📄 USER MANUAL

Smart Library Management & Recommendation System

USER MANUAL

C++ Project – Data Structures, Fall 2025

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1. Introduction

This system provides a complete command-line library management environment.
It supports:

- Book catalog search
- Borrowing & returning
- Waitlists
- User history (linked list)
- Recommendations (graph-based BFS/DFS)
- Popularity ranking (balanced BST)
- Full file I/O (persistent storage)

Built entirely in **C++** using custom data structures.

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2. System Requirements

- C++17 or newer

- g++ compiler
- Terminal / Command Prompt
- Windows, macOS, or Linux

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3. Installation Guide

Compilation

```
g++ src/main.cpp
```

Run

```
./a.exe
```

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4. Main Menu (CLI)

When executed, the system displays:

```
===== SMART LIBRARY SYSTEM =====
1. Add Book
2. Search Book
3. Add User
4. Borrow Book
5. Return Book
6. View User History
7. View Recommendations
8. View Most Popular Books
9. Exit
```

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5. Feature Instructions

5.1 Add Book

Prompts for:

- ISBN
- Title
- Author
- Total Copies

Stored using a **custom hash table** providing O(1) lookup.

5.2 Search Book

Enter ISBN to view:

- Book Title
- Author
- Available Copies
- Popularity Score

5.3 Add User

Enter:

- User ID
- Name

User is added to **UserManager**.

5.4 Borrow Book

Steps:

1. Enter User ID
2. Enter ISBN

3. System checks stock
4. If no copies → user added to waitlist

History is recorded in:

`history.txt`

5.5 Return Book

When a book is returned:

- If waitlist exists → next user automatically receives the book
- Otherwise, availableCopies++

5.6 View User History

Displays:

```
C++ Book (ISBN: 111)
Algorithms (ISBN: 222)
```

System looks up details using ISBN.

All histories stored in a **single file**:

`history.txt`

5.7 Recommendations (Graph-Based)

A co-borrow graph tracks relationships between books.

Edges created when users borrow books together.

BFS is used to generate recommendations like:

```
Because you borrowed 'C++ Book', you may also like:
- Algorithms
- DSA Essentials
```

5.8 Popularity Ranking (BST)

Books inserted into a **Balanced BST** based on popularity count.

Output:

```
1. C++ Book – 10 borrows
2. DSA Essentials – 7 borrows
3. Algorithms – 4 borrows
```

5.9 Exit

On exit, the system writes all updates to:

```
books.txt
users.txt
history.txt
graph.txt
popularity.txt
```

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6. File Formats

books.txt

```
ISBN|Title|Author|Total|Available|Popularity
```

users.txt

```
UserID|Name|BorrowCount
```

history.txt

```
UserID|ISBN
```

graph.txt

```
ISBN|LinkedISBN1,LinkedISBN2,...
```

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7. Error Messages

- "Book not found."
- "User not found."
- "Invalid option. Try again."
- "No copies available — user added to waitlist."

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8. Troubleshooting

Problem	Solution
Program won’t run	Check C++ version
History not loading	Ensure ISBN matches catalog
Data not saving	Verify write permissions
Waitlist not working	Check borrow/return sequence

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9. Credits

Developed by: **Yousuf, Zaid and Ibrahim Shahbaz**

Course: *Data Structures – Fall 2025*