : Correct ***Marks : 10/10***

Rajalakshmi Engineering College

Name: Manikandan S
Email: 240801190@rajalakshmi.edu.in
Roll no: 240801190
Phone: 6385356692
Branch: REC
Department: I ECE FB
Batch: 2028
Degree: B.E - ECE

Scan to verify results

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 3_COD_Question 3

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Sharon is developing a programming challenge for a coding competition. The challenge revolves around implementing a character-based stack data structure using an array.

Sharon's project involves a stack that can perform the following operations:

Push a Character: Users can push a character onto the stack.Pop a Character: Users can pop a character from the stack, removing and displaying the top character.Display Stack: Users can view the current elements in the stack.Exit: Users can exit the stack operations application.

Write a program to help Sharon to implement a program that performs the given operations.

Input Format

The input consists of integers corresponding to the operation that needs to be performed:

Choice 1: Push the character onto the stack. If the choice is 1, the following input is a space-separated character, representing the character to be pushed onto the stack.

Choice 2: Pop the character from the stack.

Choice 3: Display the characters in the stack.

Choice 4: Exit the program.

Output Format

The output displays messages according to the choice and the status of the stack:

1. If the choice is 1, push the given character to the stack and display the pushed character having the prefix "Pushed: ".
2. If the choice is 2, undo the character from the stack and display the character that is popped having the prefix "Popped: ".
3. If the choice is 2, and if the stack is empty without any characters, print "Stack is empty. Nothing to pop."
4. If the choice is 3, print the elements in the stack having the prefix "Stack elements: ".
5. If the choice is 3, and there are no characters in the stack, print "Stack is empty."
6. If the choice is 4, exit the program.
7. If any other choice is entered, print "Invalid choice"

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 2
4

Output: Stack is empty. Nothing to pop.

Answer

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

```
#include <stdbool.h>

#define MAX_SIZE 100

char items[MAX_SIZE];
int top = -1;

void initialize() {
   top = -1;
}
bool isFull() {
   return top == MAX_SIZE - 1;
}

bool isEmpty() {
   return top == -1;
}

void push(char value) {
   if (top >= MAX_SIZE - 1) {
      printf("Stack Overflow\n");
      return;
   }

   top++;
   items[top] = value;

   printf("Pushed: %c\n", value);
}

void pop() {
   if (top == -1) {
      printf("Stack is empty. Nothing to pop.\n");
      return;
   }

   char poppedValue = items[top];

   top--;

   printf("Popped: %c\n", poppedValue);
}
```

```
void display() {
    if (top == -1) {
        printf("Stack is empty.\n");
        return;
    }

    printf("Stack elements: ");
    for (int i = top; i >= 0; i--) {
        printf("%c ", items[i]);
    }
    printf("\n");
}

int main() {
    initialize();
    int choice;
    char value;

    while (true) {
        scanf("%d", &choice);
        switch (choice) {
            case 1:
                scanf(" %c", &value);
                push(value);
                break;
            case 2:
                pop();
                break;
            case 3:
                display();
                break;
            case 4:
                return 0;
            default:
                printf("Invalid choice\n");
        }
    }
    return 0;
}
```

Status : Correct ***Marks : 10/10***

Rajalakshmi Engineering College

Name: Manikandan S
Email: 240801190@rajalakshmi.edu.in
Roll no: 240801190
Phone: 6385356692
Branch: REC
Department: I ECE FB
Batch: 2028
Degree: B.E - ECE

Scan to verify results

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 3_COD_Question 4

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

You are a software developer tasked with building a module for a scientific calculator application. The primary function of this module is to convert infix mathematical expressions, which are easier for users to read and write, into postfix notation (also known as Reverse Polish Notation). Postfix notation is more straightforward for the application to evaluate because it removes the need for parentheses and operator precedence rules.

The scientific calculator needs to handle various mathematical expressions with different operators and ensure the conversion is correct. Your task is to implement this infix-to-postfix conversion algorithm using a stack-based approach.

Example

Input:

a+b

Output:

ab+

Explanation:

The postfix representation of (a+b) is ab+.

Input Format

The input is a string, representing the infix expression.

