CSE 305 Project Assignment 1

Team: Trappist-1f
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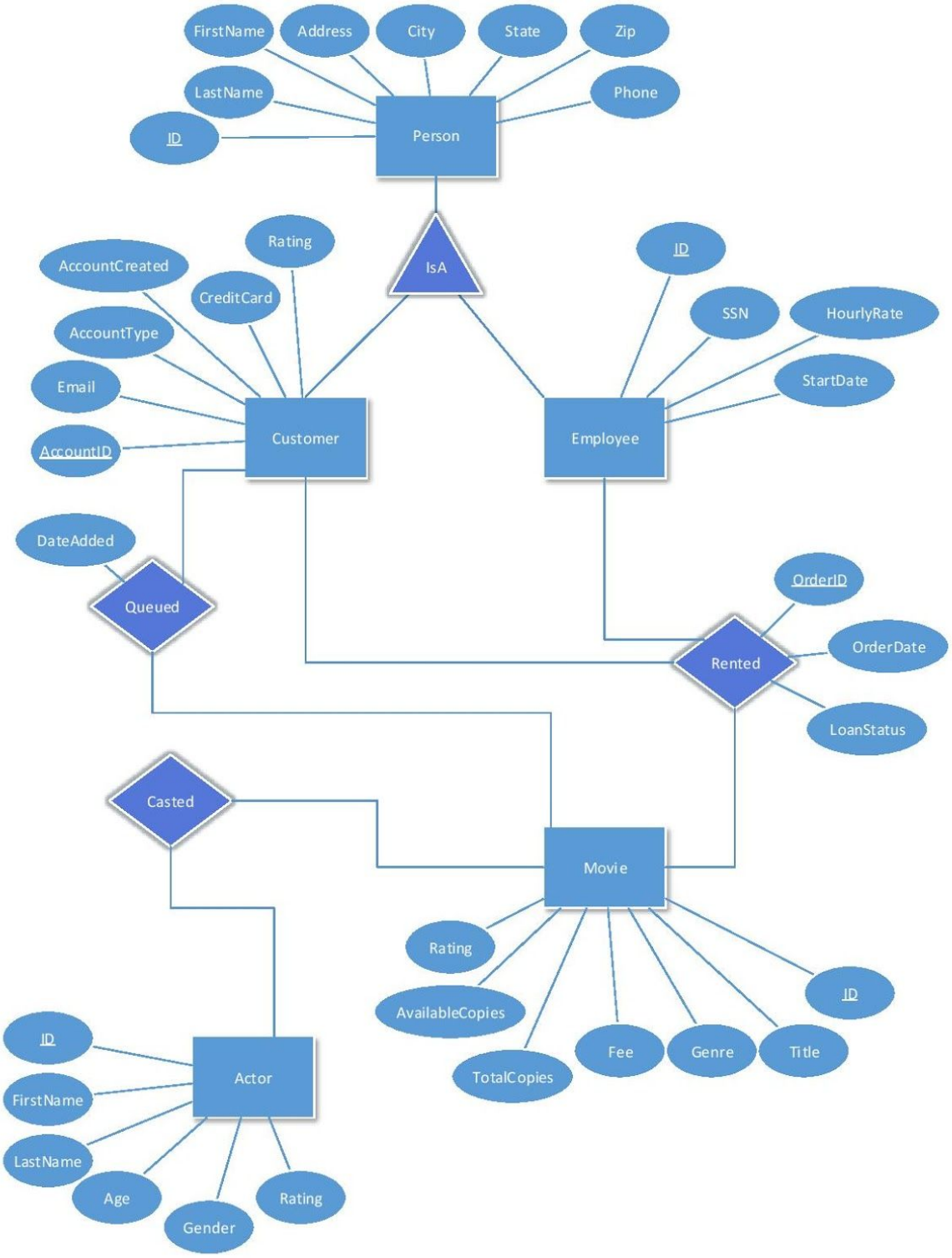
Collaboration Plan:
Zhe Lin will work on movie and actor data.
Sean Pesce will work on account and order (rental) data.
Weichao Zhao will work on customer and employee data.

Stage 1:
Zhe created the tables for **Actor** and **Movie** entity type and Weichao created the tables for **Person**, **Customer**, and **Employee** entity type. Sean worked on the 3 relationship types **Queued**, **Casted**, and **Rented**.

Stage 2:
Sean checked and included the integrity constraints and then drew the ER diagram. Weichao created the views for customer information (Movie Queued, RentalHistory, CurrentLoan). Zhe created the views for actor and movie information (CastList, Roles, ComedyMovie, etc). Sean and Zhe worked together for the triggers and procedures.

