



Question 2 part 1

CREATE TABLE Person (SSN INT primary key,

name CHAR(50));

CREATE TABLE Driver (DriverID INT primary key,

SSN INT REFERENCE Person);

CREATE TABLE NonProfessionalDriver(DriverID INT REFERENCE Driver

licenseplate VARCHAR(50) REFERENCE Car

primary key(DriverID));

CREATE TABLE ProfessionalDriver (DriverID INT REFERENCE Driver,

licenseplate VARCHAR(50) REFERENCE Car

MedicalHistory CHAR(50)

primary key(DriverID));

CREATE TABLE Truck (licenseplate VARCHAR(50) REFERENCE Vehicle,

capacity INT

primary key (licenseplate));

CREATE TABLE InsuranceCo (name CHAR(50) primary key,

phone INT);

CREATE TABLE Vehicle (licenseplate VARCHAR(50) primary key,

year real,

maxliability real

SSN INT REFERENCE Person

name CHAR(50) REFERENCE InsuranceCo);

CREATE TABLE Car (licenseplate VARCHAR(50) REFERENCE Vehicle,

make CHAR(50)

primary key (licenseplate));

CREATE TABLE Drives (DriverID INT REFERENCE Driver,

licenseplate VARCHAR(50) REFERENCE Car

primary key (DriverId, licensplate));

Question 2 part 2

The relationship "insures" is represented by the vehicle table, which is linked to the Insurance Co. This relation stands for the vehicle (which has its own license plate and year) is insured (the relationship that includes also the max liability) by the Insurance Co (which has the name and phone as attributes). This relationship between the vehicle and the Insurance Company is represented with an arrow, meaning that the vehicle can be insured at most by one Insurance Company.

Question 2 part 3

Both the relationships drives and operates are a one to many relationship; however, they get divided according to different tables because of the differentiation between professional and non professional drivers. Indeed, they are both related to the driver relation; however, a division between non-professional and professional drivers exists. Indeed the non-professional drivers links to the car table via the drives relation meaning that non professional drivers are driving cars with their attribute (make) as a specific kind of vehicle. Since it is a many to many relation, it is expressed in a table while it is not the same for the operate relation as it is a many to one relation. The professional drivers, instead, not only have an additional attribute (medical history) but they relate to truck as a kind of vehicle and their capacity to the operates relation. Even if similar, these different relations specify the divergent kinds of vehicles that non professional and professional drivers drive. Both the professional and non professional drivers relate to the vehicle through the license plate key and to the driver via the driverid.

Question 3 part 1

R(A,B,C,D,E)



The current schema violates BCNF because D is not key, so there is the need to decompose it.

$D^+ = D, B \neq A, B, C, D, E$



Decomposing into 2 relations to make BCNF hold.



R1(D,B)

R2(D,A,C,E)



Decomposing into 2 more relations because BCNF does not hold since CE is not a key.



R3(C,E,A)

R4(C,E,D)



After this decomposition, BCNF holds.

Question 3 part 2

S(A,B,C,D,E)

S1(A,E)

S2(A,B,C,D)

S3(B,C,A)

S4(B,C,D)

A+ = A, E ≠ A, B, C, D, E
BC + = B, C, A, E ≠ A, B, C, D, E
DE + = D, E, B, A ≠ A, B, C, D, E

→ All of them violate BCNF as none of them include all attributes

It needs to be decomposed on A E as A is not a key

Decomposing into 2 relations because BCNF does not hold as BC is not a key.

After this decomposition, BCNF holds as BC is a key.

Question 4

1. If all sets of attributes are closed, the set of dependencies is empty.

2. $A \longrightarrow B, C, D$

$B \longrightarrow A, C, D$

$C \longrightarrow A, B, D$

$D \longrightarrow A, B, C$

3. $C \longrightarrow A, B, D$

$D \longrightarrow A, B, C$