
# DataCrafters

# Database Design

# Phase 2

# Contents

# Project Phase 2 - Database Design

## 1. Introduction

The DataCrafters team have been tasked with digitizing the operations of African Book Stores, Phase 2 will be concerned with Database design stage of the database life cycle. Phase 1 business operations will be turned into business rules. A conceptual ER diagram will be produced to represent the entities, characteristics, and relationships that will be present in the new database, and a logical model of the business environment will also be created.

These will serve as the foundation of our database, thus they must be prepared as precisely and correctly as possible.

The database management system will store information a such as Customers and or Employees name, email address, phone number. This information will be used when transactions take place. The details of the customer, and the details of the employee handling the transaction will be recorded. Customers have the option to buy a book in-store, buy a book online, or borrow (rent) a book. If a customer buys a book online, the location of delivery and the details of the employee delivering the book will be recorded. Each book is linked to a unique ISBN that contains information on its author, publisher, and edition. The

human resources department will store employee details on the database. Each entity in the database contains a unique primary key that cannot be left null for each entry stored. Each foreign key value in our database points to an existing primary key.

## 2.Business Rules

As potential customers enter the bookstore, they are greeted by a staff member who recommends a book that has recently been placed to the store's shelves.

Consumers can choose between renting and buying a book. If a customer decides to purchase a book, the book's data, such as the title, author, language, publisher as well as the amount the book was purchased for are saved as hand written notes and filed at the end of each day.

When a book is leased, the book's information as well as the customer's name, phone number, email and house address are recorded in attempts of contacting the customer after a set number of days.

