

CSci 4707
Homework 1
Fall 2015

Chapter 2
Due Tuesday, 09/29/2015 13:00

A. (5 Points) Submission Guidelines

- All homeworks **must be typed**
- All homeworks due at the **beginning of the class in paper (15 minutes grace period)**
- Late homework will still receive these 5 points if the homework is typed
- For **ER diagram**, please use a software such as **Visio, Draw IO, Google Drawing, etc.**
- No partial credit awarded for this section

B. (95 Points) Chapter 2

Note: All ER diagrams must be drawn with the same format with the slides and textbook. All other formats will receive 0 point. Please do not add any extra attributes on each entity. This will result in point deduction (-5 points for each additional attribute)

1. **(20 Points, 5 Points each)** Imagine you are designing a Database for a Supermarket. The Database will contain information about its Customers (identified uniquely by customer id: custid) and the Products they bought (identified uniquely by product id: pid). For simplicity, each transaction will be recorded by a Transaction (identified by transaction id: tid) and each customer cannot buy the same product more than once per transaction, e.g., James cannot buy 2 bananas in one transaction. For each situation below, draw an ER diagram that fits the most.

- a. To save storage space, the CEO only want to keep track **only** the last time each customer buy a specific product. For example, Customer A bought Product X on transaction 1 and bought X again on transaction 2. We will only keep track the last transaction which is transaction 2 and transaction 1 will not be recorded (replaced by transaction 2). Note that: if customer A bought **also** product Y on transaction 1 (so A bought both X and Y on transaction 1), the record of customer A bought product Y on transaction 1 is still available (but not product X since it is updated to transaction 2).
 - b. The CEO realizes that part a design is a bad decision. Now he wants to keep the history of all transactions information made by each customer. According to the previous example (Part a), we will keep track both transactions.
 - c. To get more profit, every customer registered in the database **must buy at least one product** and we only want to keep track the last time the customer buy a specific product. (Same like Part a not b)
 - d. Now, every customer in the Customer database **must buy exactly one product** and we want to keep track the last time the customer buy the product. (Same like Part a not b)
2. (25 Points) You and a group of friends have a new idea for a start-up company: an Internet meta-bookstore. This site will query the site of many bookstores on the Web and give you a consolidated listing of books and prices. Since you are currently taking CSci 4707, you are in charge of creating the database design for the meta-bookstore. Your model should capture the following information. Books have a name, one or more authors, exactly one publisher, and are uniquely identified by their ISBN. A publisher may publish several books; the same holds for authors. In addition, books are organized into categories, which form a hierarchy (e.g., “Business & Investing” > “Marketing & Sales” > “Advertising” or “Business & Investing” > “Marketing & Sales” > “Marketing”). A category cannot have more than one parent category. Each book may belong to several categories. You may assume authors, publishers, and categories are

uniquely identified by their names. (Hint: even though categories form a hierarchy, they have different names/keys for each category). Draw an ER Diagram that captures the information above. If there are any constraints your ER Diagram cannot capture, state them explicitly.

3. (25 Points) The university is having trouble in keeping track of its professors and their grad students! It needs to know the basic information about their Professors (uniquely identified by SSN, with salary and phone as attributes), Departments (uniquely identified with dno, with name and budget as attributes), and Grad Students (with name and year as attributes). Each department must have exactly one professor as its chair. Each grad student must be identified uniquely by their name when their advisor (who is a professor, assume that each grad student only has one advisor) is known. If the advisor leaves the university, his grad students are not allowed to stay and must be removed from the database. Each grad student has exactly one advisor as well. Draw an ER Diagram that captures the information above.

4. (25 Points) You and your group of CSci 4707 friends receive a job to design a Database for an airport with the following information:

- There are two types of employees (identified by SSN and has a union member number as its attribute). The first type of employee is a technician (it has specific attributes of name and salary) and the other type of employee is traffic controller (it has a specific attribute of address).
- Each technician is an expert on at least one specific Model (identified by model number, and has capacity and weight as its attribute). An example of a Model is Boeing 787.
- A Plane (identified by registration number) is exactly a model. For example, Delta DL112 is a Boeing 777 model. It doesn't make sense to have a plane with two models.
- Each plane must be tested with one test (identified by FAA Number, and has name in its attributes). For the test result, we want to keep

track the date of the test, how many hours to do it, and the score of the test.

Draw an ER diagram that capture the above information!