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CSC 423

Project 3

Final Report

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**1) Conceptual Modeling:**

A top-down approach was used for the conceptual modeling. Firstly, a table was made with all of the entities and their related description and name. The Figure 1 documents the finding:

*Figure 1: Entity Table*

|  |  |  |  |
| --- | --- | --- | --- |
| **Entity Name** | **Descriptions** | **Alias** | **Occurrence** |
| Outlet | A location or site to buy rental vehicles | location | Each site is allocated a  stock of vehicles for rent |
| Vehicle | vehicle to be rented to client by staff | car | Each site is allocated a  stock of vehicles for rent |
| client | individual who rented a vehicle at one of the outlets | Renter | Each client can rent one to many cars |
| hireAgreement | an agreement between the client and the company that details all aspects of the vehicle(s) being rented, client information, and time the vehicle(s) are being rented for | hire | each client has their own hire agreement |
| Staff | An individual who works at Reliable rental outlet | staff | Each outlet has many staff |

Afterwards a relationship diagram was made to indicate the cardinality and the major relationships between each entity. Figure 2 below documents the results:

*Figure 2: Relationship Table*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Entity Name** | **Multiplicity** | **Relationship** | **Multiplicity** | **Entity Name** |
| Outlet | 1 to many | Rents out | 1 to many | Vehicles |
| Outlet | 1 to many | Manages | 1 to many | staff |
| Client | 1 to many | Signs | 1 to many | hireAgreement |
| Vehicle | 1 to many | Documented in | 1 to many | hireAgreement |

Figure 3 was used to document the type of relationships and their description:

*Figure 3: Relationship Description*

|  |  |
| --- | --- |
| **Relationship** | **Description** |
| Rents | Outlets store vehicles so they can be rented out to customers.  Vehicles are rented out at outlets. |
| Manages | Each outlet has staff which manage the outlet. |
| Signs | Each client signs one or more hire agreement. |
| Documented In | Each vehicle is documented in a hire agreement. Each hire agreement documents the vehicle(s) which will be rented. |

*Figure 4: Conceptual Entity Relationship Diagram*Diagram

Description automatically generated

An attribute table was then created using the client’s requirement sheet information:

Figure 5: Attributes and Constraints Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Entity Name** | **Attributes** | **Key Type** | **Description** | **Date Type & Length** | **Nulls** | **Multi-valued** |
| **Outlet** | LocationNum | Primary | Unique location identifies an outlet | 10 variable character | No | No |
|  | phoneNum | Candidate | Unique Phone number of an outlet | 10 variable character | No | No |
|  | Address | Candidate | Unique  address of outlet location | No | No | No |
|  | faxNum | Candidate | Unique address of the fax machine | 50 var char | Yes | No |
| **Vehicle** | registrationNum | Primary | Unique number to identify a vehicle | 10 var char | No | No |
|  | locationNum | Foreign | Unique location identifies an outlet | 10 var char | No | No |
|  | model | Key | The model of a car | 20 var char | Yes | No |
|  | make | Key | The make of a car | 20 var char | Yes | No |
|  | milageBeforeNewHire | Key | This is the milage before is taken out on a hire agreement. It is updated after a hire agreement is concluded. | Integer | No | No |
|  | engineSize | Key | The size of the vehicle’s engine in kilograms. | integer | No | No |
|  | capacity | Key | Number of seats in a car. | Integer | No | No |
|  | hireRate | Key | The daily rate to rent a vehicle out. | Float | No | No |
| **Client** | clientNum | Primary | Unique number to identify a client. | 10 var char | No | No |
|  | licenseNum | Candidate | A client’s license number. | 10 var char | No | No |
|  | firstName | Key | A client’s first name. | 10 var char | No | No |
|  | lastName | Key | A client’s last name. | 10 var char | No | No |
|  | sex | Key | A client’s sex. | 2 var char (M or F) | No | No |
|  | phoneNum | Key | A client’s phone number | 10 var char | No | No |
|  | homeAddress | Key | A client’s home address | 255 var char | No | No |
|  | dateOfBirth | Key | A client’s date of birth. | Date | No | No |
| **hireAgreement** | hireNum | Primary | A unique number for each hire agreement | 10 var char | No | No |
|  | clientNum | Foreign | Unique number to identify a client. | 10 var char | No | No |
|  | registrationNum | Foreign | Unique number to identify a vehicle | 10 var char | No | No |
|  | startDate | Key | The date when the hire agreement begins. | Date | No | No |
|  | endDate | Key | The date when the hire agreement ends. | Date | No | No |
| **Staff** | staffNum | Primary | A unique number to identify staff. | 10 var char | No | No |
|  | Sex | Key | A staff member’s sex. | 2 var char (M or F) | No | No |
|  | dateJoined | Key | The date a staff member joined. | Date | No | No |
|  | firstName | Key | A staff member’s first name. | 10 var char | No | No |
|  | lastName | Key | A staff member’s last name. | 10 var char | No | No |
|  | jobTitle | Key | A staff member’s job title. | 20 var char | No | No |
|  | salary | Key | A staff member’s salary. | integer | No | No |
|  | phoneNum | Key | A staff member’s phone number. | 10 var char | No | No |
|  | homeAddress | Key | A staff member’s home address. | 255 var char | No | No |
|  | dateOfBirth | Key | A staff member’s date of birth. | Date | No | No |