Stage 3:
Weichao finished the brief rationale for the E-R model and relational model.

1: E-R Diagram:


FirstName
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StartDate
Employee
DateAdded
Queued
OrderID
OrderDate
Rented
LoanStatus
Casted
Movie
Rating
AvailableCopies
TotalCopies
Fee
Genre
Title
ID
ID
FirstName
LastName
Age
Gender
Rating
Actor

1.1 : Rationale for E-R Diagram:

The online movie rental system have four major entity types: **Customer**, **Employee**, **Actor** and **Movie**. The attributes are shown on the diagram. Besides, Customer and Employee are inheritances of **Person** Entity Type so they both have attributes that **Person** has, such as FirstName, LastName, and primary key ID. (For Customer, ID is used as AccountID.) However, Actor, whose primary key is also ID, is not inheritance of **Person** since attributes like Zip or Address are not in **Actor** Entity Type, since those attributes are not required for **Actor**.

Those 4 major entity types are linked through 3 relationship types: **Queued**, **Rented** and **Casted**. **Queued**(Customer, Movie; DateAdded) relationship types relates the **Actor** and **Movie** with the DateAdded attribute. For example, Queued(John, "Superman"; 02/23/2017) describes a relationship that John added the movie "Superman" to his wish list on 02/23/2017.

Rented(Customer/Employee, Movie; OrderID, OrderDate, LoanStatus) relationship type relates **Customer/Employee** with **Movie** with attribute OrderDate. For example, John is the name of **Customer/Employee**, "Superman" name of **Movie**, then (John, "Superman"; 123, 02/23/2017, Active) describes a relationship that John rented a copy of "Superman" on 02/23/2017, and this order is active with id 123.

Casted(Actor, Movie): Queued relationship type relates an element of Actor entity type and an element of Movie entity type with attribute Role. For example, John is a value of **Actor** role, "Superman" a value of **Movie** role, then (John, "Superman") describes a relationship that John was in movie "Superman".

2. Relational Model (1):

```
CREATE TABLE Person (
        ID INT,
        LastName VARCHAR(64),
        FirstName VARCHAR(64),
        Address VARCHAR(64),
        City VARCHAR(64),
        State ENUM('AK','AL','AR','AZ','CA','CO','CT',
                'DE','FL','GA','HI','IA','ID','IL','IN','KS',
                'KY','LA','MA','MD','ME','MI','MN','MO','MS',
                'MT','NC','ND','NE','NH','NJ','NM','NV','NY',
                'OH','OK','OR','PA','RI','SC','SD','TN','TX',
                'UT','VA','VT','WA','WI','WV','WY',
                'AS','DC','FM','GU','MH','MP','PR','PW','VI',
                'AA','AE','AP'),
        Zip VARCHAR(10),
        Phone VARCHAR(20),
        PRIMARY KEY (ID),
        UNIQUE KEY NameAddress (LastName, FirstName, Address, City, State, Zip),
        CONSTRAINT chk_Zip CHECK (Zip RLIKE '^[0-9]{5}$'),
        CONSTRAINT chk_Phone CHECK (Phone RLIKE '^[0-9]{10}$')
);

CREATE TABLE Employee ( # IsA Person
        ID INT, # References Person(ID)
        SSN CHAR(9),
        StartDate DATE,  # Start of employment
        HourlyRate FLOAT NOT NULL DEFAULT 20.00,
        PRIMARY KEY (ID),
        FOREIGN KEY (ID) REFERENCES Person(ID)
                ON DELETE CASCADE
                ON UPDATE CASCADE,
        UNIQUE KEY (SSN), # No two people have the same SSN
        CONSTRAINT chk_Pay CHECK (HourlyRate >= 9.00),
        CONSTRAINT chk_SSN CHECK (SSN RLIKE '^[0-9]{9}$') );
```

