CS-157A Project Report: Car Rental App

By - Sarthak Chauhan, Subhodh Kally Srinivasa Babu, Tristan Brennan-Evans
Github link → https://github.com/kssubhodh/Car-Rentals

Introduction

The purpose of this project is to create a web application which uses a database management system and has some useful functionality. The project is required to use MySQL as the primary database management system.

Objective

The app needs to store user information including name, id, email, and password. The database should distinguish two types of user, company employee and customer. The app also needs to store car information such as price and description, and store bookings made between a car and the customer renting it.

High-Level Design

We will use Spring Boot for backend and Angular for frontend. There will be two frontend views, each with a separate login: portal made for employees to view company information, and portal for users to view and rent cars. The project will be using a relational database, in this case MySQL, for data management.

Database Design and Normalization

We started off our final design with three main entities : Car , BookACar, Users

During our **normalization** process, we split up all three starting entities to follow 3NF rules. **Table information** can be found below, including dependencies.

Database Normalization Process

Starting Out - Initial Configuration

Tables and Dependencies

- Car
  - id, name, color, transmission, brand, type, modelYear, description, price, employee, dealership, image
    - id → *all attributes*
    - name, color, transmission, brand, type, modelYear → description, price, image
    - description → image
    - employee → dealership

- Users
  - id, name, email, password, userRole
    - id → *all attributes*
    - email → *all attributes*

- BookACar
  - id, fromDate, toDate, days, amount, employee, dealership, bookCarStatus, userId, email, username
    - id → *all attributes*
    - userId → *all attributes*
    - email → *all attributes*
    - fromDate, toDate → days
    - employee → dealership

Checking Normal Forms

- Is every table in 1st Normal Form? Yes
  - There are no multi-valued attributes ✅

- Is every table in 2nd Normal Form? Yes
  - Is every table in first normal form ? ✅
  - In every table, are non-primary-key attributes all fully functionally dependent on the primary key? ✅
    - In every table, does the primary key functionally determine every attribute? ✅
    - Are these dependencies all fully functional because there are no partial dependencies? ✅
      - Are there no attributes that can be removed from any primary key without removing the functional dependency? ✅

- Is every table in 3rd Normal Form? No
    - Is every table in first and second normal form? ✅
    - Does every table have no non-primary-key attributes that are transitively dependent on the primary key? ❌
        - Transitive Dependencies ❌
            - Car
                - id → name, color, transmission, brand, type, modelYear → description, price, image
                - id → description → image
                - id → employee → dealership
            - Users
                - id → email → *all attributes*
            - BookACar
                - id → fromDate, toDate → days
                - userId → fromDate, toDate → days
                - email → fromDate, toDate → days
                - id → employee → dealership
                - id → userId → email
                - id → email → fromDate
                - *etc.*

Converting Problematic Tables to Third Normal Form

- Split Car(id, name, color, transmission, brand, type, modelYear, description, price, employee, dealership, image) into
    - CarMain
        - id, name, color, transmission, brand, type, modelYear, employee
            - id → *all attributes*
    - CarDescription
        - id, description, price
            - id → description, price
        - CarDescription.id is a foreign key to CarMain.id
    - CarImage
        - id, image
            - id → image
        - CarImage.id is a foreign key to CarMain.id
    - EmployeeDealership
        - employee, dealership
            - employee → dealership
        - EmployeeDealership.employee is a foreign key to CarMain.employee

- Split Users(id, name, email, password, userRole) into
    - UsersMain
        - id, name, password, userRole
            - id → *all attributes*

    - UsersEmail
        - id, email
            - id → email
            - UsersEmail.id is a foreign key to UsersMain.id

- Split BookACar(id, fromDate, toDate, days, amount, employee, dealership, bookCarStatus, userId, email, username)
  into
    - Booking
        - id, fromDate, toDate, amount, employee, bookCarStatus
            - id → *all attributes*
            - Booking.employee is a foreign key to UsersMain.id
    - BookingUser
        - id, userId
            - id → userId
            - BookingUser.id is a foreign key to Booking.id
            - BookingUser.userId is a foreign key to UsersMain.id
    - BookingDetails
        - id, days, dealership
            - id → days, dealership
            - BookingDetails.id is a foreign key to Booking.id
    - *(EmployeeDealership table above takes care of dealership attribute data from BookACar)*

