CS 348 - Homework 1 Solution

August 28, 2019

Note: There will be a 10% penalty for each late calendar day. After five calendar days, the homework will not be accepted.

1. Part 1 (20 points): Draw an E-R diagram for a database of your choice. Identify and explain the following terms in your model.

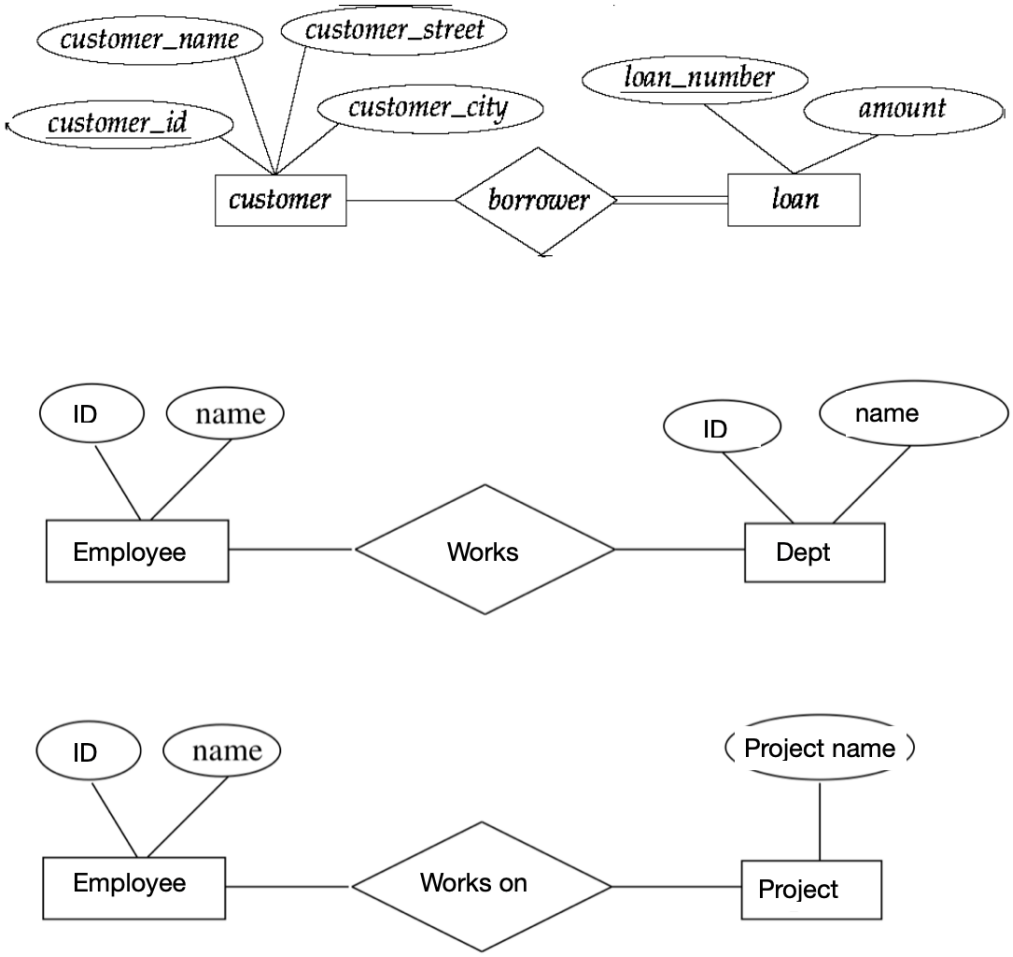
   1. Entity and Entity Set : An entity is an object that exists and is distinguishable from other objects. An Entity has a set of attributes. An entity set is a set of entities of the same type that share the same properties.

   2. Relationship and Relationship Set: A relationship is an association among several entities. A relationship set is a mathematical relation among n $\geq$ 2 entities.

   3. Attribute and their types: An attribute can also be property of a relationship set. Types:
   - Simple and composite attributes.
   - Single-valued and multivalued attributes.
   - Derived attributes.
   - Descriptive attributes

   4. Primary Key, Candidate Key and Superkey: A super key of an entity set is a set of one or more attributes whose values uniquely determine each entity. A candidate key of an entity set is a minimal super key. Although several candidate keys may exist, one of the candidate keys is selected to be the primary key. The combination of primary keys of the participating entity sets forms a superkey of a relationship set.

   5. Mapping Cardinality: For a binary relationship set the mapping cardinality must be one of the following types:
   - One to one
   - One to many
   - Many to one
   - Many to many



Part 2 (20 points): Using the following E-R diagram, explain the concepts of Total Participation and Partial Participation.
Total participation (indicated by double line): Every entity in the entity set participates in at least one relationship in the relationship set.
- every loan must have a customer associated to it via borrower.

