About me

I have completed my Bachelor of Computer Applications (BCA) from Parul University, Vadodara. During my academic journey, I worked with Python and explored various aspects of data manipulation, which sparked my interest in the field of Data Science. This curiosity led me to pursue further learning and hands-on projects in data analysis and visualization.

Here are my professional profiles for reference:

LinkedIn: Linked In Profile

GitHub: GitHub Profile

OBJECTIVE AND PROBLEM STATEMENT

To design and analyze a Library Management System database that tracks book inventory, loans, and branch activity, and to extract insights using SQL and Python visualizations for better decision-making.

INNOMATICS
RESEARCH LABS

TABLES IN MY DATABASE

tbl_book

book_BookId	book_Title	book_PublisherName
1	The Name of the Wind	DAW Books
2	It	Viking
3	The Green Mile	Signet Books
4	Dune	Chilton Books
5	The Hobbit	George Allen & Unwin

tbl_book_copies

book_copies_CopiesID	book_copies_BookID	book_copies_BranchID	book_copies_No_Of_Copies
1	1	1	5
2	2	1	5
3	3	1	5
4	4	1	5
5	5	1	5
6	6	1	5
7	7	1	5
8	8	1	5
9	9	1	5
10	10	1	5
11	11	1	5
12	12	1	5

tbl_book_authors

book_author_AuthorID	book_author_BookID	book_authors_AuthorName
1	1	Patrick Rothfuss
2	2	Stephen King
3	3	Stephen King
4	4	Frank Herbert
5	5	J.R.R. Tolkien

tbl_book_loans

book_loans_LoansID	book_loans_BookID	book_loans_BranchID	book_loans_CardNo	book_loans_DateOut	book_loans_DueDate	DateOut	DueDate
1	1	1	100	01-01-2018	02-02-2018	2018-01-01	2018-02-02
2	2	1	100	01-01-2018	02-02-2018	2018-01-01	2018-02-02
3	3	1	100	01-01-2018	02-02-2018	2018-01-01	2018-02-02
4	4	1	100	01-01-2018	02-02-2018	2018-01-01	2018-02-02
5	5	1	102	01-03-2018	02-03-2018	2018-01-03	2018-02-03
6	6	1	102	01-03-2018	02-03-2018	2018-01-03	2018-02-03
7	7	1	102	01-03-2018	02-03-2018	2018-01-03	2018-02-03
8	8	1	102	01-03-2018	02-03-2018	2018-01-03	2018-02-03
9	9	1	102	01-03-2018	02-03-2018	2018-01-03	2018-02-03
10	11	1	102	01-03-2018	02-03-2018	2018-01-03	2018-02-03
11	12	2	105	12-12-2017	01-12-2018	2017-12-12	2018-01-12
12	10	2	105	12-12-2017	01-12-2017	2017-12-12	2017-01-12

tbl_borrowers

borrower_CardNo	borrower_BorrowerName	borrower_BorrowerAddress	borrower_BorrowerPhone
100	Joe Smith	1321 4th Street, New York, NY 10014	212-312-1234
101	Jane Smith	1321 4th Street, New York, NY 10014	212-931-4124
102	Tom Li	981 Main Street, Ann Arbor, MI 48104	734-902-7455
103	Angela Thompson	2212 Green Avenue, Ann Arbor, MI 48104	313-591-2122
104	Harry Emnace	121 Park Drive, Ann Arbor, MI 48104	412-512-5522
105	Tom Haverford	23 75th Street, New York, NY 10014	212-631-3418
106	Haley Jackson	231 52nd Avenue New York, NY 10014	212-419-9935
107	Michael Horford	653 Glen Avenue, Ann Arbor, MI 48104	734-998-1513
NULL	NULL	NULL	NULL

tbl_library_branch

library_branch_BranchID	library_branch_BranchName	library_branch_BranchAddress
1	Sharpstown	32 Corner Road
2	Central	491 3rd Street
3	Saline	40 State Street
4	Ann Arbor	101 South University
NULL	NULL	NULL