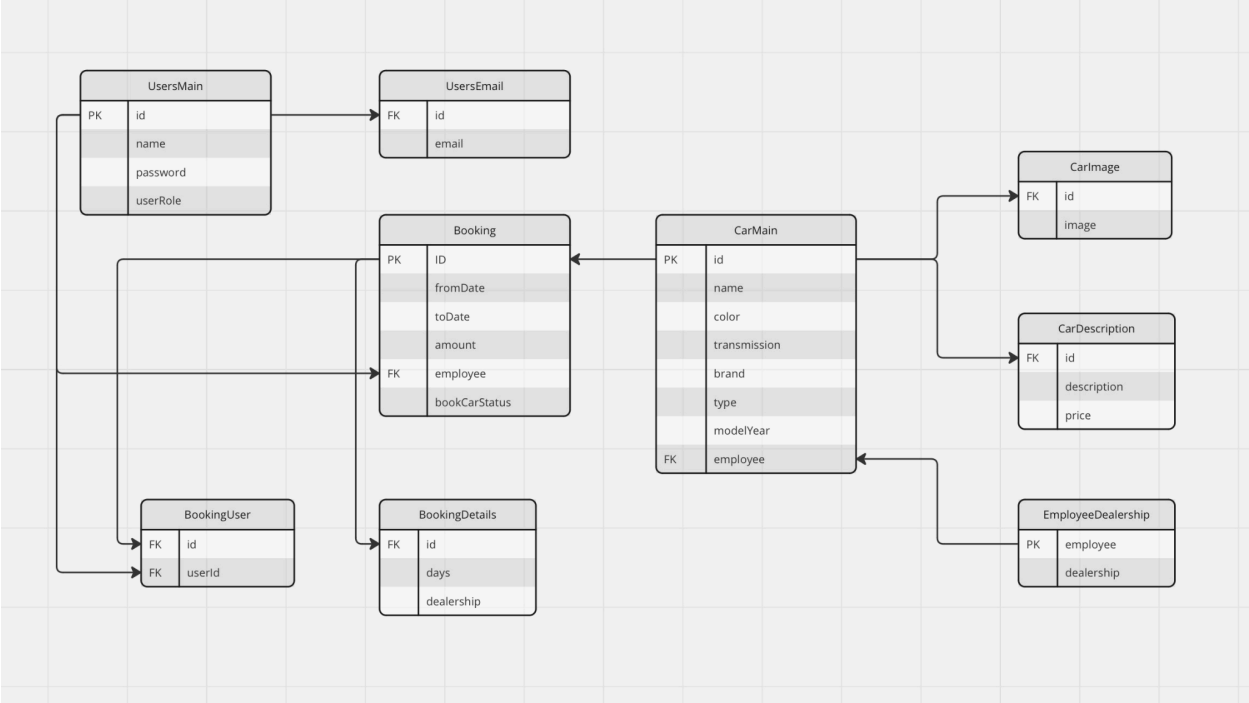
Checking Normal Forms

- Is every table in 1st Normal Form? Yes
    - There are no multi-valued attributes ✅
- Is every table in 2nd Normal Form? Yes
    - Is every table in first normal form ? ✅
    - In every table, are non-primary-key attributes all fully functionally dependent on the primary key? ✅
        - In every table, does the primary key functionally determine every attribute? ✅
        - Are these dependencies all fully functional because there are no partial dependencies? ✅
            - Are there no attributes that can be removed from any primary key without removing the functional dependency? ✅
- Is every table in 3rd Normal Form?
    - Is every table in first and second normal form? ✅
    - Does every table have no non-primary-key attributes that are transitively dependent on the primary key? ✅

