Rajalakshmi Engineering College

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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

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

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

struct Node* top = NULL;

// You are using GCC
void push(int value) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    if (!newNode) {
        printf("Memory allocation failed\n");
        return;
    }
    newNode->data = value;
    newNode->next = top;
```

```c
        top = newNode;
        printf("Pushed element: %d\n", value);
    }

    // Pop function
    void pop() {
        if (top == NULL) {
            printf("Stack is empty. Cannot pop.\n");
        } else {
            struct Node* temp = top;
            printf("Popped element: %d\n", temp->data);
            top = top->next;
            free(temp);
        }
    }

    // Display function
    void displayStack() {
        if (top == NULL) {
            printf("Stack is empty\n");
        } else {
            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;
```

```c
            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***

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REC_DS using C_Week 3_COD_Question 2

Attempt : 1
Total Mark : 10
Marks Obtained : 2.5

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
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

```c
#include <stdio.h>
#define MAX 100

// Stack declaration
int stack[MAX];
int top = -1;

// Push function
void push(int bookID) {
    if (top >= MAX - 1) {
        // Stack Overflow not mentioned in the problem — but safe to guard here.
        return;
    }
    top++;
    stack[top] = bookID;
    printf("Book ID %d is pushed onto the stack\n", bookID);
}

// Pop function
void pop() {
    if (top == -1) {
        printf("Stack Underflow\n");
    } else {
        printf("Book ID %d is popped from the stack\n", stack[top]);
        top--;
    }
}

// Display function
void display() {
    if (top == -1) {
        printf("Stack is empty\n");
    } else {
        printf("Book ID in the stack: ");
        for (int i = 0; i <= top; i++) {
            printf("%d ", stack[i]);
```

```c
        }
        printf("\n");
    }
}

// Main program
int main() {
    int choice, bookID;

    while (1) {
        if (scanf("%d", &choice) != 1) {
            // Clear invalid input
            int c;
            while ((c = getchar()) != '\n' && c != EOF);
            printf("Invalid choice\n");
            continue;
        }

        switch (choice) {
            case 1:
                if (scanf("%d", &bookID) != 1) {
                    printf("Invalid choice\n");
                    int c;
                    while ((c = getchar()) != '\n' && c != EOF);
                    continue;
                }
                push(bookID);
                break;
            case 2:
                pop();
                break;
            case 3:
                display();
                break;
            case 4:
                printf("Exiting the program\n");
                return 0;
            default:
                printf("Invalid choice\n");
        }
    }
```

```
    return 0;
}
```

Status : Partially correct   *Marks : 2.5/10*

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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>

```c
#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 ch) {
    if (top >= MAX_SIZE - 1) {
        // Not required in problem, but good to safeguard
        return;
    }
    top++;
    items[top] = ch;
    printf("Pushed: %c\n", ch);
}

// Pop function
void pop() {
    if (top == -1) {
        printf("Stack is empty. Nothing to pop.\n");
    } else {
        printf("Popped: %c\n", items[top]);
        top--;
    }
}

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

```c
    } else {
        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***

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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

```c
#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)
```

```c
        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;
}
int precedence(char op) {
    if (op == '^') return 3;
    else if (op == '*' || op == '/') return 2;
    else if (op == '+' || op == '-') return 1;
    return 0;
}

// Function to check if the character is an operand (variable or number)
int isOperand(char ch) {
    return (ch >= 'a' && ch <= 'z') || (ch >= 'A' && ch <= 'Z');
}

// Function to check if the character is an operator
int isOperator(char ch) {
    return (ch == '+' || ch == '-' || ch == '*' || ch == '/' || ch == '^');
}
```

```c
// Function to convert infix expression to postfix
void infixToPostfix(char exp[]) {
    struct Stack* stack = createStack(10); // Initial capacity
    int k = 0;
    char ch;
    char* postfix = (char*)malloc(sizeof(char) * (strlen(exp) + 1)); // Allocate
memory for postfix expression

    // Iterate through each character of the infix expression
    for (int i = 0; exp[i] != '\0'; i++) {
        ch = exp[i];

        // If the character is an operand, add it to the postfix expression
        if (isOperand(ch)) {
            postfix[k++] = ch;
        }
        // If the character is '(', push it onto the stack
        else if (ch == '(') {
            push(stack, ch);
        }
        // If the character is ')', pop and add to postfix until '(' is found
        else if (ch == ')') {
            while (!isEmpty(stack) && peek(stack) != '(') {
                postfix[k++] = pop(stack);
            }
            pop(stack);  // Pop the '(' from the stack
        }
        // If the character is an operator
        else if (isOperator(ch)) {
            while (!isEmpty(stack) && precedence(peek(stack)) >= precedence(ch)) {
                if (ch == '^' && peek(stack) == '^') {
                    break;  // Right associativity for '^'
                }
                postfix[k++] = pop(stack);
            }
            push(stack, ch);  // Push the current operator onto the stack
        }
    }

    // Pop all the remaining operators from the stack
    while (!isEmpty(stack)) {
```

```c
        postfix[k++] = pop(stack);
    }

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

    // Output the resulting postfix expression
    printf("%s\n", postfix);

    // Free allocated memory
    free(stack->array);  // Renamed 'arr' to 'array'
    free(stack);
    free(postfix);
}
int main() {
    char exp[100];
    scanf("%s", exp);

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

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

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 3_COD_Question 5

Attempt : 1
Total Mark : 10
Marks Obtained : 5

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

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

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

struct Node* top = NULL;

void push(char data) {
    struct Node* newNode =(struct Node*)malloc(sizeof(struct Node));
    newNode->next = top;
    top = newNode;
    printf("Adding Section: %c\n", data);
}

// Function to pop a class schedule from the stack
void pop() {
    if (top == NULL) {
        printf("Stack is empty. Cannot pop.\n");
        return;
    }
    struct Node* temp = top;
    printf("Removing Section: %c\n", temp->data);
    top = top->next;
    free(temp);
}

// Function to display the class schedules in the stack
void displayStack() {
    if (top == NULL) {
```

```c
        printf("Stack is empty\n");
        return;
    }
    printf("Enrolled Sections: ");
    struct Node* current = top;
    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 : Partially correct   **Marks : 5/10**