tbl_publisher

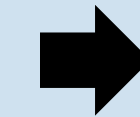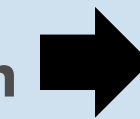| publisher_PublisherName	publisher_PublisherAddress	publisher_PublisherPhone
Alfred A. Knopf	The Knopf Doubleday Group Domestic Rights, 1...	212-940-7390
Bantam	375 Hudson Street, New York, NY 10014	212-366-2000
Bloomsbury	Bloomsbury Publishing Inc., 1385 Broadway, 5t...	212-419-5300
Chalto & Windus	375 Hudson Street, New York, NY 10014	212-366-2000
Chilton Books	Not Available	Not Available
DAW Books	375 Hudson Street, New York, NY 10014	212-366-2000
George Allen & Unwin	83 Alexander Ln, Crows Nest NSW 2065, Australia	-8466
Harcourt Brace Jovanovich	3 Park Ave, New York, NY 10016	212-420-5800
Harper and Row	HarperCollins Publishers, 195 Broadway, New Y...	212-207-7000
Pan Books	175 Fifth Avenue, New York, NY 10010	646-307-5745
Picador USA	175 Fifth Avenue, New York, NY 10010	646-307-5745
Scholastic	557 Broadway, New York, NY 10012	800-724-6527

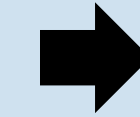# ER DIAGRAM
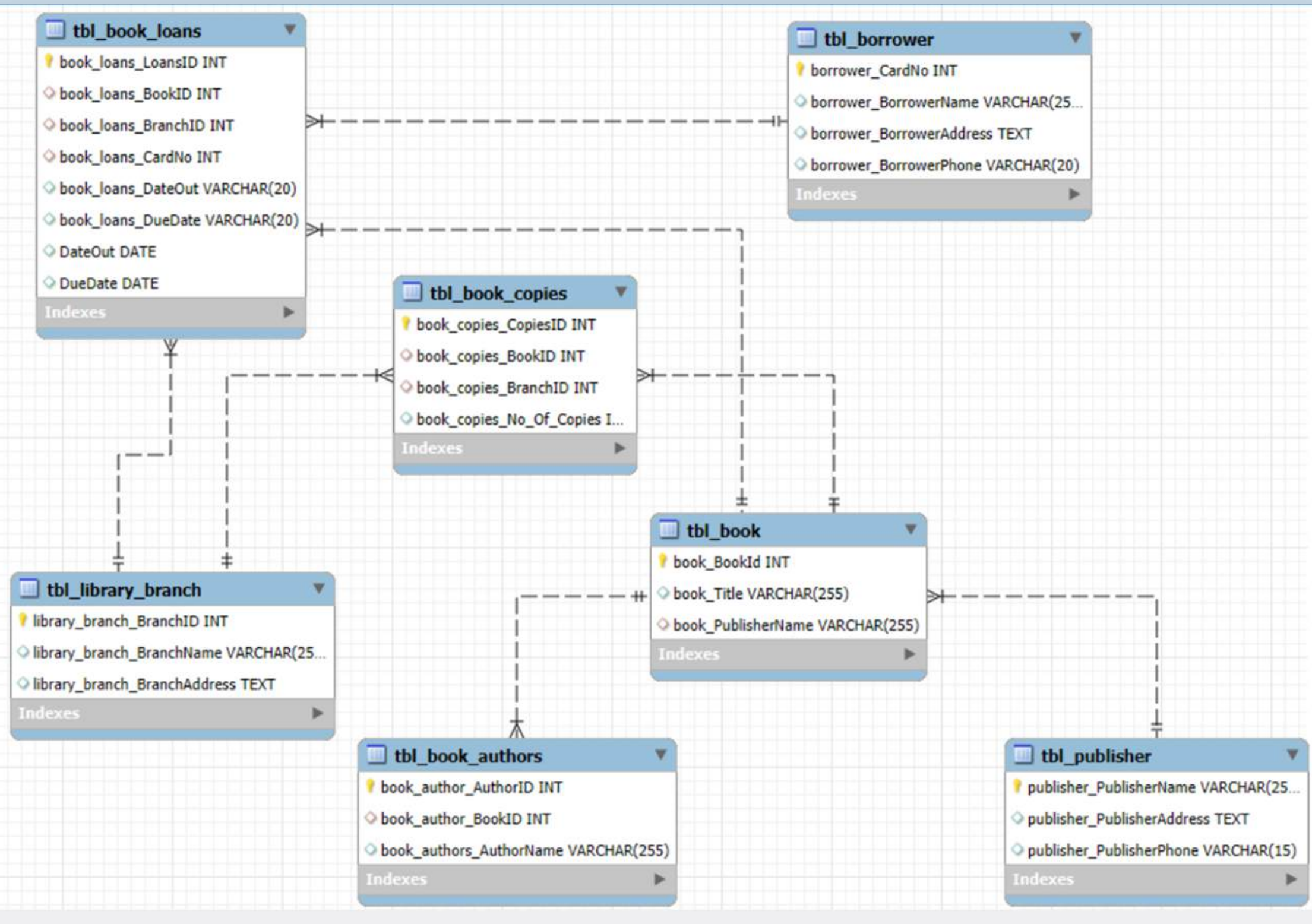
Parent Table	Child Table
tbl_book	tbl_book_loans , tbl_book_copies , tbl_book_authors
tbl_library_branch	tbl_book_loans , tbl_book_copies
tbl_borrower	tbl_book_loans
tbl_publisher	tbl_book