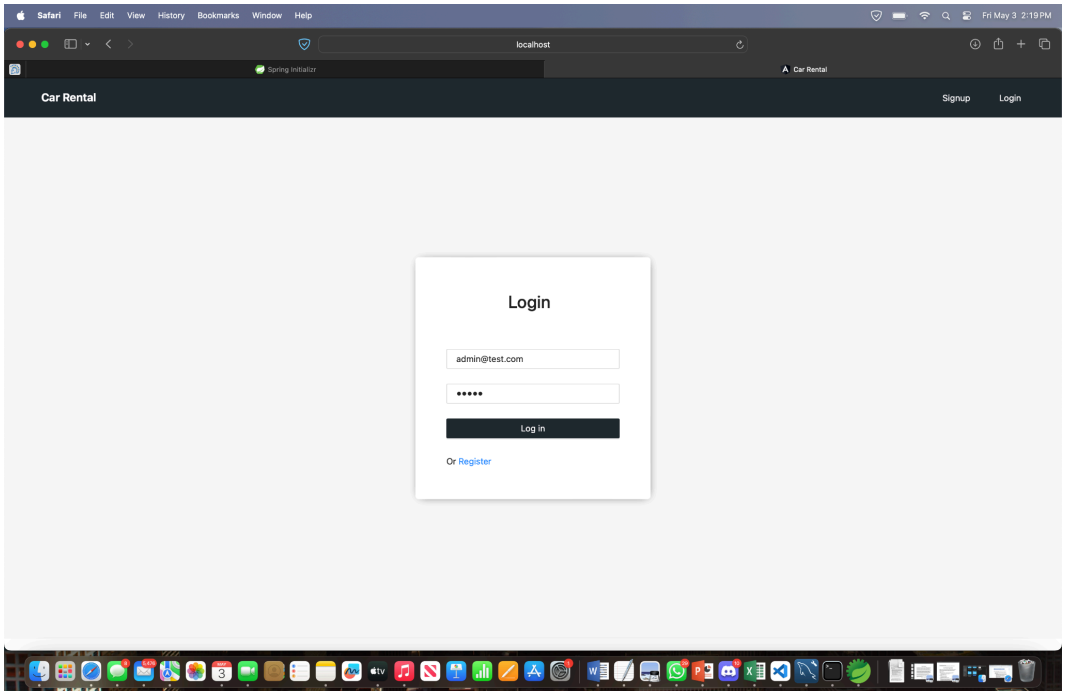
Done!

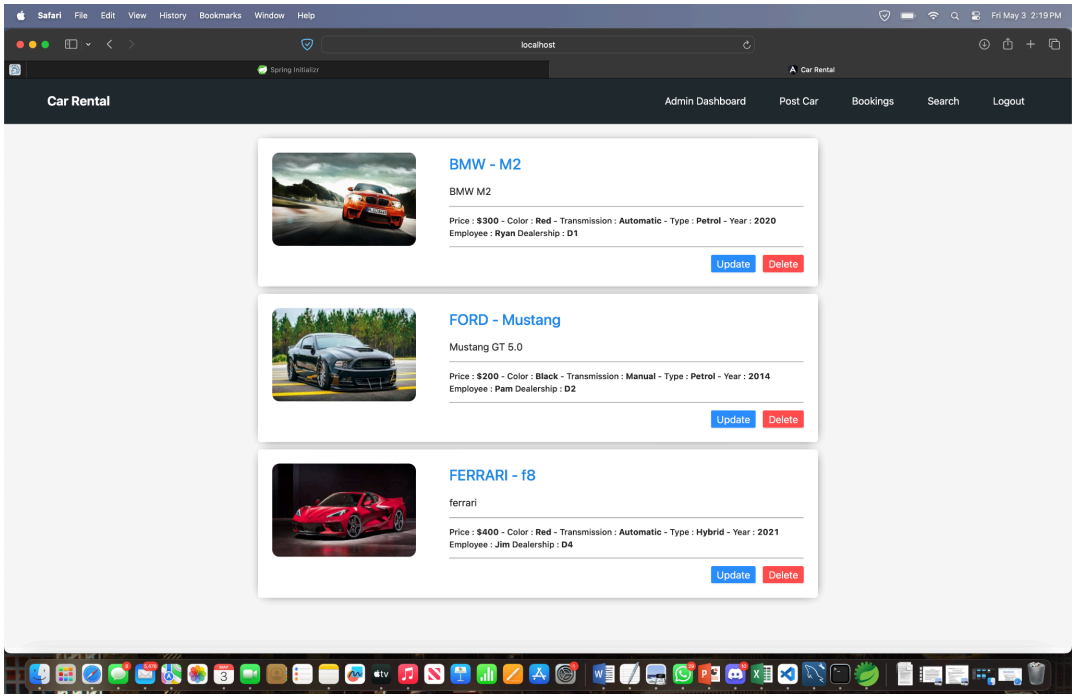
- Everything is normalized now
- The orange-highlighted tables are our final normalized configuration

