Introduction: The goal of this section is to turn our previous diagram into a more concrete definition so that we can create a database for a library. The system will be able to manage users, the checking out of books, manage inventory, apply late fees, and more.

Relational Schema Mapping:

* Book Borrowing
  + Client Id, item id, borrowed date, due date, return date
* Magazine Borrowing
  + Client id, item id, borrowed date, due date, return date
* Digital Media Borrowing
  + Client id, item id, borrowed date, due date, return date

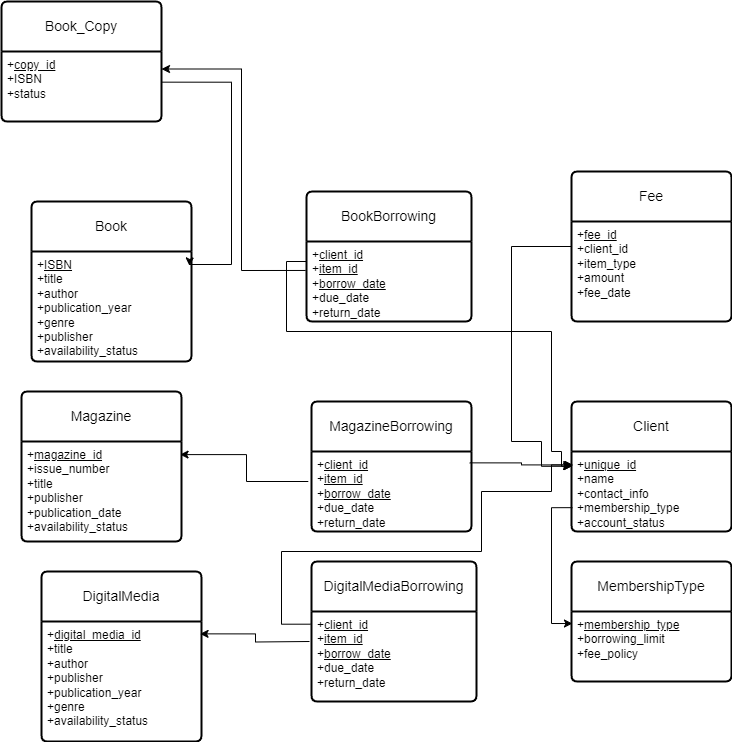
Determine Primary Keys:

* Book
  + ISBN
* Book Copy
  + copy\_ID
* Book borrowing:
  + Client id, item id, borrow date
* Magazine borrowing:
  + Client id, item id, borrow date
* Digital Media borrowing:
  + Client id, item id, borrow date
* Magazine
  + Magazine ID
* Digital Media
  + digital\_media\_id
* Membership type
  + membership\_type
* Client
  + Unique\_id
* Fee
  + Fee\_id, client\_id

Establish Foreign Keys:

* Book:
  + No foreign keys
* Book Copy:
  + ISBN
* Book borrowing:
  + Client id, item id
* Magazine borrowing:
  + Client id, item id
* Digital Media borrowing:
  + Client id, item id
* Magazine:
  + No foreign keys
* Digital Media:
  + No foreign keys
* Membership type:
  + No foreign keys
* Client:
  + membership\_type
* Fee:
  + Client\_id

Schema Documentation:

* Relational Schema Diagram
* 
* Data Dictionary

| Book | | | |
| --- | --- | --- | --- |
| Attribute Name | Data Type | Domain | Constraints |
| ISBN | VARCHAR | Valid ISBN Format | Primary Key |
| title | VARCHAR | String up to 255 characters | Not Null |
| author | VARCHAR | String up to 255 characters | Not Null |
| publication\_year | INT | Positive Integer | CHECK (publication\_year>0) |
| genre | VARCHAR | String up to 100 characters |  |
| publisher | VARCHAR | String up to 255 characters |  |

| Book\_Copy | | | |
| --- | --- | --- | --- |
| Attribute Name | Data Type | Domain | Constraints |
| copy\_id | SERIAL | Sequential integer starting from 1 | Primary Key |
| ISBN | VARCHAR | Valid ISBN Format, String references Book.ISBN | Foreign Key, Not Null |
| status | VARCHAR | String from list of values | DEFAULT ’Available’, CHECK(status IN ('Available', 'Borrowed', 'Reserved', 'Lost', 'Maintenance')) |