tbl_book_loans
- book_loans_LoansID INT
- book_loans_BookID INT
- book_loans_BranchID INT
- book_loans_CardNo INT
- book_loans_DateOut VARCHAR(20)
- book_loans_DueDate VARCHAR(20)
- DateOut DATE
- DueDate DATE
- Indexes

tbl_borrower
- borrower_CardNo INT
- borrower_BorrowerName VARCHAR(25...
- borrower_BorrowerAddress TEXT
- borrower_BorrowerPhone VARCHAR(20)
- Indexes

tbl_book_copies
- book_copies_CopiesID INT
- book_copies_BookID INT
- book_copies_BranchID INT
- book_copies_No_Of_Copies I...
- Indexes

tbl_book
- book_BookId INT
- book_Title VARCHAR(255)
- book_PublisherName VARCHAR(255)
- Indexes

tbl_library_branch
- library_branch_BranchID INT
- library_branch_BranchName VARCHAR(25...
- library_branch_BranchAddress TEXT
- Indexes

tbl_book_authors
- book_author_AuthorID INT
- book_author_BookID INT
- book_authors_AuthorName VARCHAR(255)
- Indexes

tbl_publisher
- publisher_PublisherName VARCHAR(25...
- publisher_PublisherAddress TEXT
- publisher_PublisherPhone VARCHAR(15)
- Indexes

INNOMATICS RESEARCH LABS

How many copies of the book titled "The Lost Tribe" are owned by the library branch whose name is "Sharpstown"?

```sql
SELECT bk.book_title , lb.library_branch_BranchName , count(*) no_of_copies
FROM tbl_book bk
JOIN
tbl_book_copies bc
ON bk.book_BookId = bc.book_copies_BookID
JOIN
tbl_library_branch lb
ON lb.library_branch_BranchID = bc.book_copies_BranchID
WHERE bk.book_Title =
    (SELECT book_Title FROM tbl_book
     WHERE book_Title = 'The Lost Tribe')
AND lb.library_branch_BranchName =
    (SELECT library_branch_BranchName FROM tbl_library_branch
     WHERE library_branch_BranchName = 'Sharpstown')
GROUP BY bk.book_Title , lb.library_branch_BranchName;
```

OUTPUT :

book_title	library_branch_BranchName	no_of_copies
The Lost Tribe	Sharpstown	1

OBSERVATION :

- Branch Sharpstown with the book title The Lost Tribe has only 1 copy.

How many copies of the book titled "The Lost Tribe" are owned by each library branch?

```sql
SELECT lb.library_branch_BranchName , count(*) no_of_copies
FROM tbl_book bk
JOIN
tbl_book_copies bc
ON bk.book_BookId = bc.book_copies_BookID
JOIN
tbl_library_branch lb
ON lb.library_branch_BranchID = bc.book_copies_BranchID
WHERE bk.book_Title =
    (SELECT book_Title FROM tbl_book
     WHERE book_Title = 'The Lost Tribe')
GROUP BY lb.library_branch_BranchName;
```

OUTPUT :

library_branch_BranchName	no_of_copies
Sharpstown	1
Central	1
Saline	1
Ann Arbor	1

OBSERVATION :

- Each library branch holds only one copy of the book titled The Lost Tribe

INNOMATICS
RESEARCH LABS

Retrieve the names of all borrowers who do not have any books checked out.

```sql
SELECT borrower_BorrowerName
FROM
tbl_borrower
WHERE borrower_CardNo NOT IN
    (SELECT
    DISTINCT book_loans_CardNo
    FROM tbl_book_loans);
```

OUTPUT :

borrower_BorrowerName
Jane Smith

OBSERVATION :

- Jane Smith has not borrowed any books to date.

