Database Systems

Project: Design, development and implementation of a relational database

Case Study: Pawsome Pets

A company called Pawsome Pets runs multiple clinics. The company would like for their data to be stored in a database. The following description was obtained during the analysis phase:

“Each of the Pawsome Pets clinics has several staff members and a member of staff manages at most one clinic (not all staff manage clinics). Each clinic has a unique clinic number (clinicNo) and each member of staff has a unique staff number (staffNo). Additionally, the company would like to store each clinic’s name, address and telephone number, as well as the staff’s name, address, telephone number, DOB, position and salary.

When a pet owner contacts a clinic, the owner’s pet is registered with the clinic. An owner can own one or more pets, but a pet can only be registered at one clinic. Each owner has a unique owner number (ownerNo), a name, an address and a telephone number. Each pet has a unique pet number (petNo), name, DOB, animal species, breed and color.

When the pet comes to the clinic, it undergoes an examination by a member of the consulting staff. The database should store the following information for each examination: chief complaint (i.e., the main cause for the visit), description (i.e., what was done during the examination), date seen and actions taken (e.g., a treatment was prescribed, tests were ordered). A unique examination number (examNo) is assigned to each examination.

Part 1

Develop a conceptual data model reflecting the following requirements: **(11/05/24)**

a. **Identify the main entity types:**

- Entities represent independent objects or concepts with unique identifiers.
- Main entities:
    - **Clinic**: each clinic location in Pawsome Pets organization
    - **Staff**:
        - General Staff: employees working in the clinic
        - Manager: Specific staff member managing the clinic (only one at most)
    - **Owner**: Each pet owner who registers their pets at Pawsome Pets clinic
    - **Pet**: each pet owned by an owner and registered with a clinic
    - **Examination**: each medical examination that pets undergo at clinic

b. Identify the main relationship types between the entity types identified in "a".

- In ER modeling, a relationship type defines the association between entity types, and it includes degree (the number of participating entity types) and constraints (such as participation and cardinality). Relationship types specify the logical connections between entities in real-world scenarios.
- Main relationships types:
    1. Clinic-Staff Relationship:
        - Employment Relationship
            - Type: One-to-Many
            - Degree: Binary (clinic and staff)
            - Description: Each clinic employs multiple staff members, but each staff member is associated with only one clinic.
        - Management Relationship
            - Type: One-to-One (1:1)
            - Degree: Binary (clinic and staff)
            - Description: A single staff member is manager for one clinic, and each clinic has at most one manager
    2. Owner-Pet:
        - Type: One-to-Many
        - Degree: Binary (Owner and Pet)
        - Description: One clinic registers multiple pets
    3. Clinic-Pet:
        - Type: One-to-Many
        - Degree: Binary (Clinic and Pet)
        - Description: Each clinic registers multiple pets, but each pet is registered at only one clinic.
    4. Examination Relationship:
        - Type: One-to-Many
        - Degree: Binary (Pet and Examination)
        - Description: One examination deals with one pet, but a pet can have multiple examinations

c. Determine the multiplicity constraints for each relationship identified in "b".

- Multiplicity constraints are a type of structural constraint that are applied to the relationships in the ER model. They provide the restrictions on how many instances of on entity can or must be associated with the instance of another entity
- Multiplicity Constraints;
    1. Clinic-Staff:
        - Employment Relationship:
            - Multiplicity Constraint: 1…* (clinic), and 0…1 (staff), each clinic can employ multiple staff members, while each staff member can be employed at most clinic
            - Participation Constraint:
                - Clinic: Mandatory (each clinic must have at least one staff