From this a logical conceptual model was formed:

After confirming the entities and relationships with the client (the Professor), I began creating a logical model.

**2) Logical Modeling:**

**Deriving Relations for Logical Data Model:**

Figure 6: Logical Conceptual Entity Relationship Diagram

The strong entities were found to be Outlet, Vehicle, hireAgreement, Staff, and Client. There were no weak entities found.Diagram

Description automatically generated

Relational Schema (Pre-Normalization):

*Bold – Primary Key*

*Underline – Foreign Key*

Outlet 🡪 **locationNum**, phoneNum, address, faxNum, vehicleStock

Vehicle 🡪 **registrationNum**, locationNum, model, make, milageBeforeNewHire, engineSize, capacity, hireRate

Staff 🡪 **staffNum**, locationNum, firstName, lastName, homeAddress, phoneNum, dateOfBirth, sex, dateJoined, jobTitle, salary

Client 🡪 **clientNum**, licenseNum, firstName, lastName, homeAddress, phoneNum, dateOfBirth, sex

hireAgreement 🡪 **hireNum**, clientNum, registrationNum, startDate, endDate

Entity Relationships:

Outlet 🡪 Vehicles, Staff

Client 🡪 HireAgreement

Vehicle 🡪 HireAgreement

**Normalization:**

1 NF:

The current relational schema satisfies the first stage of normalization. This is because there are no multi valued attributed.

2 NF:

Functional dependencies of Outlet relationship:

locationNum 🡪 phoneNum, address, faxNum, vehicleStock

Functional dependencies of Vehicle relationship:

registrationNum 🡪 locationNum, model, make, milageBeforeNewHire, engineSize, capacity, hireRate

staffNum 🡪 locationNum, firstName, lastName, homeAddress, phoneNum, dateOfBirth, sex, dateJoined, jobTitle, salary

clientNum 🡪 licenseNum, firstName, lastName, homeAddress, phoneNum, dateOfBirth, sex

hireAgreement 🡪 clientNum, registrationNum, startDate, endDate

The current relational schema has no partial dependencies and therefore passes the 2nd level of normalization.

3 NF:

There are no transitive dependencies in any of the relationships. Therefore, it satisfies the 3rd level of normalization.

**Relations (Post-normalization):**

**Outlet** (locationNum, phoneNum, address, faxNum, vehicleStock)

**Primary Key**: locationNum

**Vehicles** (registrationNum, locationNum, model, make, milageBeforeNewHire, engineSize, capacity, hireRate)

**Primary Key**: registrationNum

**Foreign Key**: locationNum **references** Outlet (locationNum)

**Staff** (staffNum, locationNum, firstName, lastName, homeAddress, phoneNum, dateOfBirth, sex, dateJoined, jobTitle, salary)

**Primary Key**: staffNum

**Foreign Key**: locationNum **references** Outlet (locationNum)

**Client** (clientNum, licenseNum, firstName, lastName, homeAddress, phoneNum, dateOfBirth, sex)

**Primary Key**: clientNum

**Candidate Key**: licenseNum

**hireAgreement** (hireNum, clientNum, registrationNum, startDate, endDate)

**Primary Key**: hireNum

**Candidate Key**: clientNum, registrationNum

**Foreign Key**: clientNum **references** Client (clientNum), registrationNum **references** Vehicle (registrationNum)

**Constraints**:

**Outlet** (locationNum, phoneNum, address, faxNum, vehicleStock)

**Primary Key**: locationNum

**Derived**: vehicleStock [**summation of** (vehicles(locationNum) **where** locationNum)]

**Vehicles** (registrationNum, locationNum, model, make, milageBeforeNewHire, engineSize, capacity, hireRate)

**Primary Key**: registrationNum

**Foreign Key**: locationNum **references** Outlet (locationNum) ON UPDATE CASCADE ON DELETE CASCADE

**Staff** (staffNum, locationNum, firstName, lastName, homeAddress, phoneNum, dateOfBirth, sex, dateJoined, jobTitle, salary)