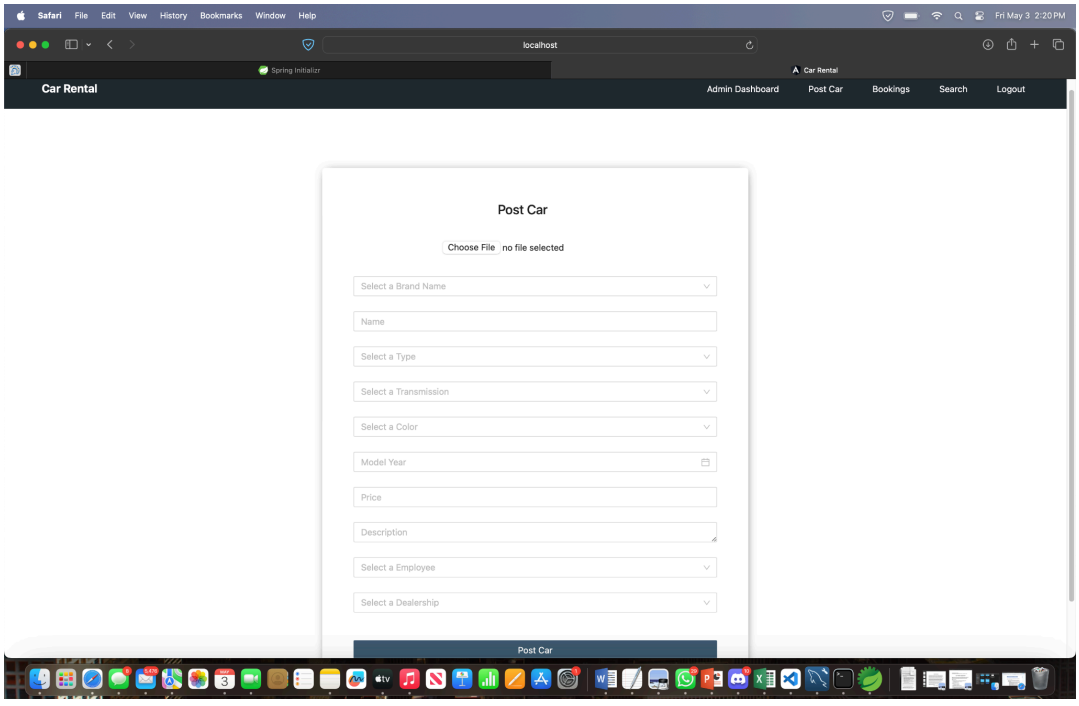
ER Diagram of Final Configuration



App Screenshots




Safari File Edit View History Bookmarks Window Help
Fri May 3 2:19 PM
localhost
Spring Initializr
Car Rental
Car Rental
Admin Dashboard
Post Car
Bookings
Search
Logout
BMW - M2
BMW M2
Price : $300 - Color : Red - Transmission : Automatic - Type : Petrol - Year : 2020
Employee : Ryan Dealership : D1
Update
Delete
FORD - Mustang
Mustang GT 5.0
Price : $200 - Color : Black - Transmission : Manual - Type : Petrol - Year : 2014
Employee : Pam Dealership : D2
Update
Delete
FERRARI - f8
ferrari
Price : $400 - Color : Red - Transmission : Automatic - Type : Hybrid - Year : 2021
Employee : Jim Dealership : D4
Update
Delete