| DigitalMedia | | | |
| --- | --- | --- | --- |
| Attribute Name | Data Type | Domain | Constraints |
| digital\_media\_id | SERIAL | Sequential integer starting from 1 | Primary Key |
| title | VARCHAR | String up to 255 characters | Not Null |
| author | VARCHAR | String up to 255 characters | Not Null |
| publisher | VARCHAR | String up to 255 characters | Not Null |
| publication\_year | INT | Positive Integer | CHECK (publication\_year>0) |
| availability\_status | VARCHAR | String from list of values | DEFAULT ‘Available’, CHECK (availability\_status IN ('Available', 'Borrowed', 'Reserved')) |
| genre | VARCHAR | String up to 100 characters |  |

| Magazine | | | |
| --- | --- | --- | --- |
| Attribute Name | Data Type | Domain | Constraints |
| magazine\_id | SERIAL | Sequential integer starting from 1 | Primary Key |
| issue\_number | INT | Positive Integer | Not Null, CHECK(issue\_number>0) |
| title | VARCHAR | String up to 255 characters | Not Null |
| publisher | VARCHAR | String up to 255 characters | Not Null |
| publication\_date | DATE | Date in the “YYYY-MM-DD” Format |  |
| availability\_status | VARCHAR | String from list of values | DEFAULT ‘Available’, CHECK (availability\_status IN ('Available', 'Borrowed', 'Reserved')) |

| MembershipType | | | |
| --- | --- | --- | --- |
| Attribute Name | Data Type | Domain | Constraints |
| membership\_type | VARCHAR | String up to 100 characters | Primary Key |
| borrowing\_limit | INT | Positive Integer | Not Null, CHECK(borrowing\_limit>0) |
| fee\_structure | VARCHAR | String up to 255 characters |  |

| Client | | | |
| --- | --- | --- | --- |
| Attribute Name | Data Type | Domain | Constraints |
| unique\_id | SERIAL | Sequential integer starting from 1 | Primary Key |
| name | VARCHAR | String up to 255 characters | Not Null |
| contact\_info | VARCHAR | String up to 255 characters |  |
| membership\_type | VARCHAR | String that references MembershipType.membership\_type | Foreign Key, Not Null |
| account\_status | VARCHAR | String from list of values | Not Null, CHECK (account\_status IN ('Active', 'Suspended', 'Expired')) |

| BookBorrowing | | | |
| --- | --- | --- | --- |
| Attribute Name | Data Type | Domain | Constraints |
| client\_id | INT | integer referencing Client.unique\_id | Primary Key, Foreign Key, Not Null |
| item\_id | INT | integer referencing Book\_Copy.copy\_id | Primary Key, Foreign Key, Not Null |
| borrow\_date | DATE | Date in the "YYYY-MM-DD" Format | Primary Key, Not Null |
| due\_date | DATE | Date in the "YYYY-MM-DD" Format | Not Null |
| return\_date | DATE | Date in the "YYYY-MM-DD" Format |  |

| DigitalMediaBorrowing | | | |
| --- | --- | --- | --- |
| Attribute Name | Data Type | Domain | Constraints |
| client\_id | INT | integer referencing Client.unique\_id | Primary Key, Foreign Key, Not Null |
| item\_id | INT | integer referencing DigitalMedia.digital\_media\_id | Primary Key, Foreign Key, Not Null |
| borrow\_date | DATE | Date in the "YYYY-MM-DD" Format | Primary Key, Not Null |
| due\_date | DATE | Date in the "YYYY-MM-DD" Format | Not Null |
| returrn\_date | DATE | Date in the "YYYY-MM-DD" Format |  |

| MagazineBorrowing | | | |
| --- | --- | --- | --- |
| Attribute Name | Data Type | Domain | Constraints |
| client\_id | INT | integer referencing Client.unique\_id | Primary Key, Foreign Key, Not Null |
| item\_id | INT | integer referencing Magazine.magazine\_id | Primary Key, Foreign Key, Not Null |
| borrow\_date | DATE | Date in the "YYYY-MM-DD" Format | Primary Key, Not Null |
| due\_date | DATE | Date in the "YYYY-MM-DD" Format | Not Null |
| returrn\_date | DATE | Date in the "YYYY-MM-DD" Format |  |

| Fee | | | |
| --- | --- | --- | --- |
| Attribute Name | Data Type | Domain | Constraints |
| fee\_id | SERIAL | Sequential integer starting from 1 | Primary Key |
| client\_id | INT | integer referencing Client.unique\_id | Foreign Key, Not Null |
| item\_type | VARCHAR | String up to 50 characters | Not Null, CHECK (item\_type in ('book','digital media','magazine')) |
| amount | DECIMAL | Positive decimal number | Not Null, CHECK (amount > 0) |
| fee\_date | DATE | Date in the "YYYY-MM-DD" Format | Not Null |

Generate DDL:

