CS450 – Database System Concepts

Fall 2015

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Homework 1 – Due 9/10

Problem 1.

For each binary relationship given below, indicate its cardinality mapping (i.e., one-to-one, one-to-many, many-to-one, many-to-many). Clearly state any assumption you make.

	Entity 1	Entity 2
1	STUDENT	SOCIAL_SECURITY_CARD
2	CLASSROOM	WALL
3	COUNTRY	CURRENT_PRESIDENT
4	COURSE	TEXTBOOK
5	ITEM	ORDER
6	STUDENT	CLASS
7	CLASS	INSTRUCTOR
8	PERSON	FINGER PRINT (RIGHT THUMB)
9	EBAY_AUCTION_ITEM	EBAY_BID
10	FACEBOOK_USER	FACEBOOK_USER

Problem 2.

Suppose a University Database contains an Entity Set named *Student*. Each Entity in the Entity Set *Student* has five attributes: Student ID, SSN, Name, Phone number, GPA. Both Student ID and SSN have unique values for each student.

(1) Choose a Primary Key for *Student*. Motivate your choice by making proper assumptions.
(2) List all Candidate Keys for *Student*. Provide the necessary explanations to support your design.
(3) List all Superkeys for *Student*. How many Superkeys are there for *Student*?
(4) In general, if a relation *R* has *n* attributes A_1, A_2, …, A_n, and exactly 2 candidate keys $\{A_1\}$ and $\{A_2\}$, how many Superkeys does *R* have?
(5) **(Extra credit)** For the question above, how many Superkeys does R have if it has *n* attributes and exactly *k* candidate keys, where each candidate key contains a single attribute?

Problem 3.

Suppose you want to design and implement a database for a member-only supermarket inventory and check-out system (think Costco).

The database should store information about the customers: membership number, customer name, birthday, gender, and address.

The database should also have information on current store inventory. For each product, store the Universal Product Code (UPC), brand, product name, product description (e.g. 12 16-oz bottles of Coke), category (e.g. Fruit, Vegetable, Meat, Beverage, etc.), marked price per unit, and quantity. For simplicity, assume that each product belongs to only one category.

All transactions are recorded. A transaction (from one check-out) contains a (unique) transaction ID, the transaction date, products purchased in the transaction, quantities, and the customer who made the transaction.

Every week, a list of products goes on sale. Sale prices of these products should be recorded. Each sale has a promotion period, indicated by promotion start date and promotion end date. For simplicity, you may use a unique sale ID for each sale period.

Draw the ER diagram for the given database, identifying the following:

(i) all the entity sets and their attributes;

(ii) all the relationship sets;

(iii) all the required key constraints and participation constraints;

(iv) the primary key for each entity set (and weak entity set, if any).

In some cases, you may have to make your own constraint assumptions. Clearly state, and justify your assumptions. Does your diagram capture all the given requirements? If not, specify which requirement(s) is (are) not captured.

While there are many variations of ER diagrams, please follow the same notations used in the textbook.

Some Hints:

Free tools for drawing ER diagrams:

The end of Ch. 7 (page 321) lists some software that you can use to draw the ER diagram. You can download Microsoft Visio Professional 2013 for free from Microsoft Dream Spark (formerly known as MSDNAA). Microsoft Dream Spark allows VSE students to access selected Microsoft products for free. See the VSE lab page for information on how to access Dream Spark: http://labs.vse.gmu.edu/index.php/FAQ/MicrosoftDreamSpark-FormerlyKnownAsMSDNAA

Please be aware that the notation employed by Visio may not be exactly the same as the one used in the textbook.