Safari File Edit View History Bookmarks Window Help
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localhost
Spring Initializr
Car Rental
Car Rental
Admin Dashboard
Post Car
Bookings
Search
Logout
Post Car
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no file selected
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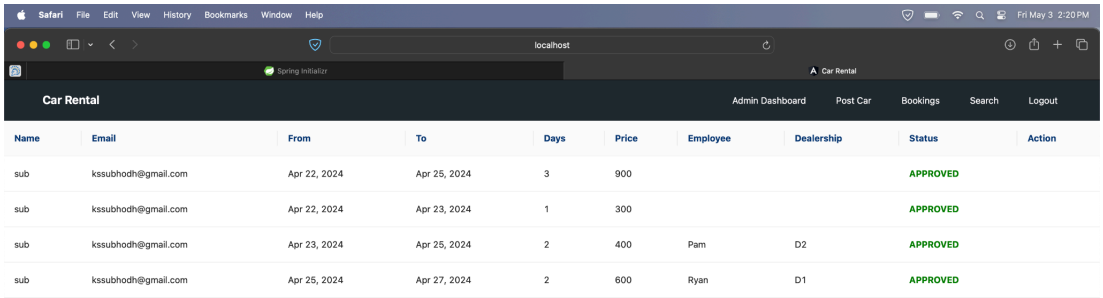
Name
Select a Type
Select a Transmission
Select a Color
Model Year
Price
Description
Select a Employee
Select a Dealership
Post Car


Safari File Edit View History Bookmarks Window Help
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localhost
Spring Initializr
Car Rental
Car Rental
Admin Dashboard
Post Car
Bookings
Search
Logout
Name
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From
To
Days
Price
Employee
Dealership
Status
Action
sub
kssubhodh@gmail.com
Apr 22, 2024
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sub
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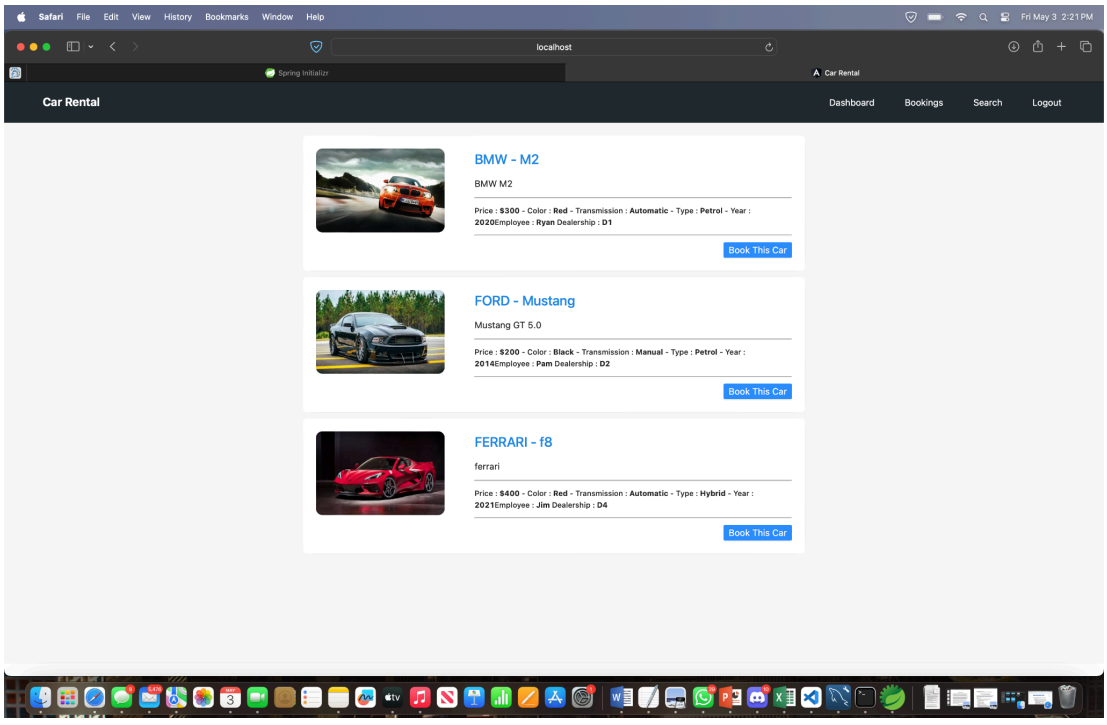
Apr 27, 2024
2
600
Ryan
D1
APPROVED