Partial participation: Some entities may not participate in any relationship in the relationship set
- participation of customer in borrower is partial

2. Think of an E-R diagram in which there is duplication of a single entity. Using the example given above, explain why allowing this redundancy not a good design ? (20 points)

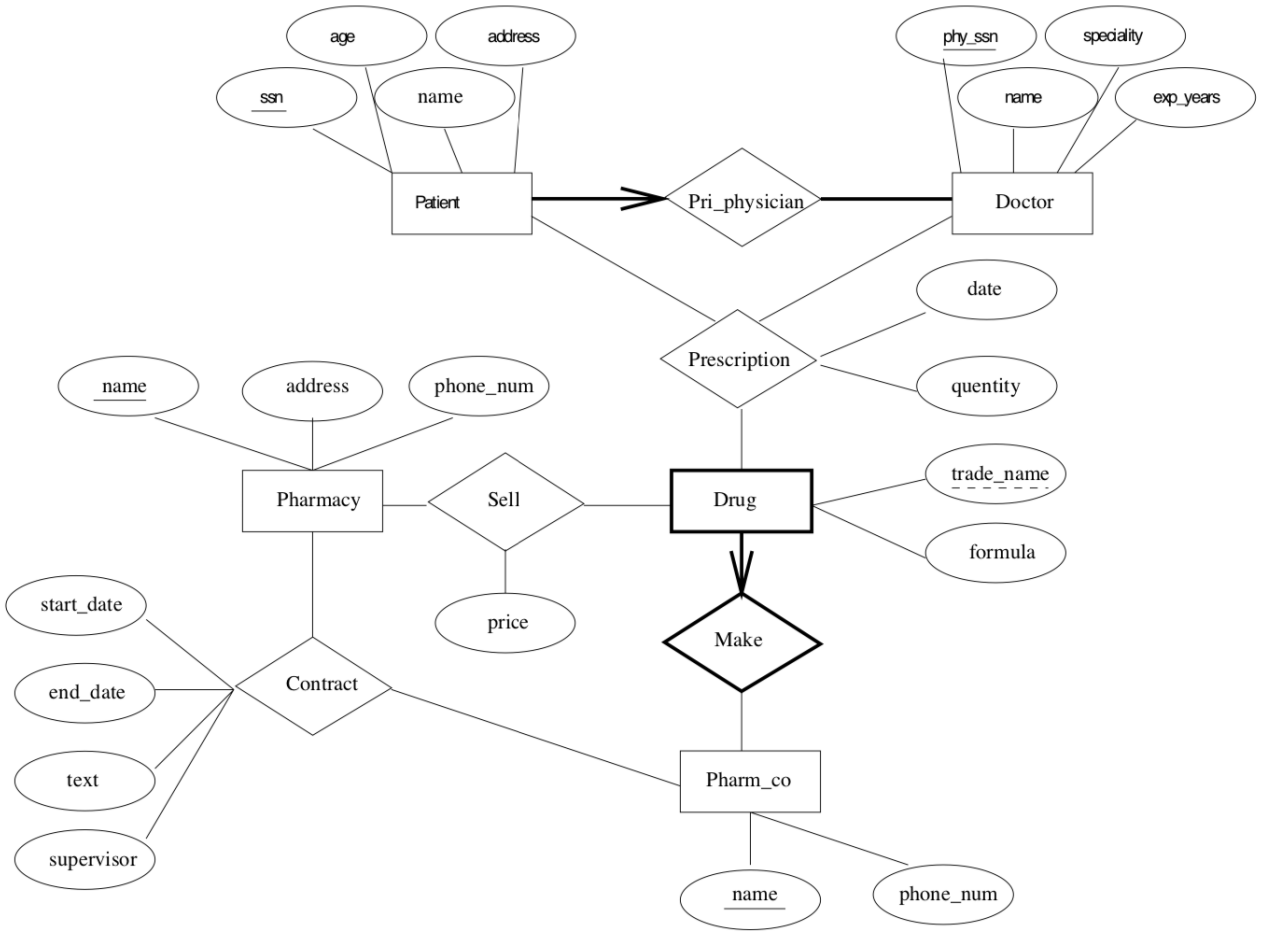
   By duplicating an entity, we might miss relationships in the model. In the E-R diagram above, the employees working for a company are the same employees who work for

particular projects, but this model does not show that.

3. The ABC chain of pharmacies has offered to give you a free life-time supply of medicine if you design its database. Given the rising cost of health care, you agree. Here's the information that you gather:

    - Patients are identified by an SSN, and their names, addresses, and ages must be recorded.
    - Doctors are identified by an SSN. For each doctor, the name, specialty, and years of experience must be recorded.
    - Each pharmaceutical company is identified by name and has a phone number.
    - For each drug, the trade name and formula must be recorded. Each drug is sold by a given pharmaceutical company, and the trade name identifies a drug uniquely from among the products of that company. If a pharmaceutical company is deleted, you need not keep track of its products any longer.
    - Each pharmacy has a name, address, and phone number.
    - Every patient has a primary physician. Every doctor has at least one patient.
    - Each pharmacy sells several drugs and has a price for each. A drug could be sold at several pharmacies, and the price could vary from one pharmacy to another.
    - Doctors prescribe drugs for patients. A doctor could prescribe one or more drugs for several patients, and a patient could obtain prescriptions from several doctors. Each prescription has a date and a quantity associated with it. You can assume that, if a doctor prescribes the same drug for the same patient more than once, only the last such prescription needs to be stored.
    - Pharmaceutical companies have long-term contracts with pharmacies. A pharmaceutical company can contract with several pharmacies, and a pharmacy can contract with several pharmaceutical companies. For each contract, you have to store a start date, an end date, and the text of the contract.
    - Pharmacies appoint a supervisor for each contract. There must always be a supervisor for each contract, but the contract supervisor can change over the lifetime of the contract.

    Draw an ER diagram that captures the preceding information. Identify any constraints not captured by the ER diagram. (40 points)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