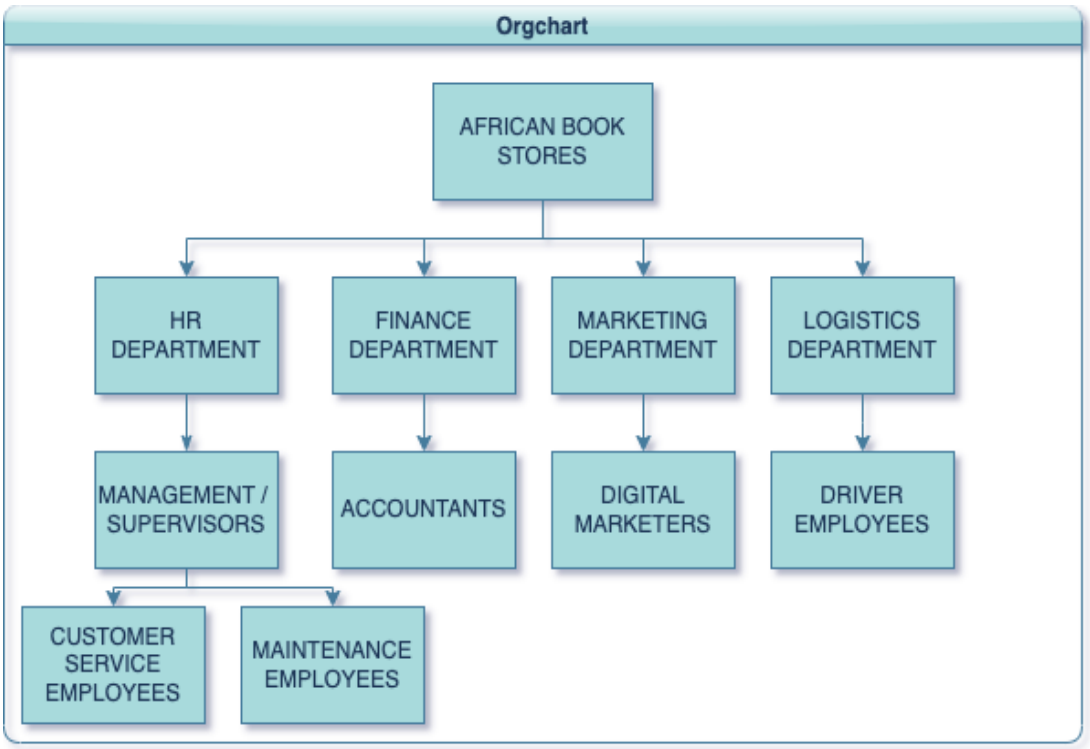


**Figure 1: African Book Stores Organizational Structure**

**The following business rules are observed when creating the database**

- One Customer can either be a Renter or Buyer
- One Customer can rent/buy zero or Many Books
- One Customer can only have One Location
- One Customer can make Many Transactions
- One Employee can maintain Many Books
- One Employee can only have One record in the Human Resources Department
- One Employee can only make One Delivery
- One Location can have Many Customers
- One Location can only have One Delivery
- One ISBN can only contain the details of One Book
- One Book can only have One ISBN
- One Book can be maintained by Many Employees
- One Book can only be involved in One Transaction
- One Book can be bought by Zero or Many Customers
- One Transaction can have Many Books
- One Transaction can only be made by One Customer
- One Transaction can only have One Delivery
- One Delivery can be made on Many Transactions
- One Delivery can only be made by One Employee
- One Delivery can be made to Many Locations
- The Human Resources department can have Many Employees

