

# Rajalakshmi Engineering College

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Batch: 2028

Degree: B.E - AI & ML

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## NeoColab\_REC\_CS23231\_DATA STRUCTURES

### REC\_DS using C\_Week 3\_MCQ\_Updated

Attempt : 1

Total Mark : 20

Marks Obtained : 16

### Section 1 : MCQ

1. 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**

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

**Answer**

-18

**Status : Correct**

**Marks : 1/1**

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

**Answer**

At the end of the list

**Status : Wrong**

**Marks : 0/1**

4. 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**

5. 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

6. 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

**Status : Wrong**

**Marks : 0/1**

7. 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 empty  
Stack elements: 30 20 10  
Stack Overflow  
Stack elements: 50 40 30 20 10

**Status :** Correct

**Marks :** 1/1

8. 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

9. 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

10. Elements are Added on \_\_\_\_\_ of the Stack.

**Answer**

Top

**Status : Correct**

**Marks : 1/1**

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

**Answer**

142

**Status : Correct**

**Marks : 1/1**

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

**Answer**

A Parantheses Balancing Program

**Status : Wrong**

**Marks : 0/1**

13. 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**

14. 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**

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. 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

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

**Answer**

Efficient memory usage

**Status :** Correct

**Marks :** 1/1

18. 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

19. Consider the linked list implementation of a stack.

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

**Answer**

Last node

**Status :** Wrong

**Marks :** 0/1

20. 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



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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**

```
#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) {
```

```
    Node* newNode = (Node*)malloc(sizeof(Node));
```

```
    if (newNode == NULL) {
```

```
        // Handle malloc failure if needed
```

```
        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;
    }

    Node* temp = top;
    int popped = temp->data;
    top = top->next;
    free(temp);

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

```
void displayStack() {
    if (top == NULL) {
```

```
    printf("Stack is empty\n");
    return;
}

printf("Stack elements (top to bottom): ");

Node* current = top;

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**

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## NeoColab\_REC\_CS23231\_DATA STRUCTURES

### 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**

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

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

```
#define MAX_SIZE 100
```

```
struct Stack {
```

```
    int top;
```

```
    int items[MAX_SIZE];
```

```
};
```

```
void initStack(struct Stack* s) {
```

```
    s->top = -1;
```

```
}
```

```
int isFull(struct Stack* s) {
```

```
    return s->top == MAX_SIZE - 1;
```

```
}
```

```
int isEmpty(struct Stack* s) {
```

```
    return s->top == -1;
```

```
}
```

```
void push(struct Stack* s, int bookID) {
```

```
if (isFull(s)) {  
    printf("Stack Overflow\n");  
} else {  
    s->items[++(s->top)] = bookID;  
    printf("Book ID %d is pushed onto the stack\n", bookID);  
}  
}  
  
int pop(struct Stack* s) {  
    if (isEmpty(s)) {  
        printf("Stack Underflow\n");  
        return -1;  
    } else {  
        return s->items[(s->top)--];  
    }  
}  
  
void display(struct Stack* s) {  
    if (isEmpty(s)) {  
        printf("Stack is empty\n");  
    } else {  
        printf("Book ID in the stack: ");  
        for (int i = 0; i <= s->top; i++) {
```

```
        printf("%d ", s->items[i]);  
    }  
    printf("\n");  
}  
}
```

```
int main() {
```

```
    struct Stack stack;
```

```
    initStack(&stack);
```

```
    int choice, bookID;
```

```
    while (1) {
```

```
        scanf("%d", &choice);
```

```
        switch (choice) {
```

```
            case 1:
```

```
                scanf("%d", &bookID);
```

```
                push(&stack, bookID);
```

```
                break;
```

```
            case 2:
```

```
                bookID = pop(&stack);
```

```
                if (bookID != -1) {
```

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

case 3:
    display(&stack);
    break;

case 4:
    printf("Exiting the program\n");
    exit(0);

default:
    printf("Invalid choice\n");
}
}

return 0;
}
```

**Status :** Partially correct

**Marks :** 2.5/10

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## 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;
```

```
}
```

```
// You are using GCC
```

```
void push(char value) {
```

```
    if (top == MAX_SIZE - 1) {
```

```
        printf("Stack Overflow\n");
```

```
    } else {
```

```
        items[++top] = value;
```

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

```
    }
```

```
}
```

```
void pop() {
```

```
    if (top == -1) {
```

```
        printf("Stack is empty. Nothing to pop.\n");
```

```
    } else {  
        char c = items[top--];  
        printf("Popped: %c\n", c);  
    }  
}
```

```
void display() {  
    if (top == -1) {  
        printf("Stack is empty.\n");  
    } 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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## NeoColab\_REC\_CS23231\_DATA STRUCTURES

### REC\_DS using C\_Week 3\_COD\_Question 4

Attempt : 2

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
int isOperand(char ch) {
    return (ch >= 'a' && ch <= 'z') || (ch >= 'A' && ch <= 'Z');//type your code here
}

```

```

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

```

```

    return 0;
} //type your code here

void infixToPostfix(char* exp) {

    struct Stack* stack = createStack(strlen(exp));
    if (!stack) {
        printf("Memory allocation failed\n");
        return;
    }
    char result[100]; // Output array
    int k = 0; // Index for result
    for (int i = 0; exp[i]; i++) {
        // If the scanned character is an operand, add it to output
        if (isOperand(exp[i])) {
            result[k++] = exp[i];
        }
        // If the scanned character is '(', push it to the stack
        else if (exp[i] == '(') {
            push(stack, exp[i]);
        }
        // If the scanned character is ')', pop and output from the stack
        // until an '(' is encountered
        else if (exp[i] == ')') {
            while (!isEmpty(stack) && peek(stack) != '(') {
                result[k++] = pop(stack);
            }
            pop(stack); // Remove '(' from stack
        }
        // An operator is encountered
        else {
            while (!isEmpty(stack) && Prec(peek(stack)) >= Prec(exp[i])) {
                result[k++] = pop(stack);
            }
            push(stack, exp[i]);
        }
    }
    // Pop all the operators from the stack
    while (!isEmpty(stack)) {
        result[k++] = pop(stack);
    }
}

```

```
        result[k] = '\0'; // Null-terminate the result
        printf("%s\n", result); //type your code here
    }

    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 : 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;
// You are using GCC
```

```
void push( char value) {

    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));

    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");
```

```
} else {
```

```
    struct Node* temp = top;
```

```
    top = top->next;
```

```
    printf("Removing Section: %c\n", temp->data);
```

```
    free(temp);
```

```
}
```

```
}
```

```
void displayStack() {
```

```
    if (top == NULL) {
```

```
        printf("Stack is empty\n");
```

```
    } else {
```

```
        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**