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```
-- The relationship 'insures' is represented in the Vehicles table
-- where there is an attribute called maxLiability. Since this is a
-- many to one relationship, there is no separate relations for 'insures'.
```

```
-- The relationship 'drives' is a many to many relation so it has its own
-- separate table whereas the relationship 'operates' is a many to one
-- relation and so it's incorporated in the Truck table.
```

```
CREATE TABLE Vehicle (
  licencePlate varchar(50) PRIMARY KEY,
  year integer,
  maxLiability float,
  name varchar(50),
  ssn integer,
  FOREIGN KEY (name) REFERENCES InsuranceCo(name)
  FOREIGN KEY (ssn) REFERENCES Person(ssn)
);
```

```

CREATE TABLE Car (
    make varchar(50),
    lp varchar(50),
    FOREIGN KEY (lp) REFERENCES Vehicle(licencePlate)
);

CREATE TABLE Truck (
    capaci varchar(50),
    lp varchar(50),
    pd_ssn integer,
    FOREIGN KEY (lp) REFERENCES Vehicle(licensePlate),
    FOREIGN KEY (pd_ssn) REFERENCES ProfessionalDriver(pd_ssn)
);

CREATE TABLE InsuranceCo (
    name varchar(50) PRIMARY KEY,
    phone integer
);

CREATE TABLE Person (
    ssn integer PRIMARY KEY,
    name varchar(50)
);

CREATE TABLE Driver (
    driverID integer,
    d_ssn integer,
    FOREIGN KEY (d_ssn) REFERENCES Person(ssn)
);

CREATE TABLE NonProfessionalDriver (
    nd_ssn integer,
    FOREIGN KEY (nd_ssn) REFERENCES Driver(d_ssn)
);

CREATE TABLE ProfessionalDriver (
    medicalHistory varchar(50),
    pd_ssn integer,
    FOREIGN KEY (pd_ssn) REFERENCES Driver(d_ssn)
);

CREATE TABLE Drives (
    nd_ssn integer REFERENCES NonProfessionalDriver,
    lp varchar(50) REFERENCES Car,
    PRIMARY KEY (nd_ssn, lp)
);

```

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

Use  $D \rightarrow B$ :

Decompose  $R$  into  $R_1(D, B)$  and  $T(A, C, D, E)$

$T$  violates  $CE \rightarrow A$  so we need to further decompose  $T$

Use  $CE \rightarrow A$ :

Decompose  $T$  into  $R_2(A, C, E)$  and  $R_3(C, D, E)$

Final relations:  $R_1(\underline{D}, B)$ ,  $R_2(\underline{C}, \underline{E}, A)$ , and  $R_3(\underline{D}, \underline{C}, \underline{E})$

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

Use  $DE \rightarrow B$ :

Decompose  $S$  into  $S_1(D, E, B)$  and  $T(A, C, D, E)$

$T$  violates  $A \rightarrow E$  so we need to further decompose  $T$

Use  $A \rightarrow E$ :

Decompose  $T$  into  $S_2(A, E)$  and  $S_3(A, C, D)$

Final relations:  $S_1(\underline{D}, \underline{E}, B)$ ,  $S_2(\underline{A}, E)$ , and  $S_3(\underline{A}, C, D)$

4. All sets of attributes are closed.

Functional Dependencies:  $A \rightarrow BCD$ ,  $B \rightarrow ACD$ ,  $C \rightarrow ABD$ , and  $D \rightarrow ABC$

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

Functional Dependencies:  $A \rightarrow A$ ,  $B \rightarrow B$ ,  $C \rightarrow C$ , and  $D \rightarrow D$

The only closed sets are  $\{\}$ ,  $\{A,B\}$ , and  $\{A,B,C,D\}$

Functional Dependencies:  $A \rightarrow B$ ,  $B \rightarrow A$ ,  $C \rightarrow DAB$ , and  $D \rightarrow CAB$