2. Relational Model (2)

```
CREATE TABLE Customer (
        AccountID INT, # References Person(ID)
        Email VARCHAR(64) NOT NULL,
        AccountType ENUM('Limited', 'Unlimited', 'Unlimited+', 'Unlimited++') NOT NULL
                DEFAULT 'Limited',
        AccountCreated  DATE,
        CreditCard CHAR(16) NOT NULL,
        Rating INT DEFAULT 1,
        PRIMARY KEY (AccountID),
        FOREIGN KEY (AccountID) REFERENCES Person(ID)
                ON DELETE CASCADE
                ON UPDATE CASCADE,
        UNIQUE KEY (Email),
        CONSTRAINT chk_Rating CHECK (Rating IN (1, 2, 3, 4, 5)),
        CONSTRAINT chk_Email CHECK (Email LIKE '%_@_%._%'),
        CONSTRAINT chk_CC CHECK (CreditCard RLIKE '^[0-9]{16}$')
);

CREATE TABLE Movie (
        ID INT,
        Title VARCHAR(64) NOT NULL,
        Genre ENUM ('Comedy', 'Drama', 'Action', 'Foreign'),
        Fee FLOAT DEFAULT 0.00,
        TotalCopies INT DEFAULT 0,
        AvailableCopies INT DEFAULT 0,
        Rating INT,
        PRIMARY KEY (ID),
        CONSTRAINT chk_Rating CHECK (Rating IN (1, 2, 3, 4, 5)),
        CONSTRAINT chk_TotalCopies CHECK (TotalCopies >= 0),
        CONSTRAINT chk_AvailableCopies CHECK (AvailableCopies >= 0),
        CONSTRAINT chk_AvailableVsTotalCopies CHECK (AvailableCopies <= TotalCopies),
        CONSTRAINT chk_Fee CHECK (Fee >= 0.0)
);
```

2. Relational Model (3)

```
CREATE TABLE Actor (
        ID INT,
        FirstName VARCHAR(64) NOT NULL,
        LastName VARCHAR(64) NOT NULL,
        Gender ENUM('M','F'), # ENUM acts as a domain
        Age INT,
        # Rating INT,
        PRIMARY KEY (ID),
        # CONSTRAINT chk_Rating CHECK (Rating IN (1, 2, 3, 4, 5)), # CONSTRAINT acts as a domain
        CONSTRAINT chk_Age CHECK (Age >= 0)
);
CREATE TABLE Casted (
        ActorID INT,
        MovieID INT,
        Role VARCHAR(128),
        ActorRating INT,
        PRIMARY KEY (ActorID, MovieID),
        FOREIGN KEY (ActorID) REFERENCES Actor(ID)
                ON DELETE CASCADE
                ON UPDATE CASCADE,
        FOREIGN KEY (MovieID) REFERENCES Movie(ID)
                ON DELETE CASCADE
                ON UPDATE CASCADE,
        CONSTRAINT chk_Rating CHECK (ActorRating IN (1, 2, 3, 4, 5))
);
CREATE TABLE Queued (
        CustomerID INT,
        MovieID INT,
        DateAdded DATETIME,
        PRIMARY KEY (CustomerID, MovieID),
        FOREIGN KEY (CustomerID) REFERENCES Customer(AccountID)
                ON DELETE CASCADE
                ON UPDATE CASCADE,
        FOREIGN KEY (MovieID) REFERENCES Movie(ID)
                ON DELETE CASCADE
                ON UPDATE CASCADE  );
```

2. Relational Model (4)

```
CREATE TABLE Rented (
        OrderID INT,
        CustomerID INT NOT NULL,
        MovieID INT,
        EmployeeID INT,
        OrderDate DATETIME,
        LoanStatus ENUM('Expired', 'Active')  NOT NULL DEFAULT 'Active',
        PRIMARY KEY (OrderID),
        FOREIGN KEY (CustomerID) REFERENCES Customer(AccountID)
                ON DELETE CASCADE
                ON UPDATE CASCADE,
        FOREIGN KEY (MovieID) REFERENCES Movie(ID)
                ON DELETE SET NULL
                ON UPDATE CASCADE,
        FOREIGN KEY (EmployeeID) REFERENCES Employee(ID)
                ON DELETE SET NULL
                ON UPDATE CASCADE,
        UNIQUE KEY (CustomerID, MovieID, OrderDate)
);
```

