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Data and File Structures Lab

Prepared by



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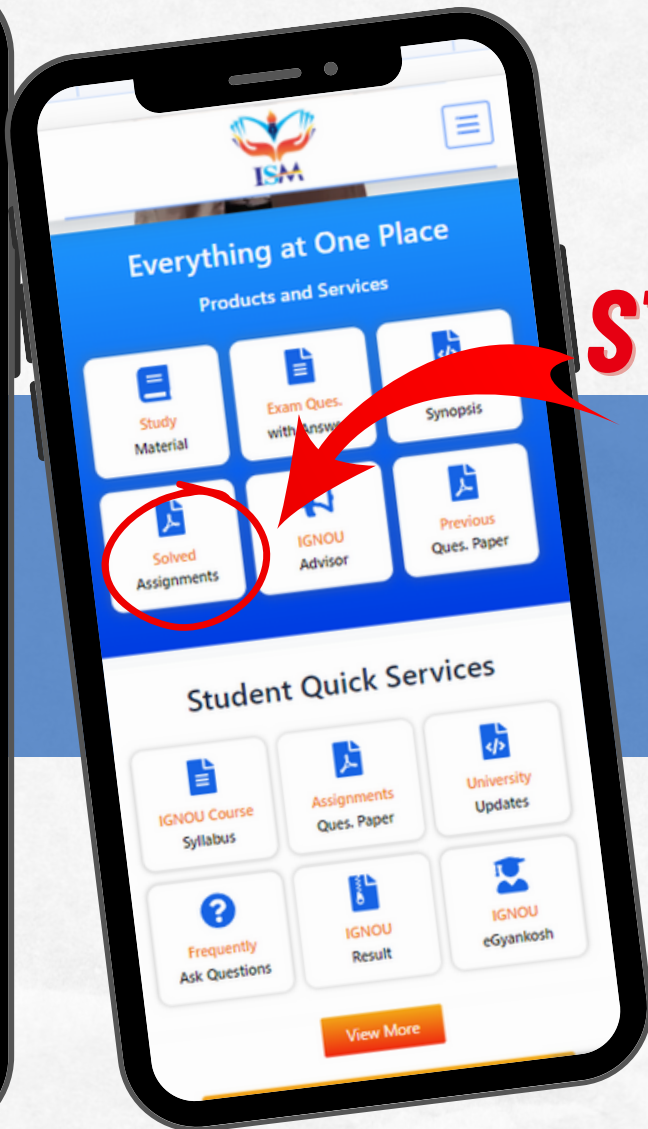
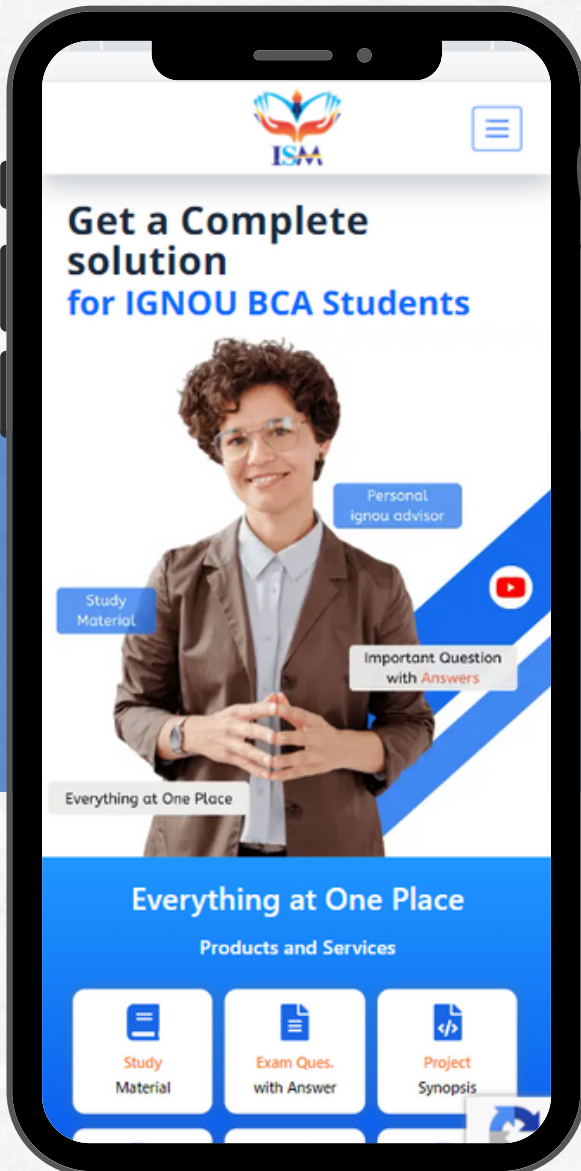


