1. Tables

CREATE TABLE Borrower(

BorrowerID CHAR(5) PRIMARY KEY,

BorrowerEmail VARCHAR(100) NOT NULL UNIQUE,

BorrowerName VARCHAR(50) NOT NULL,

BorrowerAddress VARCHAR(100) NOT NULL,

BorrowerPhone VARCHAR(13) NOT NULL,

BorrowerDOB DATE NOT NULL

)

CREATE TABLE Employee(

EmployeeID CHAR(5) PRIMARY KEY,

EmployeePositionID CHAR(5) FOREIGN KEY REFERENCES EmployeePosition ON UPDATE CASCADE ON DELETE SET NULL,

EmployeeEmail VARCHAR(100) NOT NULL UNIQUE,

EmployeeName VARCHAR(50) NOT NULL,

EmployeeAddress VARCHAR(100) NOT NULL,

EmployeePhone VARCHAR(13) NOT NULL,

EmployeeDOB DATE NOT NULL

)

CREATE TABLE EmployeePosition(

EmployeePositionID CHAR(5) PRIMARY KEY,

EmployeePositionName VARCHAR(50) NOT NULL

)

CREATE TABLE Book(

BookID CHAR(5) PRIMARY KEY,

BookCategoryID CHAR(5) FOREIGN KEY REFERENCES BookCategory ON UPDATE CASCADE ON DELETE SET NULL,

BookTitle VARCHAR(50) NOT NULL,

BookAuthor VARCHAR(50) NOT NULL

)

CREATE TABLE BookCategory(

BookCategoryID CHAR(5) PRIMARY KEY,

BookCategoryName VARCHAR(50) NOT NULL

)

CREATE TABLE Locker(

LockerID CHAR(5) PRIMARY KEY,

LockerSize VARCHAR(5) NOT NULL

)

CREATE TABLE BorrowingHeader(

BorrowingID CHAR(5) PRIMARY KEY,

BorrowerID CHAR(5) FOREIGN KEY REFERENCES Borrower ON UPDATE CASCADE ON DELETE SET NULL,

EmployeeID CHAR(5) FOREIGN KEY REFERENCES Employee ON UPDATE CASCADE ON DELETE SET NULL,

BorrowingDate DATE NOT NULL,

ReturnDate DATE NOT NULL

)

CREATE TABLE BorrowingDetail(

BorrowingID CHAR(5) FOREIGN KEY REFERENCES BorrowingHeader ON UPDATE CASCADE ON DELETE CASCADE,

BookID CHAR(5) FOREIGN KEY REFERENCES Book ON UPDATE CASCADE ON DELETE CASCADE,

PRIMARY KEY(BorrowingID, BookID)

)

CREATE TABLE Visitation(

VisitationID CHAR(5) PRIMARY KEY,

BorrowerID CHAR(5) FOREIGN KEY REFERENCES Borrower ON UPDATE CASCADE ON DELETE SET NULL,

LockerID CHAR(5) FOREIGN KEY REFERENCES Locker ON UPDATE CASCADE ON DELETE SET NULL,

VisitDate DATE NOT NULL,

LockerBorrowingDate DATETIME,

LockerReturnDate DATETIME

)

1. Transaction Analysis
2. Create, Read, Update, and Delete borrower data
3. Create, Read, Update, and Delete employee data
4. Create, Read, Update, and Delete book data
5. Create, Read, Update, and Delete locker data
6. Borrowing books
7. Returning books
8. Visiting library
9. Borrowing locker

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Relation  Transaction | 1 | | | | 2 | | | | 3 | | | | 4 | | | |
| C | R | U | D | C | R | U | D | C | R | U | D | C | R | U | D |
| Borrower | v | v | v | v |  |  |  |  |  |  |  |  |  |  |  |  |
| Employee |  |  |  |  | v | v | v | v |  |  |  |  |  |  |  |  |
| EmployeePosition |  |  |  |  | v | v | v | v |  |  |  |  |  |  |  |  |
| Book |  |  |  |  |  |  |  |  | v | v | v | v |  |  |  |  |
| BookCategory |  |  |  |  |  |  |  |  | v | v | v | v |  |  |  |  |
| Locker |  |  |  |  |  |  |  |  |  |  |  |  | v | v | v | v |
| BorrowingHeader |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BorrowingDetail |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Visitation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Relation  Transaction | 5 | | | | 6 | | | | 7 | | | | 8 | | | |
| C | R | U | D | C | R | U | D | C | R | U | D | C | R | U | D |
| Borrower |  | v |  |  |  | v |  |  |  | v |  |  |  | v |  |  |
| Employee |  | v |  |  |  | v |  |  |  |  |  |  |  |  |  |  |
| EmployeePosition |  | v |  |  |  | v |  |  |  |  |  |  |  |  |  |  |
| Book |  | v |  |  |  | v |  |  |  |  |  |  |  |  |  |  |
| BookCategory |  | v |  |  |  | v |  |  |  |  |  |  |  |  |  |  |
| Locker |  |  |  |  |  |  |  |  |  | v |  |  |  | v |  |  |
| BorrowingHeader | v | v |  |  |  |  | v |  |  |  |  |  |  |  |  |  |
| BorrowingDetail | v | v |  |  |  |  | v |  |  |  |  |  |  |  |  |  |
| Visitation |  |  |  |  |  |  |  |  | v | v |  |  |  |  | v |  |