2. Relational Model (5)

Views of Movie Information:

```
CREATE VIEW CastList (MovieID, ActorID, FirstName, LastName, Gender, Age, ActorRating) AS (
        SELECT MovieID, ActorID, FirstName, LastName, Gender, Age, Actor.Rating
        FROM (Actor JOIN Casted ON (Actor.ID = ActorID)) JOIN Movie ON (MovieID = Movie.ID)
);

CREATE VIEW Roles (ActorID, MovieID, Title, Genre, MovieRating) AS (
        SELECT ActorID, MovieID, Title, Genre, Movie.Rating
        FROM (Actor JOIN Casted ON (Actor.ID = ActorID)) JOIN Movie ON (MovieID = Movie.ID)
);

CREATE VIEW ComedyMovies (MovieId, Title, MovieRating, AvailableCopies, Fee) AS (
        SELECT MovieID, ActorID, Title, MovieRating, AvailableCopies, Fee
   FROM Movie
   WHERE Genre = 'Comedy'
);

CREATE VIEW DramaMovies (MovieId, Title, MovieRating, AvailableCopies, Fee) AS (
        SELECT MovieID, ActorID, Title, MovieRating, AvailableCopies, Fee
   FROM Movie
   WHERE Genre = 'Drama'
);

CREATE VIEW ActionMovies (MovieId, Title, MovieRating, AvailableCopies, Fee) AS (
        SELECT MovieID, ActorID, Title, MovieRating, AvailableCopies, Fee
   FROM Movie
   WHERE Genre = 'Action'
);

CREATE VIEW ForeignMovies (MovieId, Title, MovieRating, AvailableCopies, Fee) AS (
        SELECT MovieID, ActorID, Title, MovieRating, AvailableCopies, Fee
   FROM Movie
   WHERE Genre = 'Foreign'
);
```

2. Relational Model (6)

Views of Customer Information:

```
CREATE VIEW MovieQueue (CustomerID, MovieID, DateAdded) AS (
        SELECT CustomerID, MovieID, DateAdded
        FROM Queued JOIN Customer ON (CustomerID = AccountID)
        ORDER BY DateAdded ASC
);

CREATE VIEW RentalHistory (CustomerID, MovieID, Title, Genre, Rating, OrderDate, LoanStatus) AS (
        SELECT CustomerID, MovieID, Title, Genre, Movie.Rating, OrderDate, LoanStatus
        FROM Rented JOIN Movie ON (MovieID = ID)
        ORDER BY OrderDate DESC
);

CREATE VIEW CurrentLoans (CustomerID, MovieID, Title, OrderDate) AS (
        SELECT CustomerID, MovieID, Title, OrderDate
        FROM Rented JOIN Movie ON (MovieID = ID)
        WHERE LoanStatus = 'Active'
);
```

2. Relational Model (7)

```
DELIMITER $$
CREATE PROCEDURE CustomerExistsBeforeOrder (IN New_CustomerID INT, New_OrderDate DATETIME)
BEGIN
        IF DATE(New_OrderDate) < (SELECT AccountCreated
                        FROM Customer
                        WHERE New_CustomerID = AccountID
                )
        THEN
                SIGNAL SQLSTATE 'E0451'
      SET MESSAGE_TEXT = 'Date conflict: Order date precedes Customer\'s account creation.';
  END IF;
END;
$$
DELIMITER ;



DELIMITER $$
CREATE PROCEDURE EmployeeExistsBeforeOrder (IN New_EmployeeID INT, New_OrderDate DATETIME)
BEGIN
        IF DATE(New_OrderDate) < (SELECT StartDate
                        FROM Employee
                        WHERE New_EmployeeID = Employee.ID
                )
        THEN
                SIGNAL SQLSTATE 'E0451'
      SET MESSAGE_TEXT = 'Date conflict: Order date precedes Employee start date.';
  END IF;
END;
$$
DELIMITER ;
```

2. Relational Model (8)

```
DELIMITER $$
CREATE PROCEDURE CantRentUnavailable (IN New_MovieID INT, New_LoanStatus ENUM('Expired',
'Active'))
BEGIN
        IF      New_LoanStatus = 'Active' AND
                1 > (SELECT AvailableCopies
                        FROM Movie M
                        WHERE New_MovieID = M.ID
                )
        THEN
                SIGNAL SQLSTATE 'E0928'
      SET MESSAGE_TEXT = 'Rental conflict: There are no available copies of this movie.';
  END IF;
END;
$$
DELIMITER ;

DELIMITER $$
CREATE PROCEDURE CantHaveTwoCopies (
        IN New_LoanStatus ENUM('Expired', 'Active'), New_CustomerID INT, New_MovieID INT)
BEGIN
        IF      New_LoanStatus = 'Active' AND
                1 <= (SELECT COUNT(*)
                        FROM Rented R1
                        WHERE
                                New_CustomerID = R1.CustomerID AND
                                New_MovieID = R1.MovieID AND
                                R1.LoanStatus = 'Active'
                )
        THEN
                SIGNAL SQLSTATE 'E0928'
      SET MESSAGE_TEXT = 'Rental conflict: Customer is already renting a copy of this movie.';
  END IF;
END;
$$
DELIMITER ;
```