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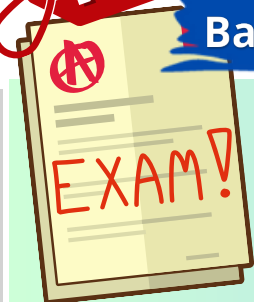
Ques Q7. Write a program to implement two stacks with the help of single array.

```
Ans. #include <stdio.h>
#define MAX 100
int top1 = -1, top2 = MAX;
int arr[MAX];
void push1(int x) {
    if (top1 < top2 - 1) {
        top1++;
        arr[top1] = x;
    } else {
        printf("Stack overflow\n");
    }
}
void push2(int x) {
    if (top1 < top2 - 1) {
        top2--; arr[top2] = x;
    } else {
        printf("Stack overflow\n");
    }
}
```

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```
int pop1() {
if (top1 >= 0) {
int x = arr[top1];
top1--; return x;
} else {
printf("Stack underflow\n");
return-1;
}
}
int pop2() {
if (top2 < MAX) {
int x = arr[top2];
top2++;
return x;
} else {
printf("Stack underflow\n");
return-1;
}
}
int main() {
int x, choice;
```



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```
printf("1. Push in stack 1\n");
printf("2. Push in stack 2\n");
printf("3. Pop from stack 1\n");
printf("4. Pop from stack 2\n");
printf("5. Exit\n");
```

```
do {
printf("\nEnter your choice: ");
scanf("%d", &choice);
```

```
switch (choice) {
case 1: printf("Enter the element to be pushed: ");
scanf("%d", &x);
push1(x);
break;
case 2: printf("Enter the element to be pushed: ");
scanf("%d", &x);
push2(x);
break;
case 3: x =pop1();
if (x !=-1) { printf("The element popped from stack 1 is %d\n", x);
}
break;
```

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```

case 4:
x =pop2();
if (x !=-1) {
printf("The element popped from stack 2 is %d\n", x);
} break;
case 5:
return 0;
default:
printf("Invalid choice.\n");
}
} while (1);
return 0;
}

```

Ques Q8. Write a program to implement a DEQUE (Double Ended Queue) using a doubly linked list.

Ans. #include <stdio.h>
#include <stdio.h>
struct node { int data; struct node *prev, *next;
};
struct node *front = NULL, *rear = NULL; int arr[MAX];
void enqueue_front(int data) {
struct node *new_node = (struct node *)malloc(sizeof(struct node));
new_node->data = data;
new_node->prev = NULL;



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```
new_node->next = front;
if (front != NULL) {
front->prev = new_node;
}
front = new_node;
}
void enqueue_rear(int data) {
struct node *new_node = (struct node *)malloc(sizeof(struct node));
new_node->data = data;
new_node->next = NULL;
new_node->prev = rear;
if (rear != NULL) {
rear->next = new_node;
}
rear = new_node;
}
int dequeue_front() {
if (front == NULL) {
printf("Queue is empty.\n");
return -1;
}
int data = front->data;
struct node *temp = front;
front = front->next;
if (front != NULL) {
```



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```
front->prev = NULL;
}
free(temp);
return data;
}
int dequeue_rear() {
if (rear == NULL) {
printf("Queue is empty.\n");
return -1;
}
int data = rear->data;
struct node *temp = rear;

rear = rear->prev;
if (rear != NULL) {
rear->next = NULL;
}
free(temp);
return data;
}

void print_queue() {
struct node *temp = front;
```

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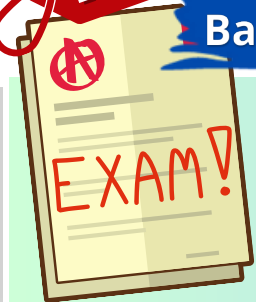
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```
while (temp != NULL) {
printf("%d ", temp->data);
temp = temp->next;
}
printf("\n");
}
int main() {
int choice, data;

printf("1. Enqueue front\n");
printf("2. Enqueue rear\n");
printf("3. Dequeue front\n");
printf("4. Dequeue rear\n");
printf("5. Print queue\n");
printf("6. Exit\n");

do {
printf("\nEnter your choice: ");
scanf("%d", &choice);

switch (choice) {
case 1:
printf("Enter the data to be enqueued at front: ");
```

