REPORT :

Library Management System with a combination of stacks and queues for book issuing and returning.

Submitted by :

Wafi Alam Fathema [C233509]

Semester: 3rd Section: 3CF

Course Name: Data Structures Lab

Course Code: CSE-2322

Department: CSE

Submitted to : Asmaul Hosna Sadika

Adjunct Lecturer

INTERNATIONAL ISLAMIC UNIVERSITY CHATTAGRAM

Introduction:

The Library Management System is designed to efficiently manage the issuing and returning of books using data structures: stacks and queues. The system allows users to issue books, return them, and view issued and returned books. This project is implemented in C and utilizes a stack to manage issued books and a queue to handle returned books.

Objectives:

- To implement an efficient book issuing and returning mechanism.
- To maintain the sequence of book returns using a queue.
- To provide a simple user interface for library operations.

System Design: The system employs two key data structures:

- **Stack**: Used to store issued books in a Last-In-First-Out (LIFO) manner.
- **Queue**: Used to store returned books in a First-In-First-Out (FIFO) manner.

Functionalities: The system provides the following functionalities:

1. **Issue a Book**: Adds a book to the issued stack.
2. **Return a Book**: Removes a book from the issued stack and adds it to the returned queue.
3. **View Issued Books**: Displays the books currently issued.
4. **View Returned Books**: Displays the books that have been returned.
5. **Exit**: Closes the

FIGURE: Library Management System with a combination of stacks and queues for book issuing and returning

Features

- Book Issuing and Returning
- View Issued Books and Returned Books
- User-Friendly Menu
- Efficient Storage

Input: The implementation is done in C programming language with the following key components:

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

#define MAX 5  // Maximum capacity of stack and queue

// Structure for a book
typedef struct {
    int id;
    char title[50];
} Book;

// Stack for issued books
typedef struct {
    Book books[MAX];
    int top;
} Stack;

// Queue for returned books
typedef struct {
    Book books[MAX];
    int front, rear, count;
} Queue;

// Function prototypes
void push(Stack *s, Book book);
Book pop(Stack *s);
void enqueue(Queue *q, Book book);
Book dequeue(Queue *q);
void displayIssuedBooks(Stack *s);
void displayReturnedBooks(Queue *q);
void menu();

int main() {
    Stack issuedBooks = {.top = -1};
    Queue returnedBooks = {.front = 0, .rear = -1, .count = 0};

    int choice;
    do {
        menu();
        printf("Enter your choice: ");
```

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

        Book book;
        switch (choice) {
            case 1:
                if (issuedBooks.top == MAX - 1) {
                    printf("Issue limit reached! Cannot issue more books.\n");
                } else {
                    printf("Enter book ID: ");
                    scanf("%d", &book.id);
                    printf("Enter book title: ");
                    scanf(" %[^\n]", book.title); // Read string with spaces
                    push(&issuedBooks, book);
                    printf("Book issued successfully.\n");
                }
                break;

            case 2:
                if (issuedBooks.top == -1) {
                    printf("No books issued yet!\n");
                } else {
                    book = pop(&issuedBooks);
                    enqueue(&returnedBooks, book);
                    printf("Book '%s' returned successfully.\n", book.title);
                }
                break;

            case 3:
                displayIssuedBooks(&issuedBooks);
                break;

            case 4:
                displayReturnedBooks(&returnedBooks);
                break;

            case 5:
                printf("Exiting the system...\n");
                break;

            default:
                printf("Invalid choice! Please try again.\n");
        }
    } while (choice != 5);

    return 0;
```

```c
}

// Function to issue a book (Push to Stack)
void push(Stack *s, Book book) {
    s->top++;
    s->books[s->top] = book;
}

// Function to return a book (Pop from Stack)
Book pop(Stack *s) {
    return s->books[s->top--];
}

// Function to add a returned book to Queue
void enqueue(Queue *q, Book book) {
    if (q->count == MAX) {
        printf("Return queue is full!\n");
        return;
    }
    q->rear = (q->rear + 1) % MAX;
    q->books[q->rear] = book;
    q->count++;
}

// Function to remove a returned book from Queue
Book dequeue(Queue *q) {
    if (q->count == 0) {
        printf("No returned books available.\n");
        Book empty = {-1, "None"};
        return empty;
    }
    Book book = q->books[q->front];
    q->front = (q->front + 1) % MAX;
    q->count--;
    return book;
}

// Function to display issued books (Stack)
void displayIssuedBooks(Stack *s) {
    if (s->top == -1) {
        printf("No books issued yet.\n");
        return;
    }
    printf("Issued Books (Most recent first):\n");
    for (int i = s->top; i >= 0; i--) {
```

```
        printf("ID: %d, Title: %s\n", s->books[i].id, s->books[i].title);
    }
}

// Function to display returned books (Queue)
void displayReturnedBooks(Queue *q) {
    if (q->count == 0) {
        printf("No books returned yet.\n");
        return;
    }
    printf("Returned Books (Oldest first):\n");
    int index = q->front;
    for (int i = 0; i < q->count; i++) {
        printf("ID: %d, Title: %s\n", q->books[index].id, q->books[index].title);
        index = (index + 1) % MAX;
    }
}

// Function to display menu
void menu() {
    printf("\n=== Library Management System ===\n");
    printf("1. Issue a Book\n");
    printf("2. Return a Book\n");
    printf("3. View Issued Books\n");
    printf("4. View Returned Books\n");
    printf("5. Exit\n");
}
```