# 3. Entity Relationship Diagram

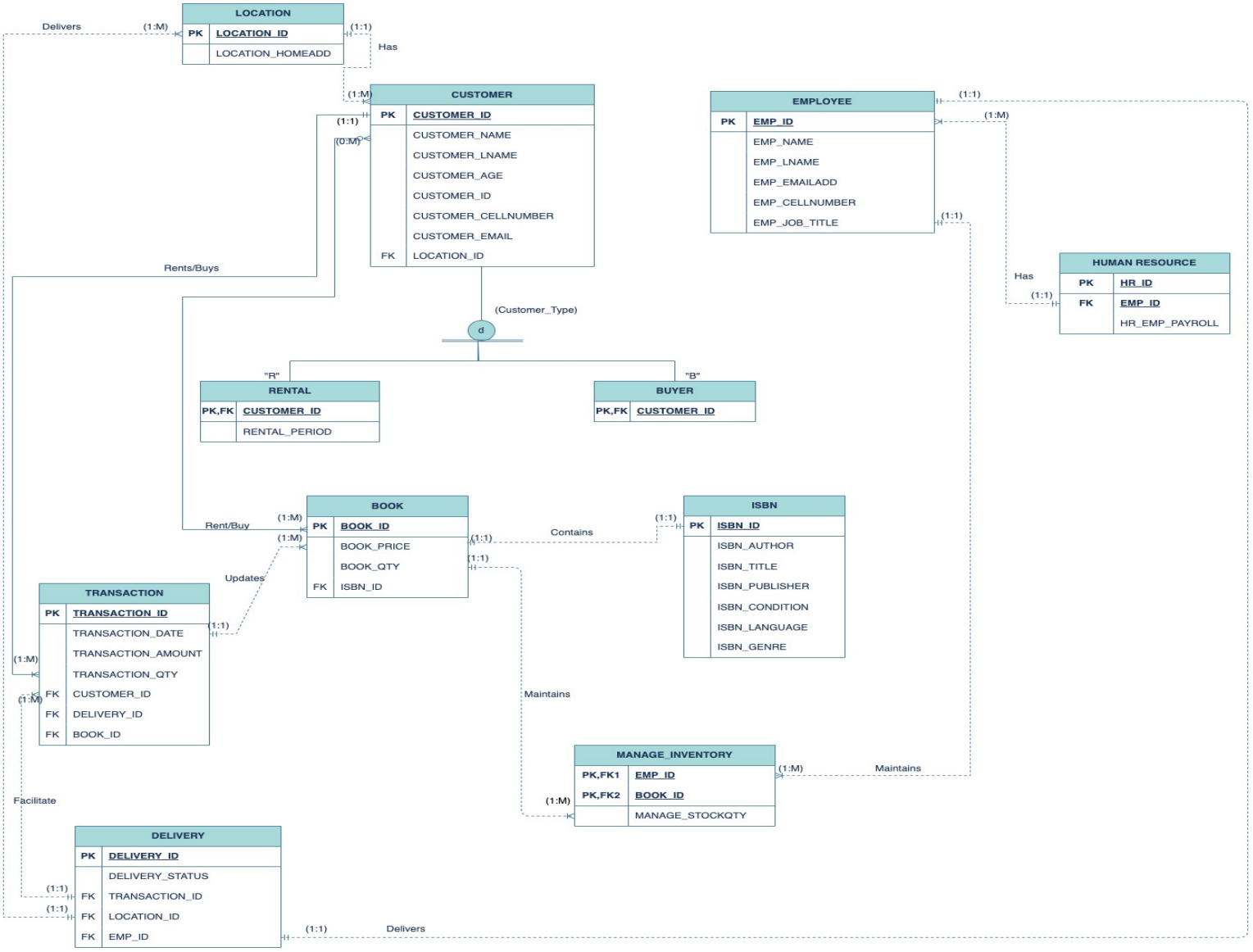


**Figure 2: African Book Stores Entity Relationship Diagram**

## 4. Notes on the Entity Relationship Diagram

**Super-Type Entities**

- Customer

**Sub-Type Entities**

- Rental
- Buyer

**Weak Entities**

- Rental
- Buyer
- Human Resource
- Book
- Delivery

**Strong Entities**

- Customer
- Employee
- Transaction
- Location
- ISBN

**Bridge Entities**

- Manage_Inventory

**Weak Relationships**

- Customer and Location
- Location and Delivery
- Employee and Human Resource
- Employee and Manage_Inventory
- Manage_Inventory and Book
- Book and Transaction

- Transaction and Delivery
- Book to ISBN
- Employee and Delivery

**Strong Relationships**

- Customer and Book
- Customer and Transaction

**Disjoint Relationships**

- Customer and Buyer
- Customer and and Rental

**Mandatory Relationships**

- Customer and Location
- Location and Delivery
- Employee and Human Resource
- Employee and Manage_Inventory
- Manage_Inventory and Book
- Book and Transaction
- Transaction and Delivery
- Book to ISBN
- Employee and Delivery
- Customer and Book
- Customer and Transaction
- Customer and Book
- Customer and Transaction

## 5. Logical Data Model

# LOGICAL DATA MODEL

## Map strong entities

- **ISBN** (**ISBN_ID**, ISBN_TITLE, ISBN_PUBLISHER, ISBN_CONDITION, ISBN_LANGUAGE, ISBN_GENRE)
    - **PRIMARY KEY: ISBN_ID**

- **LOCATION** (**LOCATION_ID**, LOCATION_HOMEADD)
    - **PRIMARY KEY: LOCATION_ID**

- **EMPLOYEE**(**EMP_ID**,EMP_NAME,EMP_LNAME,EMP_EMAILADD,EMP_CELLNUMBER,EMP_JOB_TITLE)
    - **PRIMARY KEY: EMP_ID**

## Map Supertype/Subtype Relationships

- **CUSTOMER**(**CUSTOMER_ID**,CUSTOMER_NAME,CUSTOMER_LNAME,CUSTOMER_AGE,CUSTOMER_ID,CUSTOMER_CELLNMUBER,CUSTOMER_EMAILADD,LOCATION_ID)
    - **PRIMARY KEY: CUSTOMER_ID**
    - **FOREIGN KEY: LOCATION_ID**

- **RENTAL** (**RENTAL_ID**, CUSTOMER_ID, RENTAL_PERIOD)
    - **PRIMARY KEY: RENTAL_ID**
    - **FOREIGN KEY: CUSTOMER_ID**

- **BUYER** (**BUYER_ID,** CUSTOMER_ID)

    - **PRIMARY KEY: BUYER_ID**
    - **FOREIGN KEY: CUSTOMER_ID**

## Map weak entities

- **CUSTOMER**(**CUSTOMER_ID**,CUSTOMER_NAME,CUSTOMER_LNAME, CUSTOMER_AGE,CUSTOMER_ID,CUSTOMER_CELLNMUBER,CUSTOMER_EMAILADD,LOCATION_ID)