Output Format

The output displays the postfix representation of the given infix expression.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: a+(b*e)
Output: abe*+

Answer

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

struct Stack {
    int top;
    unsigned capacity;
    char* array;
};

struct Stack* createStack(unsigned capacity) {
    struct Stack* stack = (struct Stack*)malloc(sizeof(struct Stack));

    if (!stack)
```

```
        return NULL;

    stack->top = -1;
    stack->capacity = capacity;
    stack->array = (char*)malloc(stack->capacity * sizeof(char));

    return stack;
}

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

char peek(struct Stack* stack) {
    return stack->array[stack->top];
}

char pop(struct Stack* stack) {
    if (!isEmpty(stack))
        return stack->array[stack->top--];
    return '$';
}

void push(struct Stack* stack, char op) {
    stack->array[++stack->top] = op;
}
// You are using GCC
#include <iostream>
#include <stack>
#include <cctype>

using namespace std;

// Function to determine precedence of operators
int Prec(char ch) {
    switch (ch) {
        case '+': case '-': return 1;
        case '*': case '/': return 2;
        case '^': return 3;
        default: return 0;  // Lowest precedence
    }
}
```

```
// Function to check if a character is an operand
bool isOperand(char ch) {
    return isalnum(ch);  // Returns true if alphanumeric
}

// Function to convert infix expression to postfix
void infixToPostfix(string exp) {
    stack<char> s;
    string output = "";

    for (char c : exp) {
        if (isOperand(c)) {  // Operand directly added to output
            output += c;
        } else if (c == '(') {  // Opening parenthesis
            s.push(c);
        } else if (c == ')') {  // Closing parenthesis
            while (!s.empty() && s.top() != '(') {
                output += s.top();
                s.pop();
            }
            s.pop();  // Remove '(' from stack
        } else {  // Operator
            while (!s.empty() && Prec(s.top()) >= Prec(c)) {
                output += s.top();
                s.pop();
            }
            s.push(c);
        }
    }

    while (!s.empty()) {  // Pop remaining operators
        output += s.top();
        s.pop();
    }

    cout << output << endl;
}

int main() {
    string expression;
```

```
    cin >> expression;

    infixToPostfix(expression);

    return 0;
}
int main() {
    char exp[100];
    scanf("%s", exp);

    infixToPostfix(exp);
    return 0;
}
```

Status : Correct **Marks : 10/10**

Rajalakshmi Engineering College

Name: Manikandan S
Email: 240801190@rajalakshmi.edu.in
Roll no: 240801190
Phone: 6385356692
Branch: REC
Department: I ECE FB
Batch: 2028
Degree: B.E - ECE

Scan to verify results

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 3_COD_Question 5

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Milton is a diligent clerk at a school who has been assigned the task of managing class schedules. The school has various sections, and Milton needs to keep track of the class schedules for each section using a stack-based system.

He uses a program that allows him to push, pop, and display class schedules for each section. Milton's program uses a stack data structure, and each class schedule is represented as a character. Help him write a program using a linked list.

Input Format

The input consists of integers corresponding to the operation that needs to be performed:

Choice 1: Push the character onto the stack. If the choice is 1, the following input is a space-separated character, representing the class schedule to be pushed onto the stack.

Choice 2: Pop class schedule from the stack

Choice 3: Display the class schedules in the stack.

Choice 4: Exit the program.

Output Format

The output displays messages according to the choice and the status of the stack:

- If the choice is 1, push the given class schedule to the stack and display the following: "Adding Section: [class schedule]"
- If the choice is 2, pop the class schedule from the stack and display the following: "Removing Section: [class schedule]"
- If the choice is 2, and if the stack is empty without any class schedules, print "Stack is empty. Cannot pop."
- If the choice is 3, print the class schedules in the stack in the following: "Enrolled Sections: " followed by the class schedules separated by space.
- If the choice is 3, and there are no class schedules in the stack, print "Stack is empty"
- If the choice is 4, exit the program and display the following: "Exiting the program"
- If any other choice is entered, print "Invalid choice"

Refer to the sample output for the exact format.

Sample Test Case

Input: 1 d
1 h
3
2

3
4
Output: Adding Section: d
Adding Section: h
Enrolled Sections: h d
Removing Section: h
Enrolled Sections: d
Exiting program

Answer

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

struct Node {
    char data;
    struct Node* next;
};

struct Node* top = NULL;

void push(char value) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    if (newNode == NULL) {
        printf("Memory allocation failed. Cannot add section.\n");
        return;
    }

    newNode->data = value;

    newNode->next = top;

    top = newNode;

    printf("Adding Section: %c\n", value);
}

void pop() {
    if (top == NULL) {
        printf("Stack is empty. Cannot pop.\n");
        return;
    }
```

```
    struct Node* temp = top;

    char poppedValue = temp->data;

    top = top->next;

    free(temp);

    printf("Removing Section: %c\n", poppedValue);
}

void displayStack() {
    if (top == NULL) {
        printf("Stack is empty\n");
        return;
    }

    struct Node* current = top;
    printf("Enrolled Sections: ");
    while (current != NULL) {
        printf("%c ", current->data);
        current = current->next;
    }
    printf("\n");
}

int main() {
    int choice;
    char value;
    do {
        scanf("%d", &choice);
        switch (choice) {
            case 1:
                scanf(" %c", &value);
                push(value);
                break;
            case 2:
                pop();
                break;
            case 3:
                displayStack();
                break;
            case 4:
```

```
            printf("Exiting program\n");
            break;
        default:
            printf("Invalid choice\n");
    }
  } while (choice != 4);

  return 0;
}
```