Structures Used:

- `Book`: Represents a book with an ID and title.
- `Stack`: Manages issued books.
- `Queue`: Manages returned books.

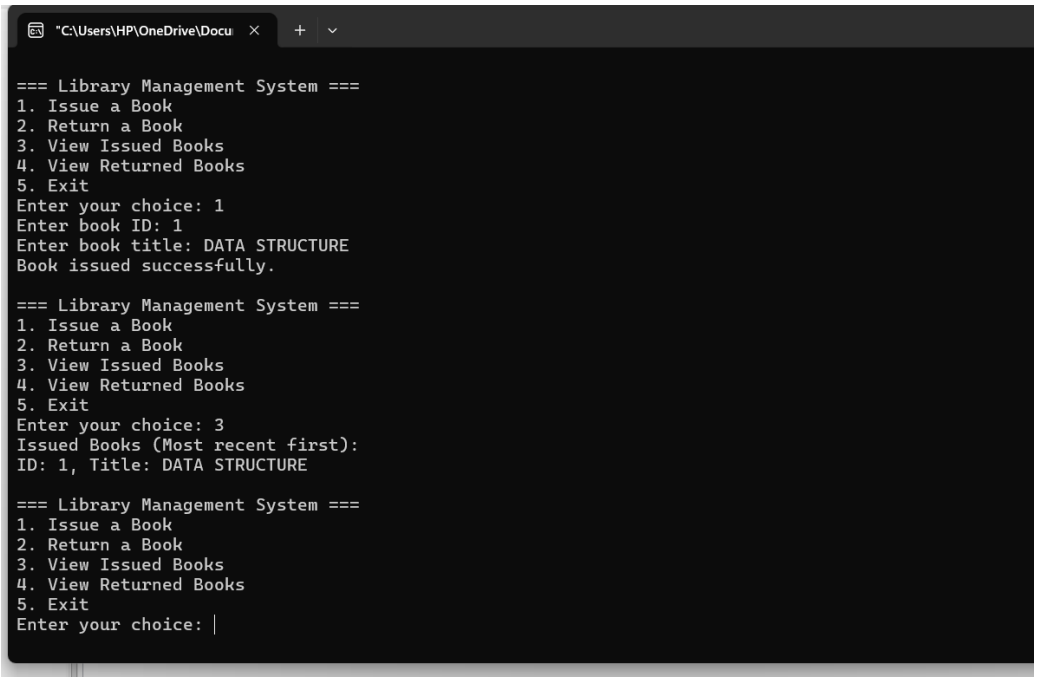
Key Functions:

