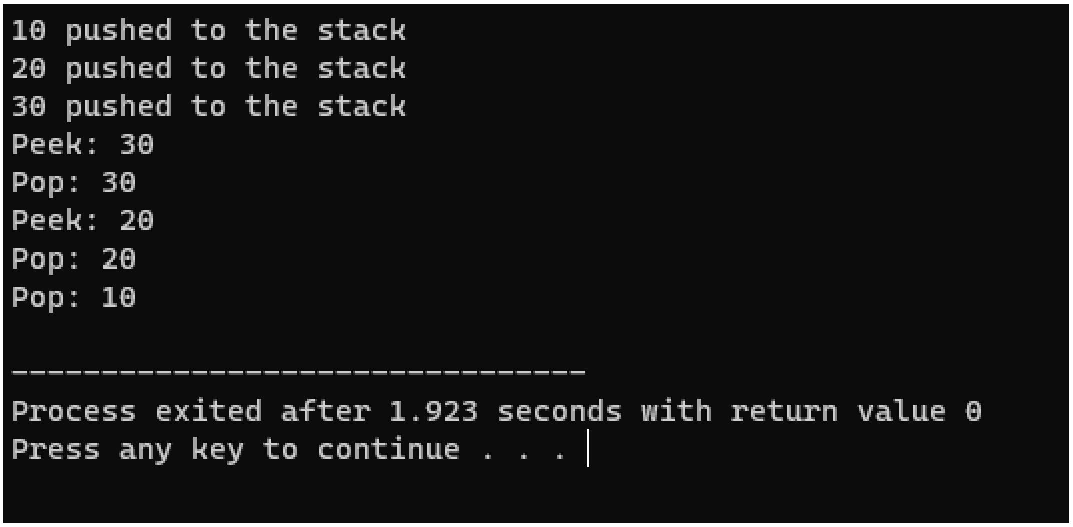
Practical programs(11-15)

11.write a c program to implement stack operations such as push,pop,and peek

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

#define MAX_SIZE 10

struct Stack {
    int arr[MAX_SIZE];
    int top;
};

void initialize(struct Stack *stack) {
    stack->top = -1;
}

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

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

void push(struct Stack *stack, int value) {
    if (isFull(stack)) {
        printf("Stack Overflow: Cannot push element %d\n", value);
    } else {
        stack->arr[++stack->top] = value;
        printf("%d pushed to the stack\n", value);
    }
}
```

```
int pop(struct Stack *stack) {
    if (isEmpty(stack)) {
        printf("Stack Underflow: Cannot pop from empty stack\n");
        return -1;
    } else {
        int value = stack->arr[stack->top--];
        return value;
    }
}

int peek(struct Stack *stack) {
    if (isEmpty(stack)) {
        printf("Stack is empty\n");
        return -1;
    } else {
        return stack->arr[stack->top];
    }
}

int main() {
    struct Stack stack;
    initialize(&stack);

    push(&stack, 10);
    push(&stack, 20);
    push(&stack, 30);

    printf("Peek: %d\n", peek(&stack));
    printf("Pop: %d\n", pop(&stack));
    printf("Peek: %d\n", peek(&stack));
    printf("Pop: %d\n", pop(&stack));
    printf("Pop: %d\n", pop(&stack));

    return 0;
}
```

Output:



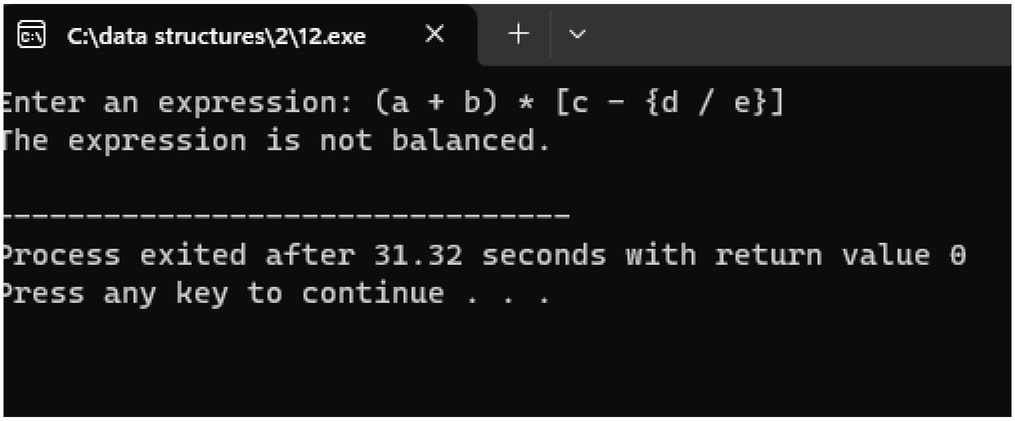
```
10 pushed to the stack
20 pushed to the stack
30 pushed to the stack
Peek: 30
Pop: 30
Peek: 20
Pop: 20
Pop: 10