    - **PRIMARY KEY: CUSTOMER_ID**
    - **FOREIGN KEY: LOCATION_ID**

- **BUYER** (**BUYER_ID,** CUSTOMER_ID)

    - **PRIMARY KEY: BUYER_ID**
    - **FOREIGN KEY: CUSTOMER_ID**

- **HUMAN RESOURCES**(**HR_ID**,EMP_ID)

    - **PRIMARY KEY: HR_ID**
    - **FOREIGN KEY: EMP_ID**

- **BOOK**(**BOOK_ID**,BOOK_PRICE,ISBN_ID,INVENTORY_ID)

    - **PRIMARY KEY: BOOK_ID**
    - **FOREIGN KEY: ISBN_ID, INVENTORY_ID**

- **TRANSACTION**(**TRANSACTION_ID**,TRANSACTION_DATE,TRANSACTION_TOTAL,CUSTOMER_ID,DELIVERY_ID,BOOK_ID)

    - **PRIMARY KEY: TRANSACTION_ID**
    - **FOREIGN KEY: CUSTOMER_ID, DELIVERY_ID,BOOK_ID**

- **DELIVERY**(**DELIVERY_ID**,DELIVERY_STATUS,TRANSACTION_ID,LOCATION_ID,EMPLOYEE_ID)

    - **PRIMARY KEY: DELIVERY_ID**
    - **FOREIGN KEY:TRANSACTION_ID,LOCATION_ID,EMPLOYEE_ID**

- **RENTAL** (**RENTAL_ID**, CUSTOMER_ID,RENTAL_PERIOD)
    - **PRIMARY KEY: RENTAL_ID**
    - **FOREIGN KEY: CUSTOMER_ID**

## VALIDATING LOGICAL MODEL INTEGRITY CONSTRAINTS

## LOCATION

- **LOCATION_ID**
    - Is valid location
    - Type: varchar
    - Display format: XXXXXXXXXXXXXXXXXXX
    - Length: 20

- **LOCATION _HOMEADD**
  - Is valid address
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10

## CUSTOMER

- **CUSTOMER _ID**
  - Is valid ID
  - Type: varchar
  - Display format: XXXXXXXX
  - Length: 8
- **CUSTOMER_NAME**
  - Type: varchar
  - Display format: XXXXXXXXXXXXXXXXXXXX
  - Length: 20
- **CUSTOMER_LNAME**
  - Type: varchar
  - Display format: XXXXXXXXXXXXXXXXXXXX
  - Length: 20

- **CUSTOMER_AGE**
  - Type: integer
  - Display format: XX
  - Length: 2
- **CUSTOMER_CELLNUMBER**
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10

- **CUSTOMER_EMAILADD**
  - Is valid email address
  - Type: varchar
  - Display format: XXXXXXXXXXXXXXX@XXXXXX.XXX
  - Length: 25

- **LOCATION_ID**
  - Is valid location
  - Type: varchar
  - Display format: XXXXXXXXXXXXXXXXXXX
  - Length: 20

## EMPLOYEE

- **EMP_ID**
  - Is valid employee ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10
- **EMP_NAME**
  - Type: varchar
  - Display format: XXXXXXXXXXXXXXXXXXX
  - Length: 20

- **EMP_LNAME**
  - Type: varchar
  - Display format: XXXXXXXXXXXXXXXXXXX
  - Length: 20

- **EMP_EMAILADD**
  - Is valid email address
  - Type: varchar
  - Display format: XXXXXXXXXXXXXXX@XXXXXX.XXX
  - Length: 25
- **EMP_CELLNUMBER**
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10
- **EMP_JOB_TITLE**
  - Is valid job title
  - Type: varchar
  - Display format: XXXXXXXXXXXXXXXXXXXXXXXXX
  - Length: 25

## RENTAL

- **CUSTOMER_ID**
  - Is valid ID
  - Type: varchar
  - Display format: XXXXXXXX
  - Length: 8