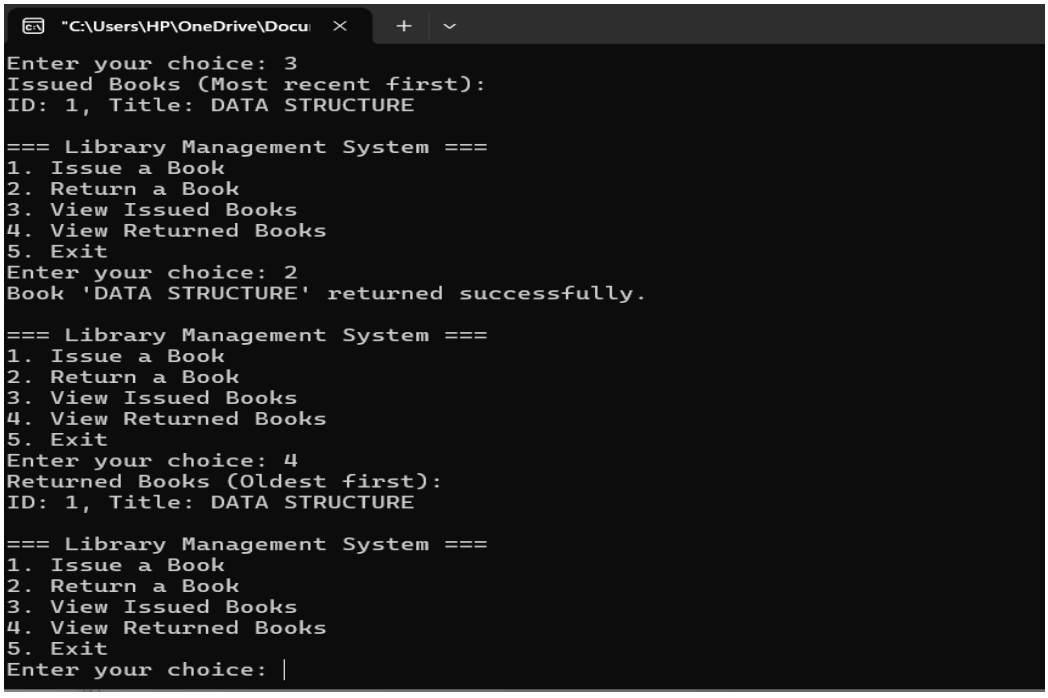
- `Push (Stack *s, Book book)`: Issues a book by adding it to the stack.
- `Pop (Stack *s)`: Returns a book by removing it from the stack.
- `Enqueue (Queue *q, Book book)`: Adds a returned book to the queue.
- `Dequeue (Queue *q)`: Removes a returned book from the queue.
- `DisplayIssuedBooks (Stack *s)`: Displays all issued books.
- `DisplayReturnedBooks (Queue *q)`: Displays all returned books.
- `Menu()`: Displays the main menu options.

Code Overview: The following is an overview of the main logic of the system:

- A **stack** (`issuedBooks`) is initialized to store issued books.
- A **queue** (`returnedBooks`) is initialized to store returned books.
- The `main()` function provides an interactive menu for user actions.
- The system ensures that books are issued up to a maximum capacity and returned in the correct sequence.

OUTPUT:


"C:\Users\HP\OneDrive\Docu
=== Library Management System ===
1. Issue a Book
2. Return a Book
3. View Issued Books
4. View Returned Books
5. Exit
Enter your choice: 1
Enter book ID: 1
Enter book title: DATA STRUCTURE
Book issued successfully.
=== Library Management System ===
1. Issue a Book
2. Return a Book
3. View Issued Books
4. View Returned Books
5. Exit
Enter your choice: 3
Issued Books (Most recent first):
ID: 1, Title: DATA STRUCTURE
=== Library Management System ===
1. Issue a Book
2. Return a Book
3. View Issued Books
4. View Returned Books
5. Exit
Enter your choice:


"C:\Users\HP\OneDrive\Docu
Enter your choice: 3
Issued Books (Most recent first):
ID: 1, Title: DATA STRUCTURE
=== Library Management System ===
1. Issue a Book
2. Return a Book
3. View Issued Books
4. View Returned Books
5. Exit
Enter your choice: 2
Book 'DATA STRUCTURE' returned successfully.
=== Library Management System ===
1. Issue a Book
2. Return a Book
3. View Issued Books
4. View Returned Books
5. Exit
Enter your choice: 4
Returned Books (Oldest first):
ID: 1, Title: DATA STRUCTURE
=== Library Management System ===
1. Issue a Book
2. Return a Book
3. View Issued Books
4. View Returned Books
5. Exit
Enter your choice:

Results and Observations:

- The system successfully maintains book issuing and returning operations.
- The stack ensures that the most recently issued book is the first to be returned.
- The queue maintains the correct order of returned books.
- The system prevents issuing beyond the maximum capacity and returning from an empty stack.

Conclusion:

This project demonstrates an efficient Library Management System using stacks and queues. It provides a structured way to manage book transactions, ensuring proper tracking of issued and returned books. Future enhancements may include database integration and user authentication for improved functionality.

Future Enhancements:

- Implementing a database for permanent storage.
- Adding a graphical user interface (GUI) for better usability.
- Introducing user authentication to track individual borrowers.
- Expanding the system to handle multiple categories of books.

THANK YOU SO MUCH