CIS 5355 - DATABASE MANAGEMENT SYSTEMS

ASSIGNMENT - 8

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A. **Normalization Step**: First Normal Form (1NF)

B. **Rules for 1NF**:

1. Relation must have a defined/designated PK
2. All attribute values must be single-valued and atomic
3. Each tuple uniquely identifies one and only one entity instance
4. Identify and eliminate repeating groups.
5. If repeating group(s) exist, isolate the attributes causing the repeating group into its own relation. Bring a copy of the PK of the relation from which the repeating group was removed as FK in the new relation.

C. **Relational Model in the Unnormalized Form (UNF)**:

- **GroomVisitRec** (**VisitID**, VisitDate, VisitStartTime, VisitEndTime, EmpID, EmpFirstName, EmpLastName, EmpStreet, EmpApartmentNumber, EmpCity, EmpState, EmpZipCode, EmpAreaCode, EmpPhoneNumber, EmpHireDate, EmpSpecialty, OwnerID, OwnerFname, OwnerLname, OwnerInitial, OwnerStreet, OwnerApartmentNumber, OwnerCity, OwnerState, OwnerZipCode, OwnerAreaCode,OwnerPhoneNumber, PetID, PetName, PetCatID, PetCategory, PetGender, **TaskID**, TaskName, TaskDescription, TaskBaseFee, TaskBaseTime, TaskActualTime, TaskComment)

D. Evaluate for Repeating Group(s):

(TaskID, TaskName, TaskDescription, TaskBaseFee, TaskBaseTime, TaskActualTime) attributes cause values of other attributes to repeat.

1. Isolate these attributes into its own relation.
2. Bring a copy of the PK (VisitID) of the remainder relation as FK in the relation these attributes were removed to.

- **OwnerVisitShop** (**VisitID**, VisitDate, VisitStartTime, VisitEndTime, EmpID, EmpFirstName, EmpLastName, EmpStreet, EmpApartmentNumber, EmpCity, EmpState, EmpZipCode, EmpAreaCode, EmpPhoneNumber, EmpHireDate, EmpSpecialty, OwnerID, OwnerFname, OwnerLname, OwnerInitial, OwnerStreet, OwnerApartmentNumber, OwnerCity, OwnerState, OwnerZipCode, OwnerAreaCode,OwnerPhoneNumber, PetID, PetName, PetCatID, PetCategory, PetGender,TaskComment)

- **Task**(**TaskID**,*VisitID*, TaskName, TaskDescription, TaskBaseFee, TaskBaseTime, TaskActualTime)

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E. **Relational Model in First Normal Form (1NF)**:

- **OwnerVisitShop (<u>VisitID</u>**, VisitDate, VisitStartTime, VisitEndTime, EmpID, EmpFirstName, EmpLastName, EmpStreet, EmpApartmentNumber, EmpCity, EmpState, EmpZipCode, EmpAreaCode, EmpPhoneNumber, EmpHireDate, EmpSpecialty, OwnerID, OwnerFname, OwnerLname, OwnerInitial, OwnerStreet, OwnerApartmentNumber, OwnerCity, OwnerState, OwnerZipCode, OwnerAreaCode,OwnerPhoneNumber, PetID, PetName, PetCatID, PetCategory, PetGender,TaskComment)

- **Task**(**<u>TaskID</u>**,*VisitID*, TaskName, TaskDescription, TaskBaseFee, TaskBaseTime, TaskActualTime)

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A. **Normalization Step**: Second Normal Form (2NF)

B. **Rules for 2NF**:

1. Relation must be in 1NF
2. Evaluate each relation for Partial Functional Dependency between the PK attributes and all remaining non-prime attributes. NOTE: Partial functional dependency exists if and only if the PK is a composite PK. Partial dependency does not exist if the PK is a single- attribute key. In that case, the relation is already in 2NF.
3. If partial dependency exists, isolate the attributes that are partially dependent into its own relation, along with the key attribute upon which they depend designated as its PK. Leave a copy of this PK behind as FK in the original relation from which partially dependent attributes were removed.

