

Ceng352 - Database Management Systems

Written Assignment 1

Spring 2019

- Q1 You are hired to design some of the modules of a project in a research-development company. Company sells GPS related products or services to customers. Draw an ER diagram according to the specifications given below:

Each party (customer) is uniquely identified by `party_id`. We record `privilege`, `tax_no` and `tax_institution` for a party. A party is either a person or an organization. We record `first_name`, `last_name`, etc., of a person. (Add 2 more attributes for a person) For an organization, we record `title`, `organization_name`, etc. (Add 1 more attribute that you think an “organization” should have) Parties have hierarchy according to their privileges. A party with a lower privilege “reports to” a party with higher privilege.

Company sells one or more products to parties. Each product is uniquely identified by a `product_id`. All products have descriptions. A product should be either a good or a service. Goods are products that are more tangible in nature and generally created in advance for sale, such as GPS terminal, car camera, GSM/GPS Antennas, alarm pedal, etc. We should store good’s type, etc. (Add 3 more attributes that you think a “good” should have) Services are products that involve the use of parties’ time and are less tangible in nature, such as web service, GPRS internet service. We should store type, duration, etc. (Add 1 more attribute that you think a “service” should have) A service may be associated with zero or more goods. A good may be associated with zero or more services.

Each party has one or more contact information. Each contact information is uniquely identified by `contact_id` and must be one of a) electronic medium, b) telecommunication medium or c) postal address. If electronic medium is given, then e-mail address and web page of the contact should be recorded. If telecommunication medium is given, then country code, region code and phone number should be recorded. In case of postal address given, we record country, city, county, district, `street_name` and `door_number` information.

- Q2 Consider the following ER diagram (1) that models a planet and its inhabitants according to the specifications given below:

In this foreign planet, there are creatures called `tiorions`. `Tiorions` must have a unique name. A `tiorion` must have at least one dependent `gwon` which is a kind of android. (A `gwon` must belong to one `tiorion`) Although `gwons` in planet may have same names, `gwons` owned by a `tiorion` should have distinct names. A `gwon` must have a `liuki` attribute. There are `calabians` as leaders of the planet that are identified by name’s and are either one of `arehan` or `elrad`. (`Arehans` and `elrads` are `calabians` that have specific attributes. To differentiate them, add 2 specific attributes to each of them. Name attributes whatever you want) `Tiorions` may be governed by only one `arehan` and any number of `elrads`. A

calabian governs one or more gwons of the tiorion. A gwon may be governed by more than one calabian.

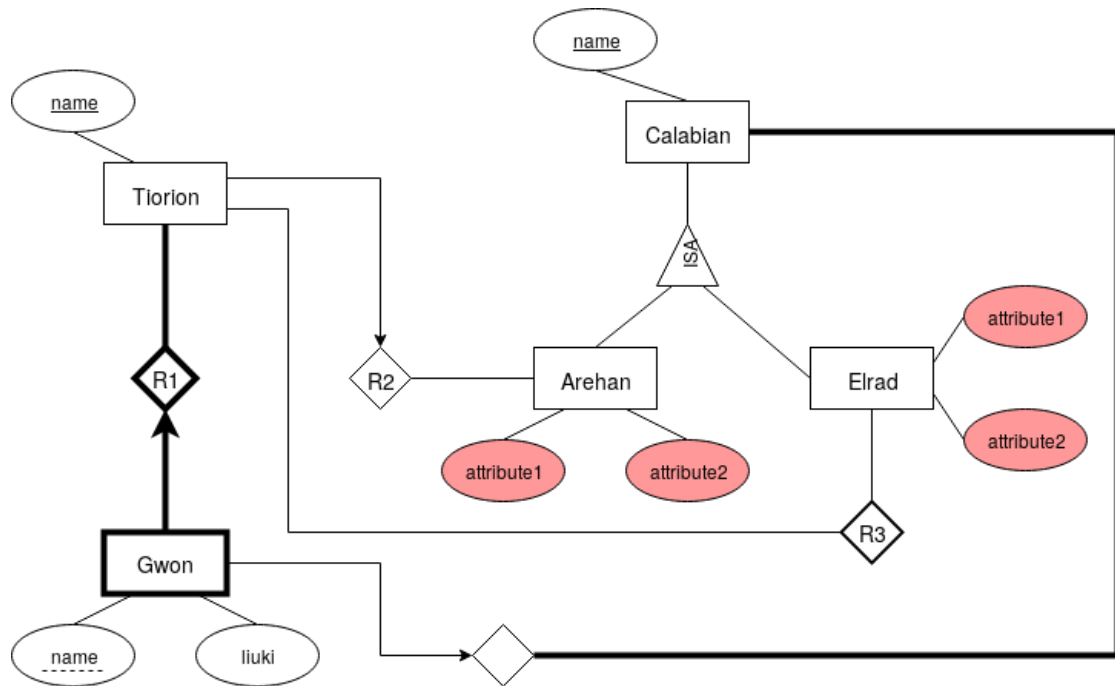


Figure 1: The ER diagram for Q2

- Create a relational schema for this E/R diagram. Write SQL statements that create the corresponding tables. Add the necessary key, foreign key, and uniqueness constraints.
- Which relation in your relational schema represents the relationship R1 in the E/R diagram and why is that your representation?
- Compare the representation of the relationships R2 and R3 in your schema, and explain why they are different.

Q3 Let $R = (A, B, C, D, E, F)$ and functional dependencies are

$C \rightarrow A$
 $CD \rightarrow E$
 $A \rightarrow B$
 $D \rightarrow F$

- Find all keys.
- Is R in BCNF form or not? Explain why?
- If it is not in BCNF form, decompose it into a collection of BCNF relations.
- Show that the above decomposition is
 - dependency-preserving or not?

ii. lossless-join or not?

Q4 Let $R = (A, B, C, D, E, F, G, H)$ and functional dependencies are

$DE \rightarrow B$
 $FD \rightarrow A$
 $HAC \rightarrow BC$
 $D \rightarrow E$
 $FH \rightarrow B$
 $A \rightarrow C$
 $CF \rightarrow DE$
 $FD \rightarrow C$

- (a) Find a minimal cover.
- (b) Decompose this relation into 3NF.

Q5 You are given a “.csv” file which contains a table for a simple database. The table has some data anomalies due to redundancy. Your task is to load this table into MySQL and identify the functional dependencies that cause anomalies by writing SQL statements. Once you identify the “bad” functional dependencies, your task is to normalize the table.

Do the following:

- (1) Download and install MySQL if you haven’t done it so far.
- (2) Create a table in the database and load the table with the data given in the given “.csv” file. You can use data import facility of *MySQL Workbench* or use load command at *MySQL Shell* client.
- (3) Find all functional dependencies in the table by writing appropriate SQL queries. Remember that a functional dependency is a constraint on a database instance. First try to identify simple FDs like $A \rightarrow B$, then try $AB \rightarrow C$, etc. You should write an SQL query for each candidate FD. You can see if the FD holds or not by checking the answer of the query.
- (4) Decompose the table into BCNF tables using the FDs that you discovered. Create tables for the normalized relations. Don’t forget to create keys and foreign keys for the BCNF schema.
- (5) Load the new tables with the data from the original table. For this step, you should write SQL statements to load data into the new tables.

What to turn in:

- (a) List of all FDs you identified and the corresponding SQL queries to discover them at the end of step 3 above.
- (b) List of all SQL statements to create normalized tables.
- (c) List of all SQL statements that load the contents of the tables.