

# CS-317 Data Management and Information Processing Spring 2003

## Midterm Solutions

### Problem 1

#### *NULL Value:*

A value of a given attribute which is unspecified (i.e. is not) from the domain of the attribute or is different from any other value of that domain is called a NULL value. It may mean any of the following:

- Missing entry
- Unknown value
- Not applicable

And hence it is ambiguous.

#### *Role:*

Role is the nature (or function) of an entity in a given relationship.

### Problem 2

A weak entity class cannot be directly represented as a schema as it does not have an unique key. It can be represented as a schema in which the key consists of

- Key attributes from the entity class involved in the relationship
- Discriminators from the weak entity class itself

### Problem 3

Following is the relation based schema of the given ER diagram:

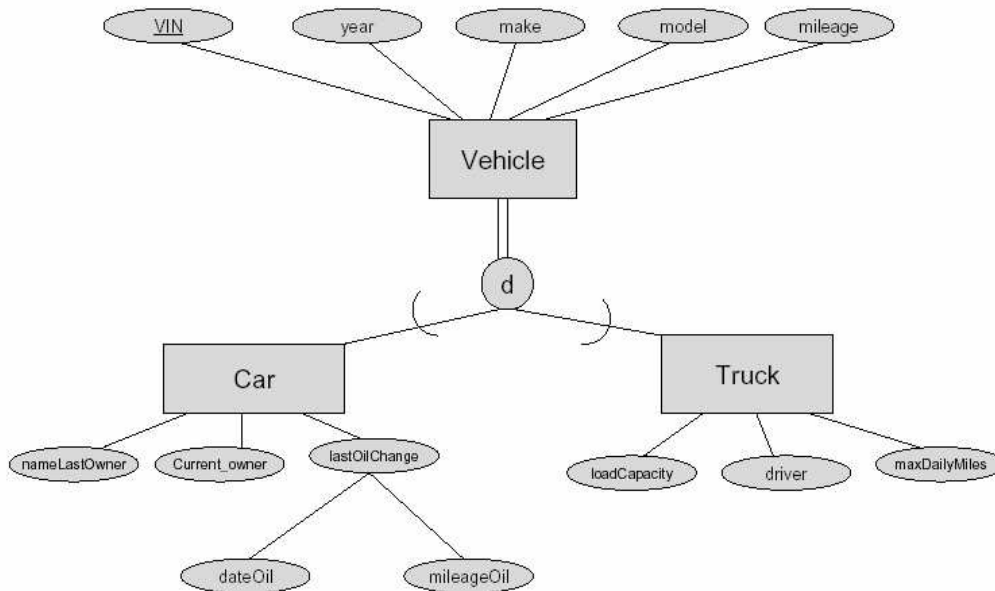
Entity\_1 (key\_1, attribute\_1)

Entity\_2 (key\_2, attribute\_2)

Rel\_12 (key\_1, key\_2, rel\_attribute)

#### Problem 4

Following is the ER diagram representing the problem domain specified in the problem



Since it is a disjoint specialization, all of the following conversions apply:

*Possible answer 1:*

Vehicle (VIN, year, make, model, mileage)

Car (VIN, nameLastOwner, currentOwner, dateOil, mileageOil)

Truck (VIN, loadCapacity, driver, maxDailyMiles)

*Possible answer 2:*

Car (VIN, year, make, model, mileage, nameLastOwner, currentOwner, dateOil, mileageOil)

Truck (VIN, year, make, model, mileage, loadCapacity, driver, maxDailyMiles)

*Possible answer 3:*

Vehicle (VIN, year, make, model, mileage, nameLastOwner, currentOwner, dateOil, mileageOil, loadCapacity, driver, maxDailyMiles)

#### Problem 5

The given relational schema is R (A, B, C, D, E, F, G, H)

Given functional dependencies are:

FD1: A -> C, D

FD2: B -> E, F, G

FD3: C -> E, F

*Reflexivity:*

From FD2 we obtain

**FD3: B, D -> E, F, G, D**

*Augmentation:*

From FD2 (augmenting with H) we obtain:

**FD4:  $B, H \rightarrow E, F, G, H$**

*Transitivity:*

Decomposing FD1 we obtain:

FD5:  $A \rightarrow C$

Using FD5 and FD3 we obtain:

**FD6:  $A \rightarrow E, F$**

*Decomposition:*

Decomposing FD1 we obtain:

**FD7:  $A \rightarrow D$**

*Union:*

Using FD1 and FD6 we obtain:

**FD8:  $A \rightarrow C, D, E, F$**

*Pseudo-Transitivity:*

Using FD7 and FD3 we obtain:

**FD9:  $B, A \rightarrow E, F, G, D$**

### **Problem 6**

1NF specifies that every attribute of a schema must take its values from an atomic domain. It is now primarily of interest from a historical perspective.

### **Problem 7**

The set of functional dependencies that are full, maximal and non-trivial are:

FD1:  $A, B \rightarrow C, D, E, F, G, H$

FD2:  $A \rightarrow C, D$

FD3:  $B \rightarrow E, F, G$

FD2 and FD3 violate 2 NF, so the relational schema R (A, B, C, D, E, F, G, H) must be broken down. As you would notice below, it has to be broken down twice and the order is not relevant.

R (A, B, C, D, E, F, G, H)

- R12 (A, B, E, F, G, H)
  - **R121 (A, B, H)**
  - **R122 (B, E, F, G)**
- **R22 (A, C, D)**

Alternatively

R (A, B, C, D, E, F, G, H)

- R12 (A, B, C, D, H)
  - **R121 (A, B, H)**
  - **R122 (A, C, D)**
- **R22 (B, E, F, G)**