



2b.)

```
CREATE TABLE InsuranceCo(  
name VARCHAR(50) PRIMARY KEY,  
phone INT  
);  
CREATE TABLE Person(  
ssn INT PRIMARY KEY,  
name VARCHAR(50)  
);  
CREATE TABLE Driver(  
ssn INT PRIMARY KEY,  
driverID INT,  
FOREIGN KEY (ssn) REFERENCES Person(ssn)  
);  
CREATE TABLE NonprofessionalDriver(  
driverID INT PRIMARY KEY,  
FOREIGN KEY (driverID) REFERENCES Driver(driverID)  
);  
CREATE TABLE ProfessionalDriver(  
driverID INT PRIMARY KEY,  
medicalHistory VARCHAR(50),  
FOREIGN KEY (driverID) REFERENCES Driver(driverID)  
);  
CREATE TABLE Truck(  
licensePlate VARCHAR(50) PRIMARY KEY,  
capacity VARCHAR(50),  
driverID INT REFERENCES ProfessionalDriver(driverID),  
FOREIGN KEY (licensePlate) REFERENCES Vehicle(licensePlate)  
);  
CREATE TABLE Car(  
licensePlate VARCHAR(50) PRIMARY KEY,  
make VARCHAR(50),  
FOREIGN KEY (licensePlate) REFERENCES Vehicle(licensePlate)  
);  
CREATE TABLE Vehicle(  
licensePlate VARCHAR(50) PRIMARY KEY,  
year INT,  
maxLiability REAL,  
name VARCHAR(50) REFERENCES InsuranceCo(name),  
ssn INT REFERENCES Person(ssn)  
);  
CREATE TABLE Drives(  
driverID INT REFERENCES NonProfessionalDriver(driverID),
```

```
licensePlate VARCHAR(50) REFERENCES CAR(licensePlate),  
PRIMARY KEY(driverID, licensePlate)  
);
```

2c.) Which relation in your relational schema represents the relationship "insures" in the E/R diagram and why is that your representation?

The insures relationship is in the Vehicle -InsuranceCo relationship. I have chosen this relationship because a vehicle needs insurance and needs to be able to reference InsuranceCo to get that information. If a vehicle does not have insurance, these attributes will be null.

2d.) Compare the representation of the relationships "drives" and "operates" in your schema, and explain why they are different.

the operate relationship is many-one and the Drives relationships is many-many. A truck can reference a one professional driver or many professional drivers. However, a car cannot show many drivers for one car.

3a) $R(A,B,C,D,E)$ with functional dependencies $D \rightarrow B$, $CE \rightarrow A$.

1) Unique Key: (C,D,E)

2) Both dependencies violate BCNF.

3) Fixing $CE \rightarrow A$ gives (C,E,A) , (C,D,E) , (C,D,B)

4) Fixing $D \rightarrow B$ gives (A,C,E) , (C,D,E) , and (D,B) which is final decomposition

3b) $S(A,B,C,D,E)$ with functional dependencies $A \rightarrow E$, $BC \rightarrow A$, $DE \rightarrow B$.

1) Unique keys are (A,C,D) , (B,C,D) , and (C,D,A)

2) all dependencies violate BCNF

3) Fixing $BC \rightarrow A$ will give us (B,C,D,E) and (B,C,A)

4) Dependency $A \rightarrow E$ is gone therefore this is not a dependence. Therefore we preserve decomposition.

5) Fixing $DE \rightarrow B$ will give us (C,D,E) , (D,E,B) , (B,C,A) which will be the final decomposition.

4a) All sets of attributes are closed.

$A \rightarrow A$

$B \rightarrow B$

$C \rightarrow C$

$D \rightarrow D$

4b) The only closed sets are $\{\}$ and $\{A,B,C,D\}$.

$A \rightarrow B$

$B \rightarrow C$

$C \rightarrow D$

$D \rightarrow A$

4c) The only closed sets are $\{\}$, $\{A,B\}$, and $\{A,B,C,D\}$.

$A \rightarrow B$

$B \rightarrow A$

$C \rightarrow A, B, D$

$D \rightarrow A, B, C$