C. **Relational Model in the First Normal Form (1NF)**:

- **OwnerVisitShop** (**VisitID**, VisitDate, VisitStartTime, VisitEndTime, EmpID, EmpFirstName, EmpLastName, EmpStreet, EmpApartmentNumber, EmpCity, EmpState, EmpZipCode, EmpAreaCode, EmpPhoneNumber, EmpHireDate, EmpSpecialty, OwnerID, OwnerFname, OwnerLname, OwnerInitial, OwnerStreet, OwnerApartmentNumber, OwnerCity, OwnerState, OwnerZipCode, OwnerAreaCode,OwnerPhoneNumber, PetID, PetName, PetCatID, PetCategory, PetGender,TaskComment)

- **Task**(**TaskID**,*VisitID*, TaskName, TaskDescription, TaskBaseFee, TaskBaseTime, TaskActualTime)

D. Evaluate Each Relation for Partial Dependency:

The relations (**OwnerVisitShop** and **Task**) have a single-attribute PK in each of them. So,They are already in 2nd Normal Form and due to only a single-attribute primary key – there is no possibility of partial dependency.

E. Relation in Second Normal Form(2NF):

- **OwnerVisitShop** (**VisitID**, VisitDate, VisitStartTime, VisitEndTime, EmpID, EmpFirstName, EmpLastName, EmpStreet, EmpApartmentNumber, EmpCity, EmpState, EmpZipCode, EmpAreaCode, EmpPhoneNumber, EmpHireDate, EmpSpecialty, OwnerID, OwnerFname, OwnerLname, OwnerInitial, OwnerStreet, OwnerApartmentNumber, OwnerCity, OwnerState, OwnerZipCode, OwnerAreaCode,OwnerPhoneNumber, PetID, PetName, PetCatID, PetCategory, PetGender,TaskComment)

- **Task**(**TaskID**,*VisitID*, TaskName, TaskDescription, TaskBaseFee, TaskBaseTime, TaskActualTime)

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A. **Normalization Step**: Third Normal Form (3NF)

B. **Rules for 3NF**:

1. Relation must be in 2NF
2. Evaluate each relation for Transitive Functional Dependency between each non-key attribute and other non-key attributes. NOTE: Transitive functional dependency exists only among non-prime attributes. Therefore, transitive dependency exists if and only if a relation has more than one non-prime attribute. Otherwise, it is already in the third normal form or 3NF.
3. If transitive dependency exists, isolate the attributes that transitively depend into its own relation, along with the non-attribute attribute upon which they depend designated as its PK. Leave a copy of this PK behind as FK in the original relation from which transitively dependent attributes were removed.

C. **Relational Model in Second Normal Form (2NF)**:

- **OwnerVisitShop** (**VisitID**, VisitDate, VisitStartTime, VisitEndTime, EmpID, EmpFirstName, EmpLastName, EmpStreet, EmpApartmentNumber, EmpCity, EmpState, EmpZipCode, EmpAreaCode, EmpPhoneNumber, EmpHireDate, EmpSpecialty, OwnerID, OwnerFname, OwnerLname, OwnerInitial, OwnerStreet, OwnerApartmentNumber, OwnerCity, OwnerState, OwnerZipCode, OwnerAreaCode,OwnerPhoneNumber, PetID, PetName, PetCatID, PetCategory, PetGender,TaskComment)

- **Task**(**TaskID**,*VisitID*, TaskName, TaskDescription, TaskBaseFee, TaskBaseTime, TaskActualTime)

D. **Evaluate Each Relation for Transitive Dependency:**

Task Relation has more than one non-prime attributes but there are no non-prime attributes that define other non-prime attributes, since all non-prime attributes are determined by the prime-key attribute, since:

- TaskName alone can't determine the TaskDescription,TaskBaseFee,TaskBaseTime,TaskActualTime
- TaskName and TaskDescription can't determine TaskBaseFee
- TaskName, TaskDescription and TaskBaseFee can't determine TaskBaseTime
- TaskName, TaskDescription, TaskBaseFee and TaskBaseTime can't determine TaskActualTime

No Transitive Dependency Detected in **Task** Relation.