2. Relational Model (9)

```
DELIMITER $$
CREATE PROCEDURE CustomerExistsBeforeQueue (IN New_CustomerID INT, New_DateAdded DATETIME)
BEGIN
        IF DATE(New_DateAdded) < (SELECT AccountCreated
                                  FROM Customer
                                  WHERE New_CustomerID = AccountID
                )
        THEN
                SIGNAL SQLSTATE 'E0451'
      SET MESSAGE_TEXT = 'Date conflict: Date of queue insertion precedes Customer\'s account creation.';
  END IF;
END;
$$
DELIMITER ;


DELIMITER $$
CREATE PROCEDURE CantExceedTotal (IN New_TotalCopies INT, New_AvailableCopies INT)
BEGIN
        IF      New_TotalCopies < New_AvailableCopies

        THEN
                SIGNAL SQLSTATE 'E0928'
      SET MESSAGE_TEXT = 'Logical Error: Available copies number cannot be exceed Total copies number.';
  END IF;
END;
$$
DELIMITER ;
```

2. Relational Model (10)

```
DELIMITER $$
CREATE PROCEDURE deleteFromQueue (IN New_LoanStatus ENUM('Expired', 'Active'), New_CustomerID
INT, New_MovieID INT)
BEGIN
        IF      New_LoanStatus = 'Active' AND
                1 = (SELECT COUNT(*)
                        FROM QUEUED Q
                        WHERE New_MovieID = Q.MovieID AND
                                New_CustomerID = Q.CustomerID
                )
        THEN
                DELETE FROM QUEUED
                WHERE MovieID = New_MovieID AND
                        CustomerID = New_CustomerID;
  END IF;
END;
$$
DELIMITER ;

# Pre-INSERT trigger for Rented:
DELIMITER $$
CREATE TRIGGER Rented_PreInsert_Checks BEFORE INSERT ON Rented
FOR EACH ROW BEGIN
        CALL CantRentUnavailable(NEW.MovieID, NEW.LoanStatus);
        CALL CantHaveTwoCopies(NEW.LoanStatus, NEW.CustomerID, NEW.MovieID);
        CALL CustomerExistsBeforeOrder (NEW.CustomerID, NEW.OrderDate);
        CALL EmployeeExistsBeforeOrder(NEW.EmployeeID, NEW.OrderDate);
END;
$$
DELIMITER ;

DELIMITER $$
CREATE TRIGGER Queued_PreInsert_Checks BEFORE INSERT ON Queued
FOR EACH ROW BEGIN
        CALL CustomerExistsBeforeQueue(NEW.CustomerID, NEW.DateAdded);
```

```
END;
$$
```

2. Relational Model (11)

```
DELIMITER $$
CREATE TRIGGER Queued_PreUpdate_Checks BEFORE UPDATE ON Queued
FOR EACH ROW BEGIN
        CALL CustomerExistsBeforeQueue(NEW.CustomerID, NEW.DateAdded);
END;
$$
DELIMITER ;

# If customer rents a movie, delete it from their queue (if it exists)
DELIMITER $$
CREATE TRIGGER Rent_Out_Queue AFTER INSERT ON RENTED
FOR EACH ROW BEGIN
        CALL deleteFromQueue(NEW.LoanStatus, NEW.CustomerID, NEW.MovieID);
END;
$$
DELIMITER ;

DELIMITER $$
CREATE TRIGGER Rent_Again_Out_Queue AFTER UPDATE ON RENTED
FOR EACH ROW BEGIN
        CALL deleteFromQueue(NEW.LoanStatus, NEW.CustomerID, NEW.MovieID);
END;
$$
DELIMITER ;

DELIMITER $$
CREATE TRIGGER Available_Copies_Check BEFORE UPDATE ON Movie
FOR EACH ROW BEGIN
        CALL CantExceedTotal(NEW.TotalCopies, NEW.AvailableCopies);
END;
$$
DELIMITER ;
```

2.1 Rationale for Relational Model:

We created corresponding tables for all the entity types and relationship types designed in our E-R diagram. We created the views and granted the permission to the customers such that the following information is available to the customers: list of available movies of a particular type; their currently held movies; and their rental history.

We also created procedures together with triggers to control changes like update value or insert rows in the tables. For example, we have a trigger Queued_PreUpdate_Checks and a procedure CustomerExistsBeforeQueue that prevent that the date (DateAdded in Queued table) a movie added to wish list (Queued table) is before the date that the customer account was created (AccountCreated in Customer table). By creating the triggers and procedures, we make sure that the system is working as intended (no invalid order is placed).