INNOMATICS
RESEARCH LABS

For each book that is loaned out from the "Sharpstown" branch and whose DueDate is 3/2/18 , retrieve the book title, the borrower's name, and the borrower's address.

```sql
SELECT bk.book_Title , br.borrower_BorrowerName , br.borrower_BorrowerAddress
FROM tbl_book_loans bl
JOIN
tbl_library_branch lb
ON bl.book_loans_BranchID = lb.library_branch_BranchID
JOIN
tbl_book bk
ON bl.book_loans_BookID = bk.book_BookID
JOIN
tbl_borrower br
ON bl.book_loans_CardNo = br.borrower_CardNo
WHERE
lb.library_branch_BranchName = 'Sharpstown'
AND
bl.DueDate = '2018-02-03';
```

OBSERVATION :

- **Tom Li has only purchased from branch Sharpstown on duedate 3/2/18**

OUTPUT :

book_Title	borrower_BorrowerName	borrower_BorrowerAddress
The Hobbit	Tom Li	981 Main Street, Ann Arbor, MI 48104
Eragon	Tom Li	981 Main Street, Ann Arbor, MI 48104
A Wise Mans Fear	Tom Li	981 Main Street, Ann Arbor, MI 48104
Harry Potter and the Philosophers Stone	Tom Li	981 Main Street, Ann Arbor, MI 48104
Hard Boiled Wonderland and The End of the World	Tom Li	981 Main Street, Ann Arbor, MI 48104
The Hitchhikers Guide to the Galaxy	Tom Li	981 Main Street, Ann Arbor, MI 48104

Books Loaned by Author and Branch

```sql
SELECT
    ba.book_authors_AuthorName AS Author,
    lb.library_branch_BranchName AS Branch,
    COUNT(*) AS BooksLoaned
FROM
    tbl_book_loans bl
JOIN
    tbl_book b ON bl.book_loans_BookID = b.book_BookId
JOIN
    tbl_book_authors ba ON b.book_BookId = ba.book_author_BookID
JOIN
    tbl_library_branch lb ON bl.book_loans_BranchID = lb.library_branch_BranchID
GROUP BY
    ba.book_authors_AuthorName, lb.library_branch_BranchName
ORDER BY
    BooksLoaned DESC;
```
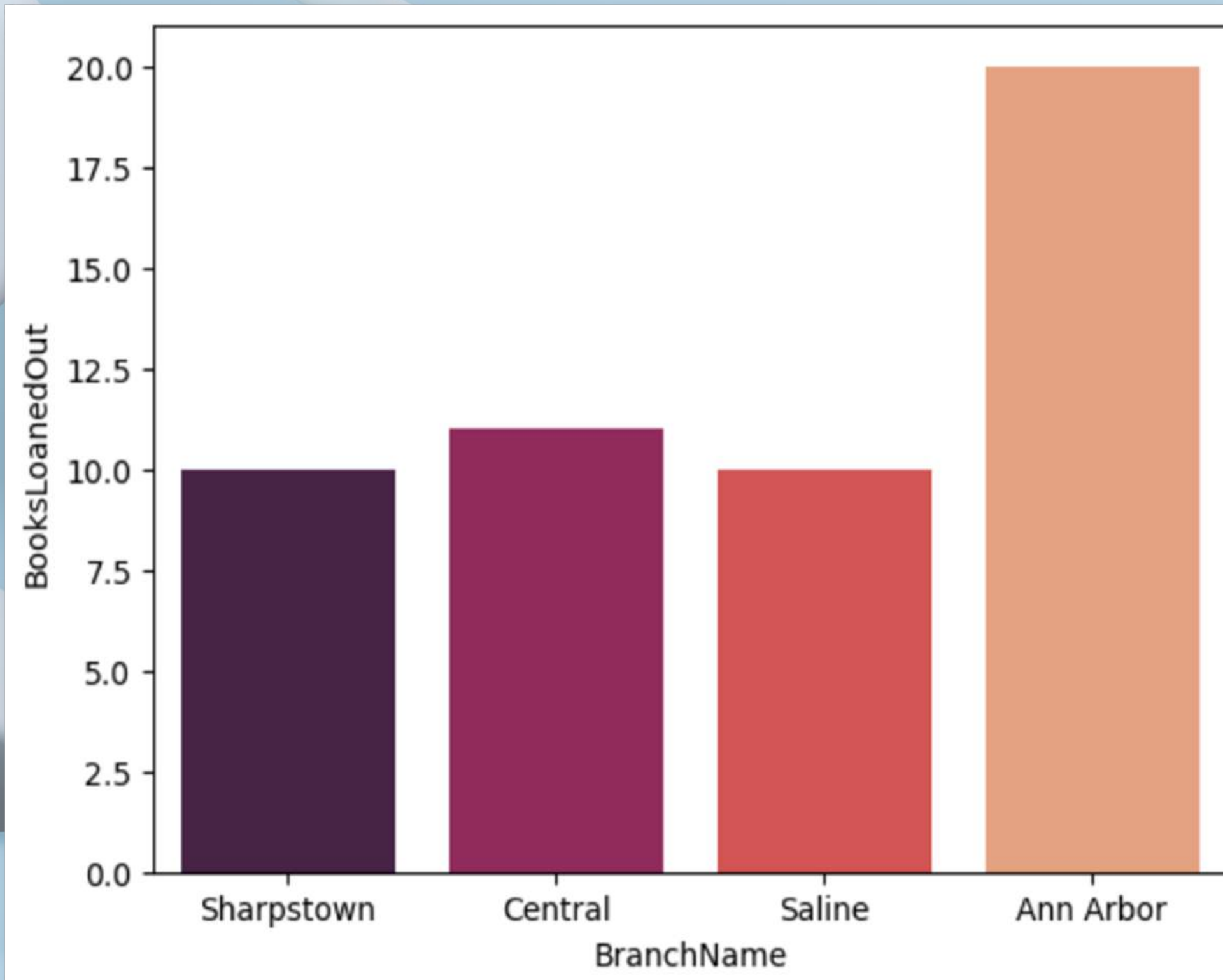
OUTPUT :