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Whereas, OwnerVisitShop Relation has possibilities for Transitive dependency since;

- VisitID → VisitDate, VisitStartTime, VisitEndTime, TaskComment
- Possible, EmpID → EmpFirstName, EmpLastName, EmpStreet, EmpApartmentNumber, EmpCity, EmpState, EmpZipCode, EmpAreaCode, EmpPhoneNumber, EmpHireDate,EmpSpecialty
- Similarly, Possible OwnerID → OwnerFname, OwnerLname, OwnerInitial, OwnerStreet, OwnerApartmentNumber, OwnerCity, OwnerState, OwnerZipCode, OwnerAreaCode,OwnerPhoneNumber
- Possible, PetID → PetName, PetGender, PetCatID, PetCategory

E. Relational Model in Third Normal Form (3NF):

- **Visit** (**<u>VisitID</u>**, *OwnerID, PetID*, *EmpID*,VisitDate, VisitStartTime, VisitEndTime, TaskComment)

- **Owner** (**<u>OwnerID</u>**, OwnerFname, OwnerLname, OwnerInitial, OwnerStreet, OwnerApartmentNumber, OwnerCity, OwnerState, OwnerZipCode, OwnerAreaCode,OwnerPhoneNumber)

- **Pet(<u>PetID</u>**, PetName, PetGender,PetCatID,PetCategory)

- **Employee(<u>EmpID</u>**, EmpFirstName, EmpLastName, EmpStreet, EmpApartmentNumber, EmpCity, EmpState, EmpZipCode, EmpAreaCode, EmpPhoneNumber, EmpHireDate, EmpSpecialty)

- **Task(<u>TaskID</u>**,*VisitID*, TaskName, TaskDescription, TaskBaseFee, TaskBaseTime, TaskActualTime)

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Following are a few of the business rules and notes for this case:

a. A pet owner/customer may own more than one pet, but each pet is owned by one and only one owner.

b. A pet may have one or more grooming visits to the store. Each visit is associated with one and only one pet.

c. More than one grooming tasks can be performed on the pet during the same visit.

d. One employee performs all grooming tasks performed on the pet during a given visit.

e. Each employee can specialize in at most one grooming task; however, for each grooming task there may be more than one employee who specialize in performing that task.

f. It is necessary to maintain data about current address and phone number for each employee and each customer/owner of pet.

Below is the final 3NF relation after consideration of Business Rules and User View:

- **Visit** (**VisitID**, *OwnerID, PetID*, *EmpID*,VisitDate, VisitStartTime, VisitEndTime, TaskComment)

- **Owner** (**OwnerID**, OwnerFname, OwnerLname, OwnerInitial, OwnerStreet, OwnerApartmentNumber, OwnerCity, OwnerState, OwnerZipCode, OwnerAreaCode,OwnerPhoneNumber)

- **Pet**(**PetID**,*OwnerID*,PetName, PetGender)

- **PetCategory**(**PetCatID**,*PetID*,PetCategory)

- **Employee**(**EmpID**, *EmpSpecialityID*,EmpFirstName, EmpLastName, EmpStreet, EmpApartmentNumber, EmpCity, EmpState, EmpZipCode, EmpAreaCode, EmpPhoneNumber, EmpHireDate)

- **EmployeeSpeciality** (**EmpSpecialityID**,EmpSpecialtyName)

- **Task**(**TaskID**,*VisitID*, *PetID*, *EmpID*,TaskName, TaskDescription, TaskBaseFee, TaskBaseTime, TaskActualTime)