--------------------------------
Process exited after 1.923 seconds with return value 0
Press any key to continue . . .
```

12.write a c program to implement the apllication of stack

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

#define MAX_SIZE 100

struct Stack {
   char arr[MAX_SIZE];
   int top;
};

void initialize(struct Stack *stack) {
   stack->top = -1;
}

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

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

void push(struct Stack *stack, char value) {
    if (isFull(stack)) {
        printf("Stack Overflow: Cannot push element %c\n", value);
    } else {
        stack->arr[++stack->top] = value;
    }
}

char pop(struct Stack *stack) {
    if (isEmpty(stack)) {
        return '\0';  // Return a special character to indicate stack underflow
    } else {
        return stack->arr[stack->top--];
    }
}

int isBalanced(char expression[]) {
    struct Stack stack;
    initialize(&stack);

    int len = strlen(expression);
    for (int i = 0; i < len; i++) {
        if (expression[i] == '(' || expression[i] == '[' || expression[i] == '{') {
            push(&stack, expression[i]);
        } else if (expression[i] == ')' || expression[i] == ']' || expression[i] == '}') {
            if (isEmpty(&stack)) {
                return 0;
            }
            char popped = pop(&stack);
            if ((expression[i] == ')' && popped != '(') ||
                (expression[i] == ']' && popped != '[') ||
                (expression[i] == '}' && popped != '{')) {
                return 0;
            }
        }
    }

    return isEmpty(&stack);
}

int main() {
    char expression[MAX_SIZE];
    printf("Enter an expression: ");
    scanf("%s", expression);

    if (isBalanced(expression)) {
        printf("The expression is balanced.\n");
    } else {
        printf("The expression is not balanced.\n");
    }

    return 0;
}
```

Output:



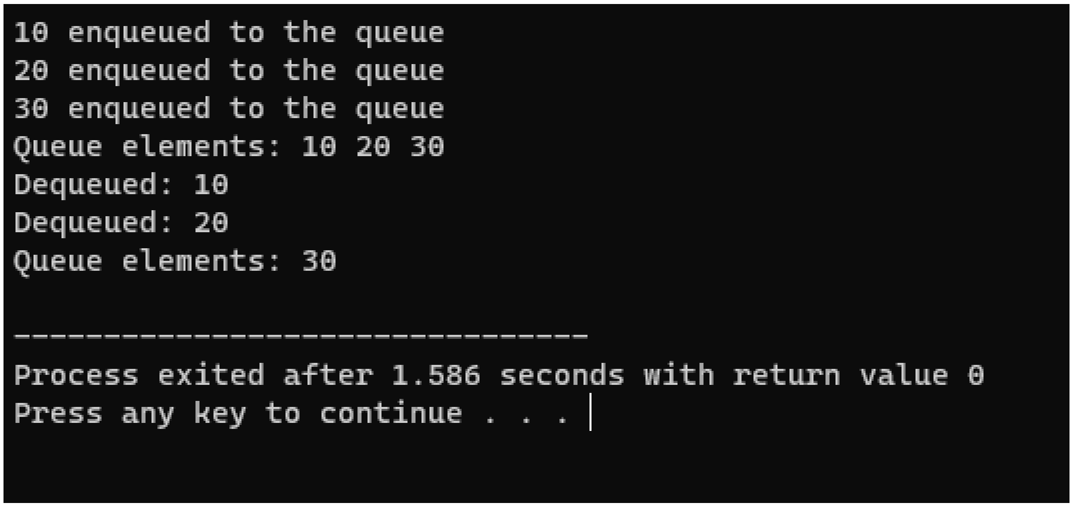
```
Enter an expression: (a + b) * [c - {d / e}]
The expression is not balanced.

--------------------------------
Process exited after 31.32 seconds with return value 0
Press any key to continue . . .
```

13.write a c program to implement queue operations such as enqueue , dequeue and display