**Primary Key**: staffNum

**Foreign Key**: locationNum **references** Outlet (locationNum) ON UPDATE CASCADE ON DELETE CASCADE

**Client** (clientNum, licenseNum, firstName, lastName, homeAddress, phoneNum, dateOfBirth, sex)

**Primary Key**: clientNum

**Candidate Key**: licenseNum

**hireAgreement** (hireNum, clientNum, registrationNum, startDate, endDate)

**Primary Key**: hireNum

**Candidate Key**: clientNum, registrationNum

**Foreign Key**: clientNum **references** Client (clientNum) ON UPDATE CASCADE ON DELETE CASCADE

**Foreign Key:** registrationNum **references** Vehicle (registrationNum) ON UPDATE CASCADE ON DELETE CASCADE

**3) Oracle DBMS**

**Initializing tables:**

CREATE TABLE Outlet(

locationNum NUMBER(10) Primary key,

phoneNum NUMBER(10) UNIQUE NOT NULL,

address VARCHAR(255) UNIQUE NOT NULL,

faxNum NUMBER(10)

);

CREATE TABLE Vehicle (

registrationNum NUMBER(10) Primary Key,

locationNum NUMBER(10) UNIQUE NOT NULL,

vehicleModel VARCHAR(50),

vehicleMake VARCHAR(50),

milageBeforeNewHire NUMBER(10,2) NOT NULL,

vehicleEngineSize NUMBER(7,1),

vehicleCapacity NUMBER(2) NOT NULL,

hireRate NUMBER(5, 2) NOT NULL,

Constraint

locationNum Foreign Key (locationNum)REFERENCES Outlet ON DELETE CASCADE

);

CREATE TABLE Staff(

staffNum NUMBER(10) Primary Key,

locationNum NUMBER(10) UNIQUE NOT NULL,

firstNum VARCHAR(20) NOT NULL,

lastNum VARCHAR(20) NOT NULL,

homeAddress VARCHAR(255) NOT NULL,

phoneNum NUMBER(10) NOT NULL,

dateOfBirth DATE NOT NULL,

sex VARCHAR(1) NOT NULL,

dateJoined DATE NOT NULL,

jobTitle VARCHAR(20) NOT NULL,

salary NUMBER(7,2) NOT NULL,

CONSTRAINT

sex\_check CHECK (sex = 'F' or sex = 'M'),

CONSTRAINT

locationNum Foreign Key (locationNum) REFERENCES Outlet ON DELETE CASCADE

);

CREATE TABLE Client(

clientNum NUMBER(10) Primary Key,

firstNum VARCHAR(20) NOT NULL,

lastNum VARCHAR(20) NOT NULL,

homeAddress VARCHAR(255) NOT NULL,

phoneNum NUMBER(10) NOT NULL,

dateOfBirth DATE NOT NULL,

sex VARCHAR(1) NOT NULL

);

ALTER TABLE Client ADD CONSTRAINT

sex\_check2 CHECK (sex = 'F' or sex = 'M');

CREATE TABLE hireAgreement(

hireNum NUMBER(10) Primary Key,

clientNum NUMBER(10) UNIQUE NOT NULL,

registrationNum NUMBER(10) UNIQUE NOT NULL,

startDate DATE NOT NULL,

endDate DATE NOT NULL,

CONSTRAINT

clientNum Foreign Key(clientNum) REFERENCES Client ON DELETE CASCADE,

CONSTRAINT

registrationNum Foreign Key(registrationNum) REFERENCES Vehicle ON DELETE CASCADE

);

**Insert Data into Tables:**

INSERT INTO Outlet

VALUES (5, 7574810287, '121 East Street, Fort Lauderdale FL',8718072326);

INSERT INTO Outlet

VALUES

(2, 1522305583, '20 NW Lane, New York NY',4848686502);

INSERT INTO Outlet

VALUES (3, 3810731254, '1010 Ye Lane, Chicago IL',8718072326);

INSERT INTO Outlet

VALUES

(4, 2811647753, '22 Testing Avenue, Los Angles CA',4848686502);

INSERT INTO Vehicle

VALUES (4617515767, 1, 'XDF-F', 'Ford', 420, 20, 4, 32.12);

INSERT INTO Vehicle

VALUES (8807351172, 2, 'Model S', 'Tesla', 1000, 0, 5, 100.50);

INSERT INTO Vehicle

VALUES (6089327956, 3, 'Model X', 'Tesla', 10000, 0, 7, 105.50);