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```
scanf("%d", &data);
enqueue_front(data);
break;
case 2:
printf("Enter the data to be enqueued at rear: ");
scanf("%d", &data);
enqueue_rear(data);
break;
case 3:
data = dequeue_front();
if (data != -1) {
printf("The data dequeued from front is %d\n", data);
}
break;
case 4:
data = dequeue_rear();
if (data != -1) {
printf("The data dequeued from rear is %d\n", data);
} break;
case 5:
print_queue();
break;
case 6:
return 0;
```

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```
default:
printf("invalid choice. \n");
}
} while (1);
return 0;
}
```

Ques Q9. Write a program to convert an infix expression to a postfix expression. Use appropriate data structure.

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

#define MAX 100

char infix[MAX], postfix[MAX];
int top=-1;

void push(char c) {
top++;
infix[top]=c;
}
char pop() {
char c = infix[top];
top--;
return c;
}
```

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```

top--;
return c;
}

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

void convert_infix_to_postfix() {
int i, j;
char c;
push('(');
for (i = 0, j = 0; infix[i] != '\0'; i++) {
c = infix[i];
if (c == '(') {
push(c);
}
}
}

```

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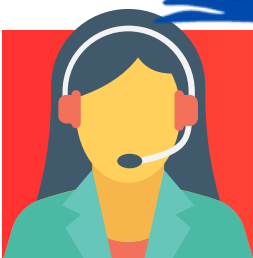
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```
} else if (c == ')') {
while (top !=-1 && infix[top] != '(') {
postfix[j++] = pop();
}
pop();
} else if (isalnum(c)) {
postfix[j++] = c;
} else {
while (top !=-1 && precedence(infix[top]) >= precedence(c)) {
postfix[j++] = pop();
} push(c);
}
}
while (top !=-1) {
postfix[j++] = pop();
}
postfix[j] = '\0';
}
int main() {
printf("Enter the infix expression: ");
scanf("%s", infix);
convert_infix_to_postfix();
printf("The postfix expression is: %s\n", postfix);
return 0;
}
```



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Ques Q10. Write a program to implement binary search tree (BST). Also, write functions to traverse the BST in In-order, Pre-order and Post-order forms.

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

```
struct Node {  
    int data;  
    struct Node *left, *right;  
};
```

```
struct Node *root = NULL;  
void insert(int data) {  
    struct Node *new_node = (struct Node *)malloc(sizeof(struct Node));  
    new_node->data = data;  
    new_node->left = NULL;  
    new_node->right = NULL;
```

```
if (root == NULL) {  
    root = new_node;  
} else {  
    struct Node *temp = root;
```



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```

while (temp != NULL) {
    if (data < temp->data) {
        if (temp->left == NULL) {
            temp->left = new_node;
            break;
        } else {
            temp = temp->left;
        }
    } else {
        if (temp->right == NULL) {
            temp->right = new_node;
            break;
        } else {
            temp = temp->right;
        }
    }
}

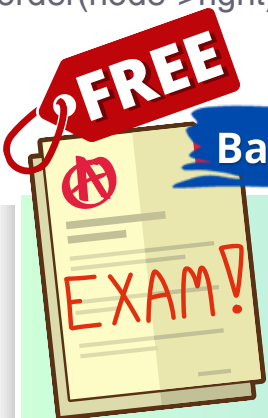
void inorder(struct Node *node) {
    if (node != NULL) {
        inorder(node->left);
        printf("%d ", node->data);
        inorder(node->right);
    }
}

```

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```

}
}
void preorder(struct Node *node) {
    if (node != NULL) {
        printf("%d ", node->data);
        preorder(node->left);
        preorder(node->right);
    }
}
void postorder(struct Node *node) {
    if (node != NULL) {
        postorder(node->left);
        postorder(node->right);
        printf("%d ", node->data);
    }
}
int main() {
    int n, data;

    printf("Enter the number of elements: ");
    scanf("%d", &n);
    for (int i = 0; i < n; i++) {
        printf("Enter the element: ");

```

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```
scanf("%d", &data);
insert(data);
}
printf("Inorder traversal: ");
inorder(root);
printf("\n");
printf("Preorder traversal: ");
preorder(root);
printf("\n");

printf("Postorder traversal: ");
postorder(root);
printf("\n");

return 0;
}
```

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