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

#define MAX_SIZE 10

struct Queue {
   int arr[MAX_SIZE];
   int front, rear;
};

void initialize(struct Queue *queue) {
   queue->front = -1;
   queue->rear = -1;
}

int isEmpty(struct Queue *queue) {
   return queue->front == -1;
}

int isFull(struct Queue *queue) {
   return (queue->rear + 1) % MAX_SIZE == queue->front;
}

void enqueue(struct Queue *queue, int value) {
   if (isFull(queue)) {
      printf("Queue is full: Cannot enqueue element %d\n", value);
   } else {
      if (isEmpty(queue)) {
         queue->front = 0;
      }
      queue->rear = (queue->rear + 1) % MAX_SIZE;
      queue->arr[queue->rear] = value;
```

```
        printf("%d enqueued to the queue\n", value);
    }
}

int dequeue(struct Queue *queue) {
    if (isEmpty(queue)) {
        printf("Queue is empty: Cannot dequeue\n");
        return -1;
    } else {
        int value = queue->arr[queue->front];
        if (queue->front == queue->rear) {
            queue->front = -1;
            queue->rear = -1;
        } else {
            queue->front = (queue->front + 1) % MAX_SIZE;
        }
        return value;
    }
}

void display(struct Queue *queue) {
    if (isEmpty(queue)) {
        printf("Queue is empty\n");
    } else {
        printf("Queue elements: ");
        int i = queue->front;
        while (i != queue->rear) {
            printf("%d ", queue->arr[i]);
            i = (i + 1) % MAX_SIZE;
        }
        printf("%d\n", queue->arr[i]);
    }
}

int main() {
    struct Queue queue;
    initialize(&queue);

    enqueue(&queue, 10);
    enqueue(&queue, 20);
    enqueue(&queue, 30);

    display(&queue);

    printf("Dequeued: %d\n", dequeue(&queue));
    printf("Dequeued: %d\n", dequeue(&queue));

    display(&queue);

    return 0;
}
```

Output:



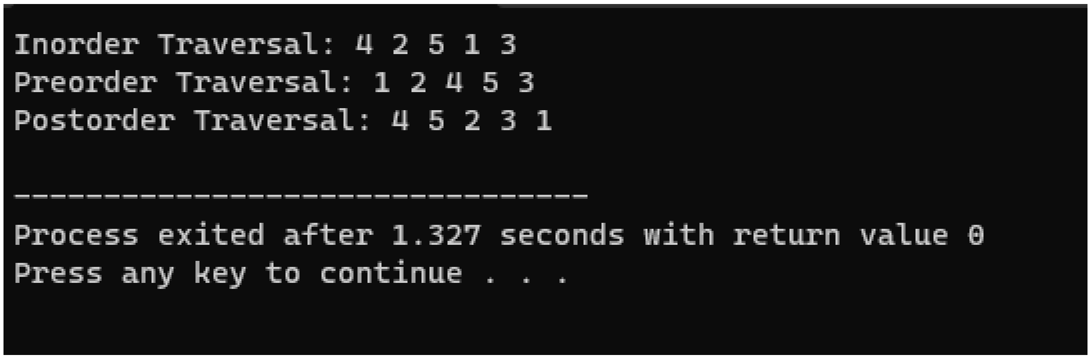
```
10 enqueued to the queue
20 enqueued to the queue
30 enqueued to the queue
Queue elements: 10 20 30
Dequeued: 10
Dequeued: 20
Queue elements: 30

--------------------------------
Process exited after 1.586 seconds with return value 0
Press any key to continue . . .
```

14.write a c program to implement tree traversals(inorder,preorder and postorder)

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

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

struct Node *createNode(int data) {
    struct Node *newNode = (struct Node *)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->left = NULL;
    newNode->right = NULL;
    return newNode;
}

void inorderTraversal(struct Node *root) {
    if (root == NULL) {
        return;
    }
    inorderTraversal(root->left);
    printf("%d ", root->data);
    inorderTraversal(root->right);
}

void preorderTraversal(struct Node *root) {
    if (root == NULL) {
        return;
    }
    printf("%d ", root->data);
    preorderTraversal(root->left);
    preorderTraversal(root->right);
}

void postorderTraversal(struct Node *root) {
    if (root == NULL) {
        return;
    }
    postorderTraversal(root->left);
    postorderTraversal(root->right);
    printf("%d ", root->data);
}

int main() {
    struct Node *root = createNode(1);
    root->left = createNode(2);
    root->right = createNode(3);
    root->left->left = createNode(4);
    root->left->right = createNode(5);

    printf("Inorder Traversal: ");
    inorderTraversal(root);
    printf("\n");

    printf("Preorder Traversal: ");
    preorderTraversal(root);
    printf("\n");

    printf("Postorder Traversal: ");
    postorderTraversal(root);
    printf("\n");
    return 0;
}
```