CREATE TABLE Book (

ISBN VARCHAR(20) PRIMARY KEY,

title VARCHAR(255) NOT NULL,

author VARCHAR(255) NOT NULL,

publication\_year INT CHECK (publication\_year > 0),

genre VARCHAR(100),

publisher VARCHAR(255)

);

CREATE TABLE Book\_Copy (

copy\_id SERIAL PRIMARY KEY,

ISBN VARCHAR(20) NOT NULL,

status VARCHAR(20) DEFAULT 'Available' CHECK (status IN ('Available', 'Borrowed', 'Reserved', 'Lost', 'Maintenance')),

FOREIGN KEY (ISBN) REFERENCES Book(ISBN)

);

CREATE TABLE DigitalMedia (

digital\_media\_id SERIAL PRIMARY KEY,

title VARCHAR(255) NOT NULL,

author VARCHAR(255) NOT NULL,

publisher VARCHAR(255) NOT NULL,

publication\_year INT CHECK (publication\_year > 0),

genre VARCHAR(100),

availability\_status VARCHAR(20) DEFAULT 'Available' CHECK (availability\_status IN ('Available', 'Borrowed', 'Reserved'))

);

CREATE TABLE Magazine (

magazine\_id SERIAL PRIMARY KEY,

issue\_number INT NOT NULL CHECK(issue\_number > 0),

title VARCHAR(255) NOT NULL,

publisher VARCHAR(255) NOT NULL,

publication\_date DATE,

availability\_status VARCHAR(20) DEFAULT 'Available' CHECK (availability\_status IN ('Available', 'Borrowed', 'Reserved'))

);

CREATE TABLE MembershipType (

membership\_type VARCHAR(100) PRIMARY KEY,

borrowing\_limit INT NOT NULL CHECK(borrowing\_limit>0),

fee\_structure VARCHAR(255)

);

CREATE TABLE Client (

unique\_id SERIAL PRIMARY KEY,

name VARCHAR(255) NOT NULL,

contact\_info VARCHAR(255),

membership\_type VARCHAR(100) NOT NULL,

account\_status VARCHAR(20) NOT NULL CHECK (account\_status IN ('Active', 'Suspended', 'Expired')),

FOREIGN KEY (membership\_type) REFERENCES MembershipType(membership\_type)

);

CREATE TABLE BookBorrowing (

client\_id INT NOT NULL,

item\_id INT NOT NULL, -- copy\_id from Book\_Copy

borrow\_date DATE NOT NULL,

due\_date DATE NOT NULL,

return\_date DATE,

PRIMARY KEY (client\_id, item\_id, borrow\_date),

FOREIGN KEY (client\_id) REFERENCES Client(unique\_id),

FOREIGN KEY (item\_id) REFERENCES Book\_Copy(copy\_id)

);

CREATE TABLE DigitalMediaBorrowing (

client\_id INT NOT NULL,

item\_id INT NOT NULL, -- digital\_media\_id

borrow\_date DATE NOT NULL,

due\_date DATE NOT NULL,

return\_date DATE,

PRIMARY KEY (client\_id, item\_id, borrow\_date),

FOREIGN KEY (client\_id) REFERENCES Client(unique\_id),

FOREIGN KEY (item\_id) REFERENCES DigitalMedia(digital\_media\_id)

);

CREATE TABLE MagazineBorrowing (

client\_id INT NOT NULL,

item\_id INT NOT NULL, -- magazine\_id

borrow\_date DATE NOT NULL,

due\_date DATE NOT NULL,

return\_date DATE,

PRIMARY KEY (client\_id, item\_id, borrow\_date),

FOREIGN KEY (client\_id) REFERENCES Client(unique\_id),

FOREIGN KEY (item\_id) REFERENCES Magazine(magazine\_id)

);

CREATE TABLE Fee (

fee\_id SERIAL PRIMARY KEY,

client\_id INT NOT NULL,

item\_type VARCHAR(50) NOT NULL CHECK (item\_type in (‘book’, ‘digital\_media’, ‘magazine’)),

amount DECIMAL(10, 2) NOT NULL CHECK (amount > 0),

fee\_date DATE NOT NULL,

FOREIGN KEY (client\_id) REFERENCES Client(unique\_id)

);

Normalization Considerations: While normalization is not required right now, we must consider normalization since there is a bit of redundancy with tables having repeated publisher and author categories and the borrowing tables having some repeated values, creating unique queries could cause an overlap with these categories.

Appendices:

* There is currently no addition needed here, but it will be updated as required.

Github Repository Management:

* A new path was added for the Logical Relational Schema Design to easily separate this document from previous documents
* The file was also uploaded into the documents of the repository.

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