Status : Correct **Marks : 10/10**

Rajalakshmi Engineering College

Name: Manikandan S
Email: 240801190@rajalakshmi.edu.in
Roll no: 240801190
Phone: 6385356692
Branch: REC
Department: I ECE FB
Batch: 2028
Degree: B.E - ECE

Scan to verify results

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 3_CY

Attempt : 1
Total Mark : 30
Marks Obtained : 30

Section 1 : Coding

1. Problem Statement

Suppose you are building a calculator application that allows users to enter mathematical expressions in infix notation. One of the key features of your calculator is the ability to convert the entered expression to postfix notation using a Stack data structure.

Write a function to convert infix notation to postfix notation using a Stack.

Input Format

The input consists of a string, an infix expression that includes only digits(0-9), and operators(+, -, *, /).

Output Format

The output displays the equivalent postfix expression of the given infix expression.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 1+2*3/4-5

Output: 123*4/+5-

Answer

```
// You are using GCC
#include <stdio.h>
#include <stdlib.h>
#include <ctype.h>
#include <string.h>

#define MAX 30

// Structure for Stack
struct Stack {
    int top;
    char items[MAX];
};

// Function to initialize the stack
void initStack(struct Stack* s) {
    s->top = -1;
}

// Function to check if stack is empty
int isEmpty(struct Stack* s) {
    return s->top == -1;
}

// Function to push an element onto the stack
void push(struct Stack* s, char c) {
    if (s->top < MAX - 1) {
        s->items[++(s->top)] = c;
    }
}
```

```
// Function to pop an element from the stack
char pop(struct Stack* s) {
    if (!isEmpty(s)) {
        return s->items[(s->top)--];
    }
    return '\0';
}

// Function to get the top element of the stack without popping it
char peek(struct Stack* s) {
    if (!isEmpty(s)) {
        return s->items[s->top];
    }
    return '\0';
}

// Function to return precedence of operators
int precedence(char c) {
    if (c == '+' || c == '-') return 1;
    if (c == '*' || c == '/') return 2;
    return 0;
}

// Function to convert infix to postfix
void infixToPostfix(char* infix, char* postfix) {
    struct Stack s;
    initStack(&s);
    int i = 0, j = 0;

    while (infix[i] != '\0') {
        // If operand, add to postfix output
        if (isdigit(infix[i])) {
            postfix[j++] = infix[i];
        }
        // If '(', push to stack
        else if (infix[i] == '(') {
            push(&s, infix[i]);
        }
        // If ')', pop until '('
        else if (infix[i] == ')') {
            while (!isEmpty(&s) && peek(&s) != '(') {
                postfix[j++] = pop(&s);
```

```
            }
            pop(&s); // Remove '('
        }
        // If operator, pop stack until precedence is lower
        else {
            while (!isEmpty(&s) && precedence(peek(&s)) >= precedence(infix[i])) {
                postfix[j++] = pop(&s);
            }
            push(&s, infix[i]);
        }
        i++;
    }

    // Pop remaining operators from the stack
    while (!isEmpty(&s)) {
        postfix[j++] = pop(&s);
    }

    postfix[j] = '\0'; // Null-terminate the string
}

// Main function
int main() {
    char infix[MAX], postfix[MAX];
    scanf("%s", infix);

    infixToPostfix(infix, postfix);

    printf("%s\n", postfix);

    return 0;
}
```

Status : Correct **Marks : 10/10**

2. Problem Statement

Raj is a software developer, and his team is building an application that processes user inputs in the form of strings containing brackets. One of the essential features of the application is to validate whether the input string meets specific criteria.

During testing, Raj inputs the string "(([])){}". The application correctly returns "Valid string" because the input satisfies the criteria: every opening bracket (, [, and { has a corresponding closing bracket),], and }, arranged in the correct order.

Next, Raj tests the application with the string "([)]". This time, the application correctly returns "Invalid string" because the opening bracket [is incorrectly closed by the bracket), which violates the validation rules.