Author	Branch	BooksLoaned
Patrick Rothfuss	Ann Arbor	4
Patrick Rothfuss	Sharpstown	2
Stephen King	Sharpstown	2
Stephen King	Central	2
Stephen King	Ann Arbor	2
Frank Herbert	Ann Arbor	2
J.R.R. Tolkien	Central	2
Haruki Murakami	Ann Arbor	2
Douglas Adams	Ann Arbor	2
Aldous Huxley	Ann Arbor	2
William Goldman	Saline	2
Louis Sachar	Saline	2
J.K. Rowling	Saline	2
J.R.R. Tolkien	Ann Arbor	2
George R.R. M...	Central	2
Mark Lee	Ann Arbor	2
Patrick Rothfuss	Central	1
Frank Herbert	Sharpstown	1
Frank Herbert	Saline	1
J.R.R. Tolkien	Sharpstown	1

OBSERVATION :

- At the Ann Arbor branch,
  Patrick Rothfuss is the most borrowed
  author, with a total of 4 book loans.

For each library branch, retrieve the branch name and the total number of books loaned out from that branch.
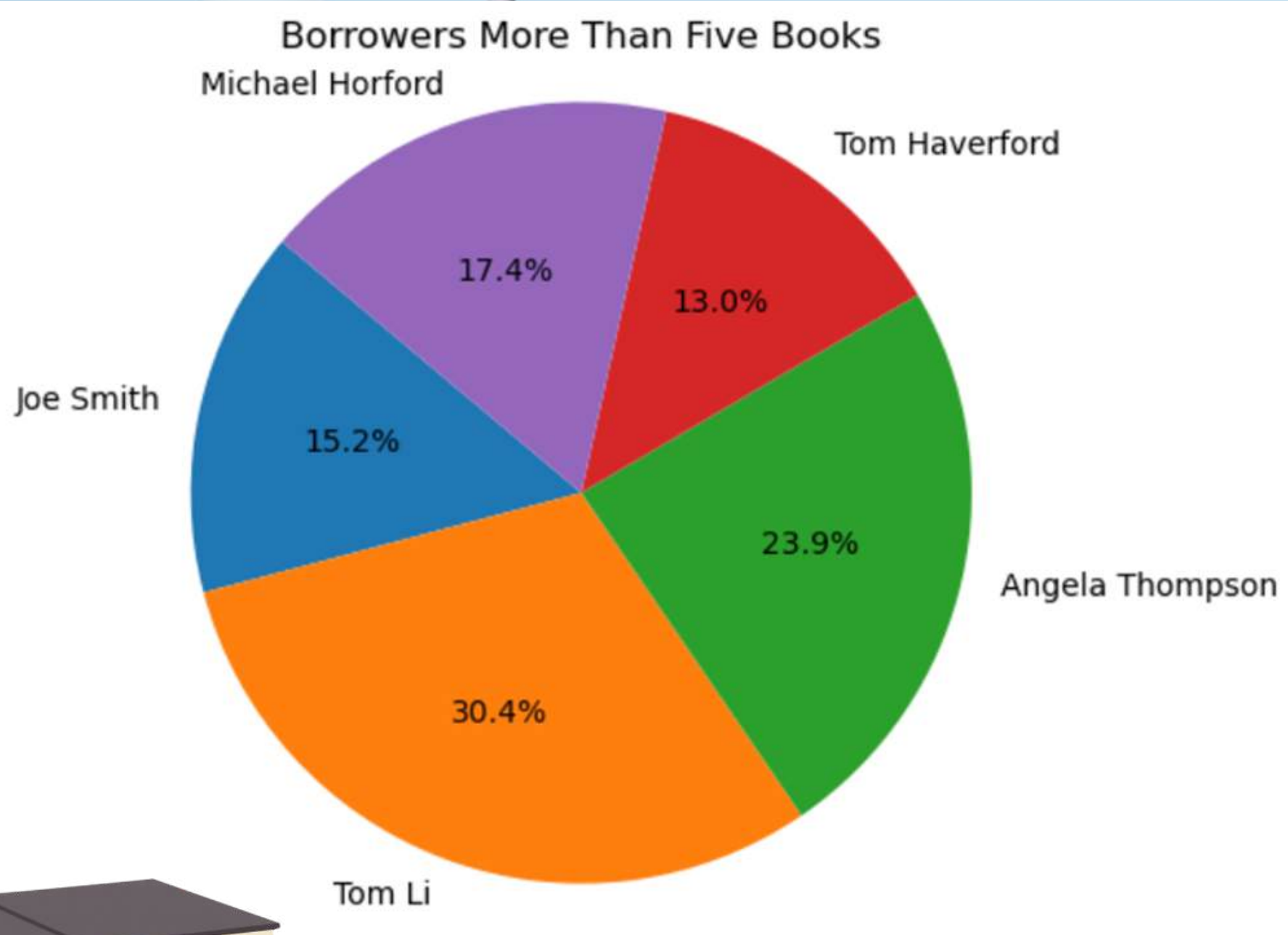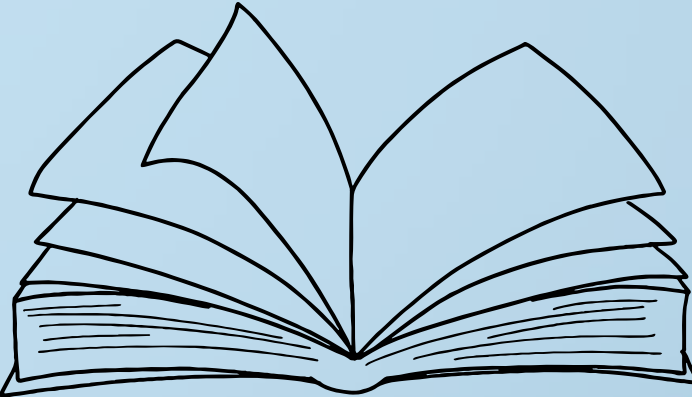

QUERY :

```sql
SELECT lb.library_branch_BranchName , count(*) books_loaned_out
FROM
tbl_book_loans bl
JOIN
tbl_library_branch lb
ON bl.book_loans_BranchID = lb.library_branch_BranchID
GROUP BY lb.library_branch_BranchName;
```

OUTPUT :

library_branch_BranchName	books_loaned_out
Sharpstown	10
Central	11
Saline	10
Ann Arbor	20

Retrieve the names, addresses, and number of books checked out for all borrowers who have more than five books checked out.

