Task A: Third Normal Form Normalization Report

### Introduction

This document outlines the process of normalizing the existing database schema into Third Normal Form (3NF). Each table is analyzed for compliance with 3NF principles, which include the elimination of functional dependencies on non-key attributes and the removal of transitive dependencies.

### 1. User Table

* Original Structure:
  + Primary Key: user\_id
  + Attributes: user\_password, name, email, owned\_books, address (for Customer subclass), salary (for Employee subclass)
* Issues Identified:
  + Subclass attributes (owned\_books, address) in the User table do not relate to all users.
* Normalization Steps:
  + Separate Customer and Employee into their own tables linked by user\_id.
* Final Structure:
  + User Table: user\_id (PK), user\_password, name, email
  + Customer Table: user\_id (FK), owned\_books, address
  + Employee Table: user\_id (FK), salary

### 2. Order Table

* Original Structure:
  + Primary Key: order\_id
  + Foreign Keys: customer\_id, book\_id
  + Attributes: quantity, total\_price, order\_date
* Issues Identified:
  + Total\_price potentially a calculated field.
* Normalization Steps:
  + Remove total\_price if it is calculated from quantity and book price.
* Final Structure:
  + Order Table: order\_id (PK), customer\_id (FK), book\_id (FK), quantity, order\_date

### 3. Supplier Table

* Original Structure:
  + Primary Key: supplier\_id
  + Foreign Key: book\_id
  + Attributes: price, quantity
* Issues Identified:
  + Possible many-to-many relationship between suppliers and books not adequately represented.
* Normalization Steps:
  + Create a Supplier\_Book junction table if multiple suppliers can supply the same book.
* Final Structure:
  + Supplier Table: supplier\_id (PK)
  + Supplier\_Book Table: supplier\_id (FK), book\_id (FK), price, quantity

### 4. Book Table

* Original Structure:
  + Primary Key: book\_id
  + Attributes: Price, age\_rating, genre, quantity\_available, quantity\_sold, title, author\_id
* Issues Identified:
  + Potential many-to-many relationship between books and authors.
* Normalization Steps:
  + Create a Book\_Author table if a book can have multiple authors.
* Final Structure:
  + Book Table: book\_id (PK), Price, age\_rating, genre, quantity\_available, title
  + Book\_Author Table: book\_id (FK), author\_id (FK)

### 5. Owned\_By Table

* Original Structure:
  + Foreign Keys: book\_id, user\_id
* Issues Identified:
  + None. This table is already in 3NF.
* Normalization Steps:
  + None required.
* Final Structure:
  + Owned\_By Table: book\_id (FK), user\_id (FK)

### Conclusion

The normalization process has ensured that each table in the database schema is now in Third Normal Form. This involves removing redundancy, avoiding unnecessary duplication, and ensuring that each piece of data is stored only once. By following these steps, the database is now more efficient and less prone to inconsistencies.