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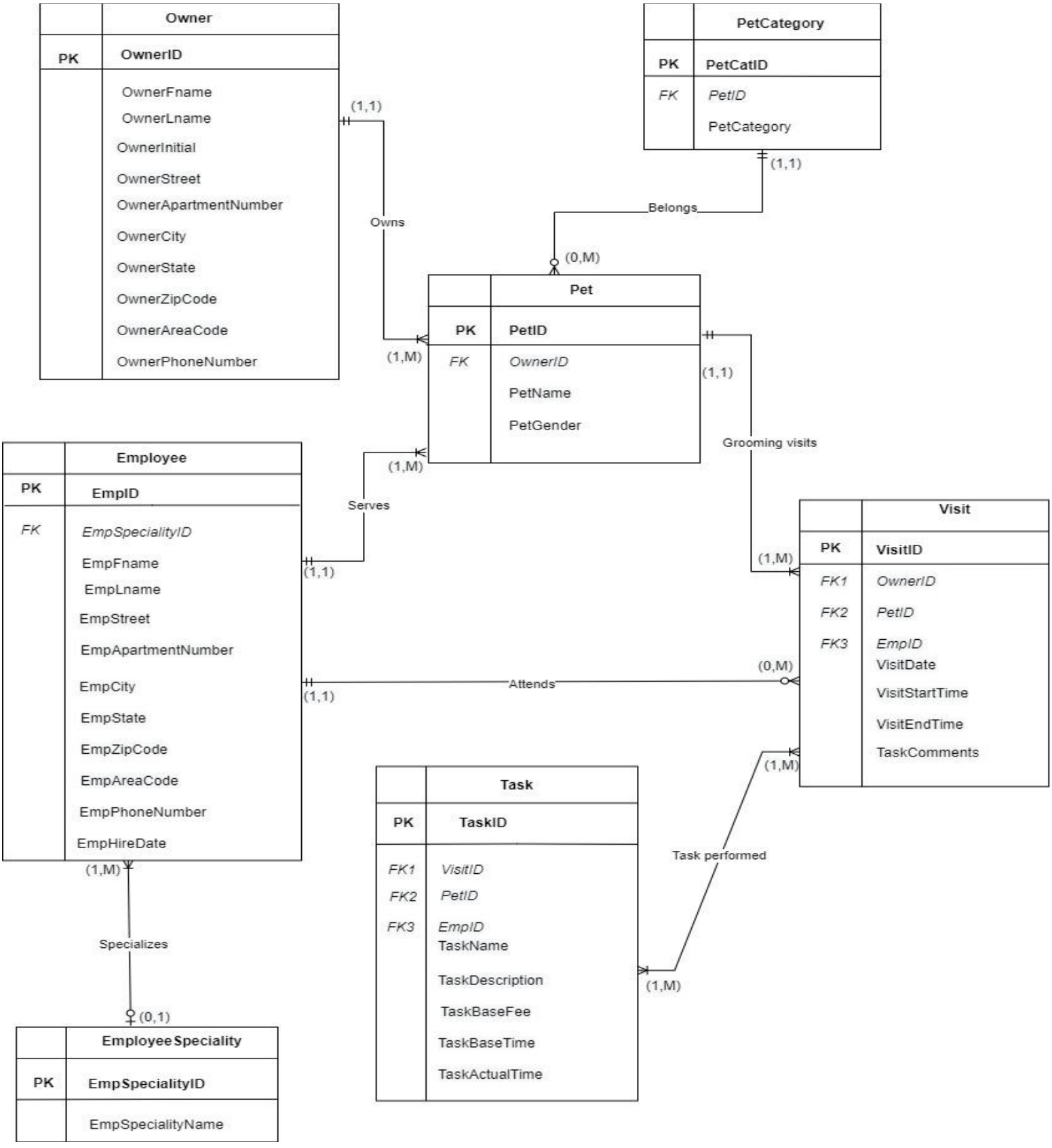
Owner
PK
OwnerID
OwnerFname
OwnerLname
OwnerInitial
OwnerStreet
OwnerApartmentNumber
OwnerCity
OwnerState
OwnerZipCode
OwnerAreaCode
OwnerPhoneNumber
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Owns
(1,M)
PetCategory
PK
PetCatID
FK
PetID
PetCategory
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Belongs
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Pet
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PetID
FK
OwnerID
PetName
PetGender
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Grooming visits
Employee
PK
EmpID
FK
EmpSpecialityID
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EmpLname
EmpStreet
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EmpCity
EmpState
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EmpAreaCode
EmpPhoneNumber
EmpHireDate
Serves
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Visit
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VisitID
FK1
OwnerID
FK2
PetID
FK3
EmpID
VisitDate
VisitStartTime
VisitEndTime
TaskComments
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(0,M)
Attends
(1,1)
Task
PK
TaskID
FK1
VisitID
FK2
PetID
FK3
EmpID
TaskName
TaskDescription
TaskBaseFee
TaskBaseTime
TaskActualTime
Task performed
(1,M)
(1,M)
Specializes
(0,1)
Employee Speciality
PK
EmpSpecialityID
EmpSpecialityName

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