- **RENTAL_ID**
  - Is valid rental ID
  - Type: string
  - Display format: XXXXXXXXXX
  - Length: 10
- **RENTAL_PERIOD**
  - Is valid time period
  - Type:  datetime

- Display format: xxxx/xx/xx
- Length: 10

- **BOOK_ID**
  - Is valid book ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10

## BUYER

- **CUSTOMER_ID**
  - Is valid ID
  - Type: varchar
  - Display format: XXXXXXXX
  - Length: 8

- **BUYER_ID**
  - Is valid buyer ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10
- **BOOK_ID**
  - Is valid book ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10

## TRANSACTION

- **TRANSACTION_ID**
  - Is valid transaction ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10
- **TRANSACTION_DATE**
  - Is valid date
  - Type: datetime
  - Display format: XXXX/XX/XX
  - Length: 10
- **TRANSACTION_TOTAL**
  - Is valid total
  - Type: integer
  - Range: low(0) high(9999999999)
  - Display format: XXXXXXXXXX
  - Length: 10
- **CUSTOMER_ID**
  - Is valid ID
  - Type: varchar
  - Display format: XXXXXXXX
  - Length: 8
- **INVENTORY_ID**
  - Is valid inventory ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10
- **DELIVERY_ID**
  - Is valid delivery ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10
- **BOOK_ID**
  - Is valid book ID

- Type: varchar
- Display format: XXXXXXXXXX
- Length: 10

## BOOK

- **BOOK_ID**
  - Is valid book ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10
- **BOOK_PRICE**
  - Is valid price
  - Type: integer
  - Range: low(1) high(9999999999)
  - Display format: XXXXXXXXXX
  - Length: 10
- **ISBN_ID**
  - Is valid ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10
- **INVENTORY_ID**
  - Is valid inventory ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10

## ISBN

- **ISBN_ID**
  - Is valid ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10
- **ISBN_AUTHOR**
  - Is valid name
  - Type: varchar
  - display format: XXXXXXXXXXXXX
  - length: 13
- **ISBN_TITLE**
  - Is valid title
  - Type: varchar
  - Display format: XXXXXXXXXXXXXXXXXXXXXXXXX
  - Length: 25
- **ISBN_PUBLISHER**
  - Is valid publisher
  - Type: varchar
  - Display format: XXXXXXXXXXXXXXXXXXXXXXXXX
  - Length: 25
- **ISBN_CONDITION**
  - Is valid condition
  - Type: char
  - Display format: G/B
  - Length: 1
- **ISBN_LANGUAGE**
  - Is valid language
  - Type: varchar
  - Display format: XXXXXXXXXXXXXXX
  - Length: 15
- **ISBN_GENRE**

- Is valid genre
- Type: varchar
- Display format: XXXXXXXXXXXXXXX
- Length: 15

## MANAGE_INVENTORY

- **EMP_ID**
  - Is valid employee ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10
- **BOOK_ID**
  - Is valid book ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10
- **MANAGE_STOCKQTY**
  - Is valid stock quantity
  - Type: integer
  - Range: low(1) and high(9999999999)
  - Display format: XXXXXXXXXX
  - Length: 10

## DELIVERY

- **DELIVERY_ID**
  - Is valid delivery ID
  - Type: varchar
  - Display format: XXXXXXXXXX
- **DELIVERY_STATUS**

- Is valid status
- Type: varchar
- Display format: XXXXXXXXXX
- Length: 10

- **TRANSACTION_ID**
  - Is valid transaction ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10
- **LOCATION_ID**

  -Is valid location

  -Type: varchar

  -Display format: XXXXXXXXXXXXXXXXXXXX

  -Length: 20
- **EMP_ID**
  - Is valid employee ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: 10

## HUMAN RESOURCE

- **HR_ID**
  - Is valid ID
  - Type: varchar
  - Display format: XXXXXXXXXX
  - Length: XXXXXXXXXX

- **HR_EMP_PAYROLL**
  - Is valid payroll amount
  - Type: integer
  - Range: low (1) and high (9999999999)
  - Display format: XXXXXXXXXX

- Length: 10