        - Staff: ask tomorrow
    - Management Relationship:
        - Multiplicity Constraint: 0..1 (Clinic), and 0..1 (staff), each clinic can have one manager, and each staff member manages at most one clinic.
        - Participation Constraint:
            - Clinic: Optional, some clinics may not have a manager (at most one)
            - Staff: Optional, not all staff members are managers (at most one)
2. Owner-pet
    - Multiplicity constraint: 1…* (Owner) and 1..1 (Pet), each owner can have multiple pets, but each pet has only one owner.
    - Participation constraint:
        - Owner: Mandatory, all owners must have at least one pet to be recorded as an owner
        - Pet: Mandatory, each pet must have an associated owner
3. Clinic-pet:
    - Multiplicity constraint: 1…* (clinic) and 1..1 (pet), each clinic can register multiple pets, but each pet is registered with only one clinic
    - Participation constraint:
        - Clinic: Optional, a clinic may have no pets initially **(questionable)**
        - Pet: mandatory, every pet must be associated with one clinic
4. Examination Relationship:
    - Multiplicity constraint:
        - Pet and Examination: 1…* (Pet) and 1…1 (examination), each pet can have multiple examinations, and each examination involves one specific pet.
        - Staff and Examination: 1…* (Staff) and 1…1 (examination), each staff member can conduct multiple examinations, but each examination is conducted by one specific staff member.
    - Participation constraints:
        - Pet: Mandatory, an examination must involve one pet
        - Staff: Mandatory, an examination must be conducted by one staff
        - Examination: Mandatory, each examination record must involve a pet and staff member. **(question:** is this referring to whether an examination is mandatory or if the examination record itself requires a pet and staff)

(CHART BELOW)

E_1	M_1	Relationship	M_2	E_2	Type
Clinic	1..1	Employment	1..*	Staff	1…*
Staff	0..1	Manages	0..1	Clinic	1..1
Owner	1..1	Owns	1..*	Pet	1..*
Pet	1..*	Registered	1..1	Clinic	1..*
Pet	1..1	Undergoes	1..*	Examination	1..*
Staff	1..1	Performs	1..*	Examination	1..*

For the final relationship I am unsure if there is a direct relationship between staff and examination or if there is a relationship between staff and pet where the staff examines the pet

d. Identify attributes and associate them with entity or relationship types.

1. Clinic:
    - Attributes:
        - clinicNo: Unique Identifier for each clinic (primary key)
        - name: the name of the clinic
        - address: includes street, city, and zip code (composite)
        - telephone: clinics may have multiple contact numbers (multivalue)
2. Staff
    - Attributes:
        - staffNo: unique identifier for each staff member (primary key)
        - name: the name of staff member
        - address: includes street, city, and zip code (composite)
        - telephone: number to contact staff member (multi-valued)
        - dob: date of birth (single-valued)
        - position: the position or job title of staff member
        - salary: the salary of staff member
        - clinicNo: references the clinic where staff member works/manages (foreign key)
3. Owner
    - Attributes:
        - ownerNo: unique identifier for each pet owner
        - name: the name of pet owner
        - address: composite attribute
        - telephone: multi valued attribute,
4. Pet
    - Attributes:
        - petNo: unique identifier for each pet

        - name: the name of the pet
        - DOB: simple single-valued attribute
        - species: the species of pet
        - breed: the breed of pet
        - color: the color of the pet
        - ownerNo: foreign key, references the owner of pet
        - clinicNo: foreign key, references the clinic where pet is registered
5. Examination
    - Attribute:
        - examNo: unique identifier for each examination (primary key)
        - chiefCompliant: description of the main reason for pet's visit
        - description: detailed account of the examination or treatment performed
        - date: the date on which examination occurred
        - actionsTaken: actions or treatments taken during examination
        - petNo: foreign key, references pet that was examined
        - staffNo: foreign key, references staff member who conducts examination

e. Determine candidate and primary key attributes for each (strong) entity type.

- Candidate Keys = (Primary Keys U Alternate Keys)

Strong Entity	**Primary Key**	**Candidate Key(s)**
Clinic	clinicNo	clinicNo, telephone
Staff	staffNo	staffNo, telephone
Owner	ownerNo	ownerNo, telephone
Pet	petNo	petNo
Examination	examNo	examNo

f. Generate the E-R diagram for the conceptual level (no FKs as attributes).