Safari File Edit View History Bookmarks Window Help
Fri May 3 2:21 PM
localhost
Spring Initializr
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Car Rental
Dashboard
Bookings
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Logout
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BMW M2
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Book This Car
FORD - Mustang
Mustang GT 5.0
Price : $200 - Color : Black - Transmission : Manual - Type : Petrol - Year : 2014Employee : Pam Dealership : D2
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FERRARI - f8
ferrari
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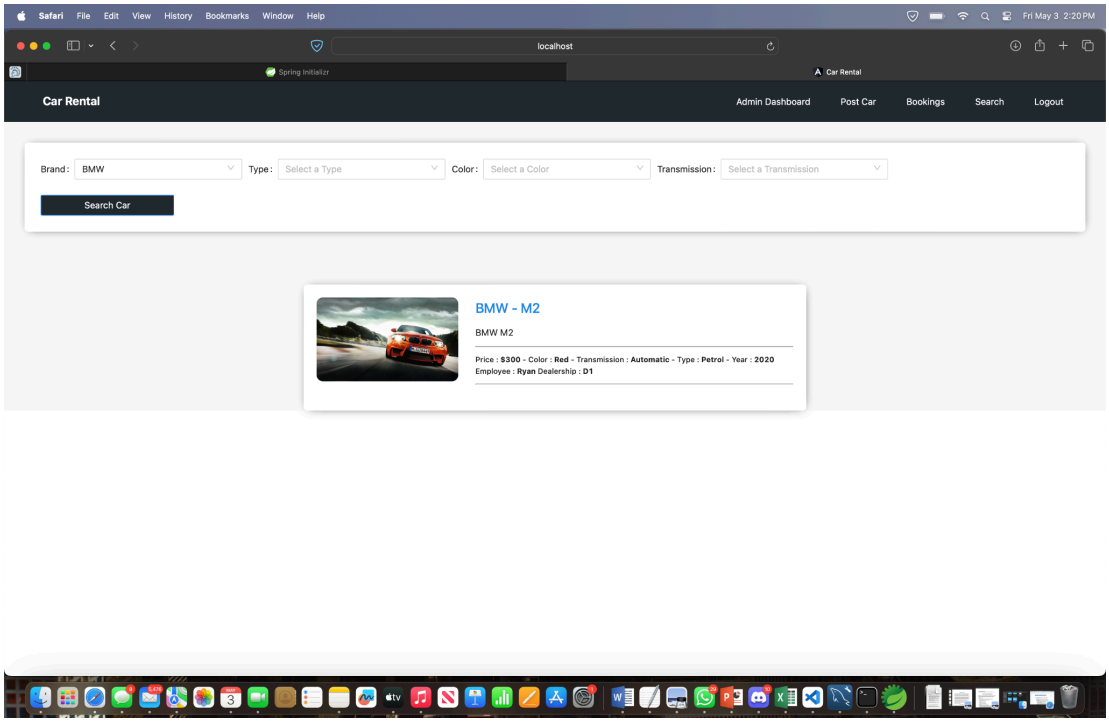

Results

As a team we were able to achieve the following functionality in the project.

1) A Database system for businesses that runs dealerships, obtains cars and rents
2) Two frontend views for different roles : Customer and Admin
3) Password authentication.

What are we thinking about the project for future:

1) Search functionality to search for cars based on types, price and dealerships
2) Offer car rental deals based on customer credit score
3) Maintain a chain of ownership to calculate the actual price of the car

Individual Contributions

Sarthak Chauhan

- Implemented backend using Spring Boot and MySql

Subhodh Kally Srinivasa Babu

- Implemented frontend using Angular, Typescript, HTML and CSS

Tristan Brennan-Evans

- Design and Planning, Database Normalization