Output:

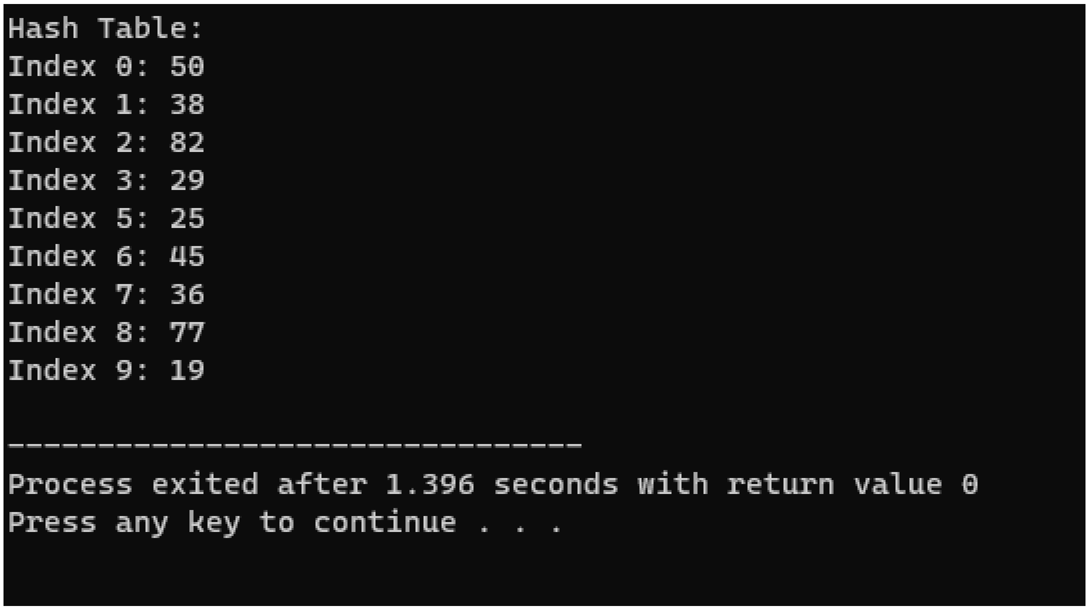


```
Inorder Traversal: 4 2 5 1 3
Preorder Traversal: 1 2 4 5 3
Postorder Traversal: 4 5 2 3 1

--------------------------------
Process exited after 1.327 seconds with return value 0
Press any key to continue . . .
```

15.write a c program to implement hashing using linear probing method

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

#define TABLE_SIZE 10

struct HashTable {
    int table[TABLE_SIZE];
};

void initializeHashTable(struct HashTable *hashTable) {
    for (int i = 0; i < TABLE_SIZE; i++) {
        hashTable->table[i] = -1;  // Initialize all slots as empty (-1)
    }
}

int hashFunction(int key) {
    return key % TABLE_SIZE;
}

void insert(struct HashTable *hashTable, int value) {
    int index = hashFunction(value);

    while (hashTable->table[index] != -1) {
        index = (index + 1) % TABLE_SIZE; // Move to the next slot using linear
probing
    }

    hashTable->table[index] = value;
}

void display(struct HashTable *hashTable) {
    printf("Hash Table:\n");
    for (int i = 0; i < TABLE_SIZE; i++) {
        if (hashTable->table[i] != -1) {
            printf("Index %d: %d\n", i, hashTable->table[i]);
        }
    }
}

int main() {
    struct HashTable hashTable;
    initializeHashTable(&hashTable);

    int values[] = {25, 45, 36, 77, 82, 19, 50, 38, 29};

    for (int i = 0; i < sizeof(values) / sizeof(values[0]); i++) {
        insert(&hashTable, values[i]);
    }

    display(&hashTable);

    return 0;
}
```

Output:



```
Hash Table:
Index 0: 50
Index 1: 38
Index 2: 82
Index 3: 29
Index 5: 25
Index 6: 45
Index 7: 36
Index 8: 77
Index 9: 19

--------------------------------
Process exited after 1.396 seconds with return value 0
Press any key to continue . . .
```