INSERT INTO Vehicle

VALUES (7637611473, 4, 'Prius', 'Toyota', 51932, 0, 5, 50.00);

INSERT INTO Vehicle

VALUES (1882028286, 5, 'Roadster', 'Tesla', 1000, 0, 2, 150.00);

Select \* From Vehicle;

Insert Into Staff

VALUES (6792108913, 1, 'Josh', 'Welsh', '1232 City Lane, Miami',1293752374 , TO\_DATE('04-12-2000','MM-DD-YYYY'), 'M', TO\_DATE('01-01-2020', 'MM-DD-YYYY'), 'Owner',50000.01);

Insert Into Staff

VALUES (7444280365, 2, 'Bob', 'Builder', '1032 Bike Avenue, New York',8960967802 , TO\_DATE('04-12-1990','MM-DD-YYYY'), 'M', TO\_DATE('01-01-2015', 'MM-DD-YYYY'), 'Owner',96030.00);

Insert Into Staff

VALUES (7970668390, 3, 'Alex', 'Fridman', '10 Nw St, Chicago',1068402172 , TO\_DATE('12-22-2001','MM-DD-YYYY'), 'M', TO\_DATE('04-30-2019', 'MM-DD-YYYY'), 'Owner',52000.01);

Insert Into Staff

VALUES (4617902150, 4, 'Jannette', 'Smith', '1032 Surfer Road, Los Angles',9858549998 , TO\_DATE('11-02-1995','MM-DD-YYYY'), 'M', TO\_DATE('07-05-2020', 'MM-DD-YYYY'), 'Owner',99030.00);

Insert Into Staff

VALUES (2861883351, 5, 'Jake', 'Lindsay', '1002 Lidar Apartments, Fort Lauderdale',6068299677 , TO\_DATE('04-12-1990','MM-DD-YYYY'), 'M', TO\_DATE('01-01-2015', 'MM-DD-YYYY'), 'Owner',43230.00);

Select \* From Staff;

Insert Into Client

VALUES (8028822224,'Josh', 'Joseph', '653 St Austin, Texas',4043970030 , TO\_DATE('04-12-1980','MM-DD-YYYY'), 'M');

Insert Into Client

VALUES (8240452670, 'Alex', 'Fununon', '10 NW 24 St Dallas, Texas',6127288679 , TO\_DATE('10-20-2000','MM-DD-YYYY'), 'M');

Insert Into Client

VALUES (3388630185, 'David', 'Mob', '10 St Baltimore, Maryland',4064727884 , TO\_DATE('12-22-1971','MM-DD-YYYY'), 'M');

Insert Into Client

VALUES (1578170632, 'Jane', 'Dowe', '5032 Surfer Road, Los Angles',9858549998 , TO\_DATE('11-02-1995','MM-DD-YYYY'), 'M');

Insert Into Client

VALUES (2161517274, 'David', 'Blaine', '1002 Lidar Apartments, Fort Lauderdale',5568752339 , TO\_DATE('04-12-1963','MM-DD-YYYY'), 'M');

Select \* FRom Client;

Insert Into Hireagreement

VALUES (5452916486, 8028822224, 4617515767, TO\_DATE('04-20-2019','MM-DD-YYYY'),TO\_DATE('05-20-2019','MM-DD-YYYY') );

Insert Into Hireagreement

VALUES (4801444242,8240452670,8807351172, TO\_DATE('1-20-2020','MM-DD-YYYY'),TO\_DATE('05-19-2020','MM-DD-YYYY') );

Insert Into Hireagreement

Values (9579541632, 3388630185, 6089327956,TO\_DATE('3-29-2020','MM-DD-YYYY'),TO\_DATE('04-15-2020','MM-DD-YYYY') );

Insert Into hireagreement

Values (5235482910, 1578170632, 7637611473, TO\_DATE('6-01-2020','MM-DD-YYYY'),TO\_DATE('06-09-2020','MM-DD-YYYY') );

Insert Into hireagreement

Values (9516216753, 2161517274, 1882028286, TO\_DATE('7-11-2020','MM-DD-YYYY'),TO\_DATE('07-20-2020','MM-DD-YYYY') );

Select \* From hireAgreement;

**Queries:**

1. How many vehicles are sold at each location?
2. Are there any returning clients, if so, who are they?
3. List out all the employees, first, last name, and salary, sort it by salary in descending order?
4. Who is the highest paid employee? List out there first, last name, date of birth and date they joined.
5. List all the vehicle details that are currently available for hire?

**The sql queries can be found in the query.py file in the GitHub repository.**

**4) Conclusion**

A successful database was created which satisfies the users transactions. All attributes in the database satisfy up to 3 NF.