1. Creating indexes

CREATE UNIQUE INDEX ix\_borrower ON Borrower(BorrowerID)

CREATE UNIQUE INDEX ix\_employee ON Employee(EmployeeID)

CREATE UNIQUE INDEX ix\_employeeposition ON EmployeePosition(EmployeePositionID)

CREATE UNIQUE INDEX ix\_book ON Book(BookID)

CREATE UNIQUE INDEX ix\_bookcategory ON BookCategory(BookCategoryID)

CREATE UNIQUE INDEX ix\_locker ON Locker(LockerID)

CREATE UNIQUE INDEX ix\_Borrowingheader ON BorrowingHeader(BorrowingHeaderID)

CREATE UNIQUE INDEX ix\_Borrowingdetail ON BorrowingDetail(BorrowingDetailID)

CREATE UNIQUE INDEX ix\_visitation ON Visitation(VisitationID)

1. Storage Use Estimation

|  |  |  |  |
| --- | --- | --- | --- |
| Table | Attribute | Data Type | Size (byte(s)) |
| Borrower | BorrowerID | CHAR | 5 |
| BorrowerEmail | VARCHAR | 102 |
| BorrowerName | VARCHAR | 52 |
| BorrowerAddress | VARCHAR | 102 |
| BorrowerPhone | VARCHAR | 15 |
| BorrowerDOB | DATE | 3 |

|  |  |  |  |
| --- | --- | --- | --- |
| Table | Attribute | Data Type | Size (byte(s)) |
| Employee | EmployeeID | CHAR | 5 |
| EmployeePositionID | CHAR | 5 |
| EmployeeEmail | VARCHAR | 102 |
| EmployeeName | VARCHAR | 52 |
| EmployeeAddress | VARCHAR | 102 |
| EmployeePhone | VARCHAR | 15 |
| EmployeeDOB | DATE | 3 |

|  |  |  |  |
| --- | --- | --- | --- |
| Table | Attribute | Data Type | Size (byte(s)) |
| EmployeePosition | EmployeePositionID | CHAR | 5 |
| EmployeePositionName | VARCHAR | 52 |

|  |  |  |  |
| --- | --- | --- | --- |
| Table | Attribute | Data Type | Size (byte(s)) |
| Book | BookID | CHAR | 5 |
| BookCategoryID | CHAR | 5 |
| BookTitle | VARCHAR | 52 |
| BookAuthor | VARCHAR | 52 |

|  |  |  |  |
| --- | --- | --- | --- |
| Table | Attribute | Data Type | Size (byte(s)) |
| BookCategory | BookCategoryID | CHAR | 5 |
| BookCategoryName | VARCHAR | 52 |

|  |  |  |  |
| --- | --- | --- | --- |
| Table | Attribute | Data Type | Size (byte(s)) |
| Locker | LockerID | CHAR | 5 |
| LockerSize | VARCHAR | 7 |

|  |  |  |  |
| --- | --- | --- | --- |
| Table | Attribute | Data Type | Size (byte(s)) |
| BorrowingHeader | BorrowingID | CHAR | 5 |
| BorrowerID | CHAR | 5 |
| EmployeeID | CHAR | 5 |
| BorrowingDate | DATE | 3 |
| ReturnDate | DATE | 3 |

|  |  |  |  |
| --- | --- | --- | --- |
| Table | Attribute | Data Type | Size (byte(s)) |
| BorrowingDetail | BorrowingID | CHAR | 5 |
| BookID | CHAR | 5 |

|  |  |  |  |
| --- | --- | --- | --- |
| Table | Attribute | Data Type | Size (byte(s)) |
| Visitation | VisitationID | CHAR | 5 |
| BorrowerID | CHAR | 5 |
| LockerID | CHAR | 5 |
| VisitDate | DATE | 3 |
| LockerBorrowingDate | DATETIME | 8 |
| LockerReturnDate | DATETIME | 8 |

Total storage used: 868 bytes

1. Security Mechanism

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Relation  Transaction | Admin | | | | Borrowing | | | | Returning | | | | Visiting | | | |
| C | R | U | D | C | R | U | D | C | R | U | D | C | R | U | D |
| Borrower | v | v | v | v |  | v |  |  |  |  |  |  |  |  |  |  |
| Employee | v | v | v | v |  | v |  |  |  |  |  |  |  |  |  |  |
| EmployeePosition | v | v | v | v |  | v |  |  |  |  |  |  |  |  |  |  |
| Book | v | v | v | v |  | v |  |  |  |  |  |  |  |  |  |  |
| BookCategory | v | v | v | v |  | v |  |  |  |  |  |  |  |  |  |  |
| Locker | v | v | v | v |  | v |  |  |  |  |  |  |  |  |  |  |
| BorrowingHeader |  |  |  | v | v | v |  |  |  |  | v |  |  |  |  |  |
| BorrowingDetail |  |  |  | v | v | v |  |  |  |  | v |  |  |  |  |  |
| Visitation |  |  |  | v |  |  |  |  |  |  |  |  | v | v | v |  |