Finally, Raj enters the string "{[()]}". The application correctly identifies it as a "Valid string" since all opening brackets are matched with the corresponding closing brackets in the correct order.

As a software developer, Raj's responsibility is to ensure that the application works reliably and produces accurate results for all input strings, following the validation rules. He accomplishes this by using a method for solving such problems.

Input Format

The input comprises a string representing a sequence of brackets that need to be validated.

Output Format

The output prints "Valid string" if the string is valid. Otherwise, it prints "Invalid string".

Refer to the sample output for formatting specifications.

Sample Test Case

Input: (([])){}
Output: Valid string

Answer

```
// You are using GCC
#include <stdio.h>
#include <stdlib.h>
```

```c
#include <string.h>

#define MAX 100

// Structure for Stack
struct Stack {
    int top;
    char items[MAX];
};

// Function to initialize the stack
void initStack(struct Stack* s) {
    s->top = -1;
}

// Function to check if stack is empty
int isEmpty(struct Stack* s) {
    return s->top == -1;
}

// Function to push an element onto the stack
void push(struct Stack* s, char c) {
    if (s->top < MAX - 1) {
        s->items[++(s->top)] = c;
    }
}

// Function to pop an element from the stack
char pop(struct Stack* s) {
    if (!isEmpty(s)) {
        return s->items[(s->top)--];
    }
    return '\0';
}

// Function to check if brackets match
int isMatchingPair(char opening, char closing) {
    return (opening == '(' && closing == ')') ||
           (opening == '[' && closing == ']') ||
           (opening == '{' && closing == '}');
}
```

```
// Function to validate the bracket sequence
int isValidString(char* str) {
    struct Stack s;
    initStack(&s);

    for (int i = 0; i < strlen(str); i++) {
        // Push opening brackets onto the stack
        if (str[i] == '(' || str[i] == '[' || str[i] == '{') {
            push(&s, str[i]);
        }
        // If closing bracket, check if it matches the top of the stack
        else if (str[i] == ')' || str[i] == ']' || str[i] == '}') {
            if (isEmpty(&s) || !isMatchingPair(pop(&s), str[i])) {
                return 0; // Invalid string
            }
        }
    }

    // If stack is empty, brackets are balanced
    return isEmpty(&s);
}

// Main function
int main() {
    char str[MAX];
    scanf("%s", str);

    if (isValidString(str)) {
        printf("Valid string\n");
    } else {
        printf("Invalid string\n");
    }

    return 0;
}
```

Status : Correct **Marks : 10/10**

3. Problem Statement

You are required to implement a stack data structure using a singly linked

list that follows the Last In, First Out (LIFO) principle.

The stack should support the following operations: push, pop, display, and peek.

Input Format

The input consists of four space-separated integers N, representing the elements to be pushed onto the stack.

Output Format

The first line of output displays all four elements in a single line separated by a space.

The second line of output is left blank to indicate the pop operation without displaying anything.

The third line of output displays the space separated stack elements in the same line after the pop operation.

The fourth line of output displays the top element of the stack using the peek operation.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 11 22 33 44
Output: 44 33 22 11

33 22 11
33

Answer

```
// You are using GCC
#include <stdio.h>
#include <stdlib.h>

// Structure for a stack node
struct Node {
```

```
    int data;
    struct Node* next;
};

// Function to push an element onto the stack
void push(struct Node** top, int value) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = value;
    newNode->next = *top;
    *top = newNode;
}

// Function to pop an element from the stack
void pop(struct Node** top) {
    if (*top == NULL) return; // Empty stack
    struct Node* temp = *top;
    *top = (*top)->next;
    free(temp);
}

// Function to display the stack elements
void display(struct Node* top) {
    struct Node* current = top;
    while (current != NULL) {
        printf("%d ", current->data);
        current = current->next;
    }
    printf("\n");
}

// Function to return the top element of the stack
int peek(struct Node* top) {
    if (top != NULL) return top->data;
    return -1; // Edge case for empty stack
}

// Main function
int main() {
    struct Node* top = NULL;
    int values[4];

    // Read input values
```

```
    for (int i = 0; i < 4; i++) {
        scanf("%d", &values[i]);
        push(&top, values[i]);
    }

    // Display stack before pop
    display(top);

    printf("\n"); // Blank line for pop operation

    // Perform pop
    pop(&top);

    // Display stack after pop
    display(top);

    // Peek the top element
    printf("%d\n", peek(top));

    return 0;
}
```

Status : Correct ***Marks : 10/10***