Borrowers More Than Five Books

Michael Horford — 17.4%
Tom Haverford — 13.0%
Joe Smith — 15.2%
Angela Thompson — 23.9%
Tom Li — 30.4%

QUERY :

```
SELECT br.borrower_BorrowerName , br.borrower_BorrowerAddress ,
count(*) book_count_more_than_five
FROM
tbl_book_loans bl
JOIN
tbl_borrower br
ON bl.book_loans_CardNo = br.borrower_CardNo
GROUP BY br.borrower_BorrowerName , br.borrower_BorrowerAddress
HAVING book_count_more_than_five > 5;
```

OUTPUT :

borrower_BorrowerName	borrower_BorrowerAddress	book_count_more_than_five
Joe Smith	1321 4th Street, New York, NY 10014	7
Tom Li	981 Main Street, Ann Arbor, MI 48104	14
Angela Thompson	2212 Green Avenue, Ann Arbor, MI 48104	11
Tom Haverford	23 75th Street, New York, NY 10014	6
Michael Horford	653 Glen Avenue, Ann Arbor, MI 48104	8

INNOMATICS
RESEARCH LABS

For each book authored by "Stephen King", retrieve the title and the number of copies owned by the library branch whose name is "Central".

```sql
SELECT bk.book_Title , count(*) count
FROM
tbl_book bk
JOIN
tbl_book_authors ba
ON bk.book_BookId = ba.book_author_BookID
JOIN
tbl_book_copies bc
ON bk.book_BookId = bc.book_copies_BookID
JOIN
tbl_library_branch lb
ON bc.book_copies_BranchID = lb.library_branch_BranchID
WHERE ba.book_authors_AuthorName = 'Stephen King'
AND lb.library_branch_BranchName = 'Central'
GROUP BY bk.book_Title;
```

OUTPUT :

book_Title	count
It	1
The Green Mile	1

OBSERVATION :

- The books It and The Green Mile, both authored by Stephen King, have one copy each available at the Central branch.

INNOMATICS
RESEARCH LABS

Popular Books Loaned By Branches

```sql
SELECT
    lb.library_branch_BranchName AS Branch,
    b.book_Title AS BookTitle,
    COUNT(*) AS TimesLoaned
FROM
    tbl_book_loans bl
JOIN
    tbl_book b ON bl.book_loans_BookID = b.book_BookId
JOIN
    tbl_library_branch lb ON bl.book_loans_BranchID = lb.library_branch_BranchID
GROUP BY
    lb.library_branch_BranchName, b.book_Title
ORDER BY
    TimesLoaned DESC;
```

OUTPUT :

Branch	BookTitle	TimesLoaned
Ann Arbor	The Name of the Wind	4
Ann Arbor	Dune	2
Central	A Game of Thrones	2
Saline	Holes	2
Saline	The Princess Bride	2
Ann Arbor	The Lost Tribe	2
Ann Arbor	The Green Mile	2
Ann Arbor	The Fellowship of the Ring	2
Ann Arbor	Brave New World	2
Ann Arbor	The Hitchhikers Guide to the Galaxy	2
Ann Arbor	Hard Boiled Wonderland and The E...	2

TOP 5 Most Popular Books Loaned By Branch

Top 5 Most Popular Books Loaned by Branch
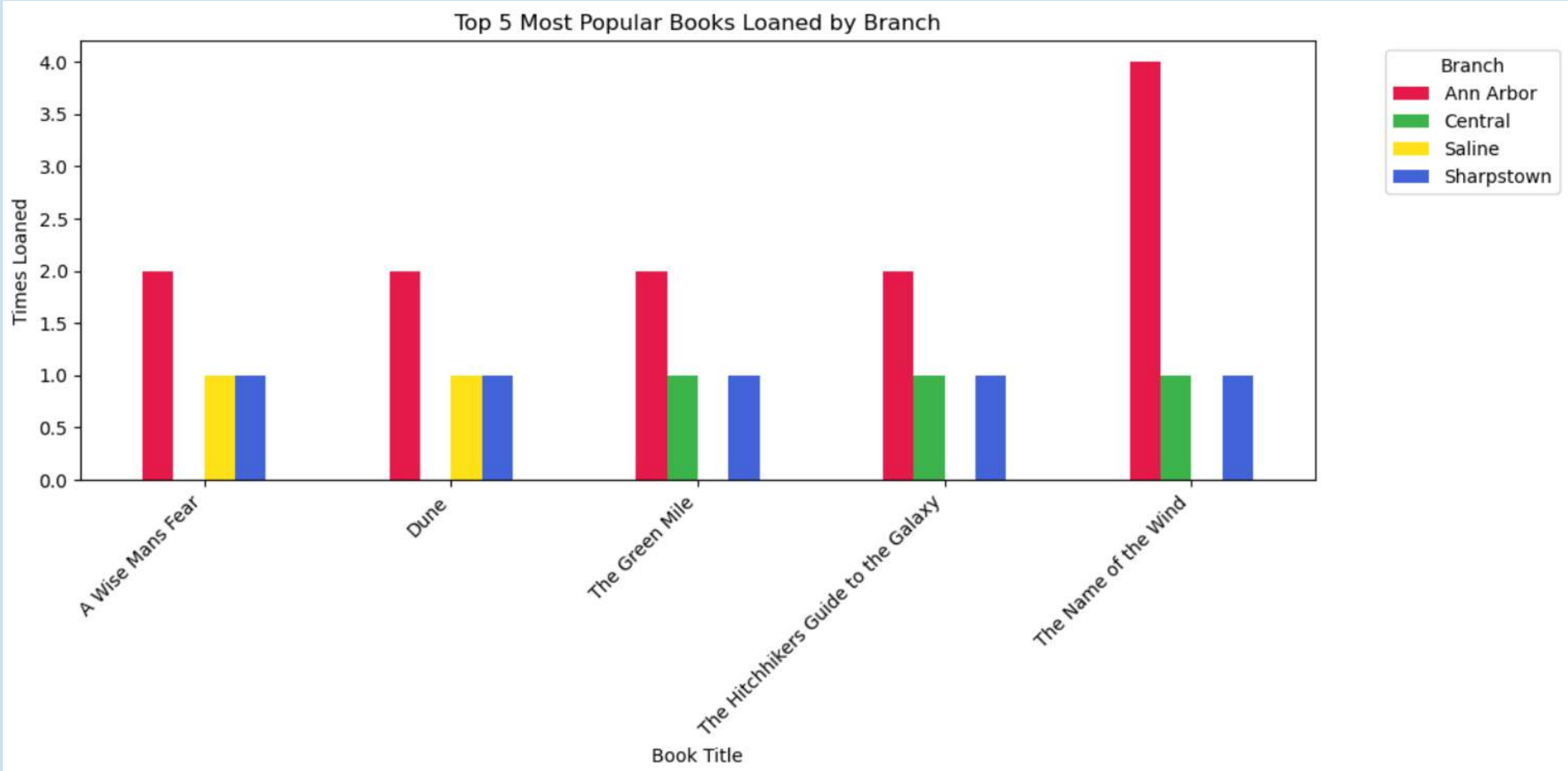
Final Business Insights

High Loan Activity in January 2018

- Most book loans occurred in January 2018, suggesting a strong seasonal borrowing pattern aligned with academic or calendar cycles.

Loan Activity is Inconsistent Across Months

- Post-January months like February 2019 show low engagement, possibly due to operational changes, data gaps, or lack of new inventory.

Branch-Wise Performance Varies

- Certain branches like Ann Arbor consistently show higher loan volumes, while others like Sharpstown , Central or Saline remain underutilized.

CONCLUSION

This project analyzed a library management database using SQL and Python to uncover patterns in book loans, branch activity, and author popularity. Key insights like seasonal borrowing trends and branch-wise performance helped identify areas for inventory optimization and improved user engagement.

CHALLENGES

- While importing data into the tbl_book_loans table, the DateOut and DueDate columns failed to import due to inconsistent date formats (e.g., MM/DD/YY). To resolve this, I initially changed the column data type to VARCHAR to allow successful import of raw date strings.

- After importing the data, I used the STR_TO_DATE() function in MySQL to convert the string values into proper DATE format and stored them in new DATE columns.

- And some difficulties faced while merging two or more tables using JOIN .

QUESTIONS

Thank You