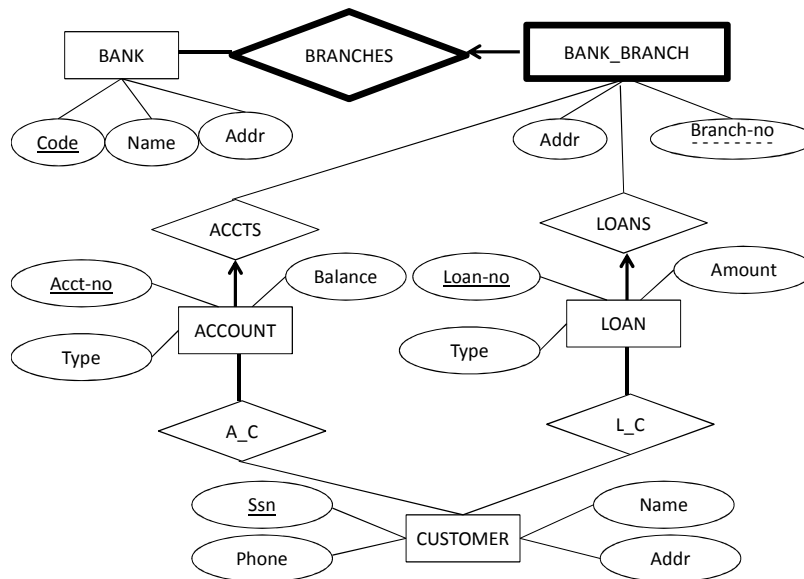


CSC540 (Fall 2009)
Assignment 1
Due date 9/10/2009 (at the beginning of class)

Part A Database Design

1. Consider the ER diagram shown below for part of a BANK database. Each bank can have multiple branches, and each branch can have multiple accounts and loans.
 - a. List the (nonweak) entity types in the ER diagram.
 - b. Is there a weak entity type? If so, give its name, partial key, and identifying relationship
 - c. What constraints do the partial key and the identifying relationship of the weak entity type specify in this diagram?
 - d. Translate this ER model into a relational schema (not SQL notation)



2. Draw ER model for the following scenario.

Although you always wanted to be an artist, you ended up being an expert on databases because you love to cook data and you somehow confused *database* with *data baste*. Your old love is still there, however, so you set up a database company, ArtBase, that builds a product for art galleries. The core of this product is a database with a schema that captures all the information that galleries need to maintain. Galleries keep information about artists, their names (which are unique), birthplaces, age, and style of art. For each piece of artwork, the artist, the year it was made, its unique title, its type of art (e.g., painting, lithograph, sculpture, photograph), and its price must be stored. Pieces of artwork are also classified into groups of various kinds,

for example, portraits, still lifes, works by Picasso, or works of the 19th century; a given piece may belong to more than one group. Each group is identified by a name (like those just given) that describes the group. Finally, galleries keep information about customers. For each customer, galleries keep that person's unique name, address, total amount of dollars spent in the gallery (very important!), and the artists and groups of art that the customer tends to like.

3. Write SQL statements to create the corresponding relations to the ER diagram you designed for Exercise 2. If your translation cannot capture any constraints in the ER diagram, explain why.

PART B Relational Model and Algebra

4. Consider the **AIRLINE** relational database schema shown in the figure below, which describes a database for airline flight information. Each **FLIGHT** is identified by a ***Flight_number***, and consists of one or more **FLIGHT_LEG**s, with ***Leg_numbers*** 1, 2, 3, and so on. Each **FLIGHT_LEG** has scheduled arrival and departure times, airports, and one or more **LEG_INSTANCES** – one for each ***Date*** on which the flight travels. **FARES** are kept for each **FLIGHT**. For each **FLIGHT_LEG** instance, **SEAT_RESERVATIONS** are kept, as are the **AIRPLANE** used on the leg and actual arrival and departure times and airports. An **AIRPLANE** is identified by an ***Airplane_id*** and is of a particular **AIRPLANE_TYPE**. **CAN_LAND** relates **AIRPLANE_TYPE**s to the **AIRPORT**s at which they can land. An **AIRPORT** is identified by an ***Airport_code***. Consider an update for the **AIRLINE** database to enter a reservation on a particular flight or flight leg on a given date.
 - a. Give the operations for this update.
 - b. What type of constraints would you expect to check?
 - c. Which of these constraints are key, entity integrity and referential integrity constraints, and which are not?
 - d. Specify all the referential integrity constraints that hold on the schema shown in the Figure below.

AIRPORT

<u>Airport_code</u>	Name	City	State
---------------------	------	------	-------

FLIGHT

<u>Flight_number</u>	Airline	Weekdays
----------------------	---------	----------

FLIGHT_LEG

<u>Flight_number</u>	<u>Leg_number</u>	<u>Departure_airport_code</u>	<u>Scheduled_departure_time</u>
		<u>Arrival_airport_code</u>	<u>Scheduled_arrival_time</u>

LEG_INSTANCE

<u>Flight_number</u>	<u>Leg_number</u>	<u>Date</u>	<u>Number_of_available_seats</u>	<u>Airplane_id</u>	
<u>Departure_airport_code</u>			<u>Departure_time</u>	<u>Arrival_airport_code</u>	<u>Arrival_time</u>

FARE

<u>Flight_number</u>	<u>Fare_code</u>	Amount	Restrictions
----------------------	------------------	--------	--------------

AIRPLANE_TYPE

<u>Airplane_type_name</u>	Max_seats	Company
---------------------------	-----------	---------

CAN_LAND

<u>Airplane_type_name</u>	<u>Airport_code</u>
---------------------------	---------------------

AIRPLANE

<u>Airplane_id</u>	Total_number_of_seats	Airplane_type
--------------------	-----------------------	---------------

SEAT_RESERVATION

<u>Flight_number</u>	<u>Leg_number</u>	<u>Date</u>	<u>Seat_number</u>	<u>Customer_name</u>	<u>Customer_phone</u>
----------------------	-------------------	-------------	--------------------	----------------------	-----------------------

5. Consider the **LIBRARY** relational database schema shown figure below, which is used to keep track of books, and borrowers, and book loans.

BOOK(Book_id, Title, Publisher_name)

BOOK_AUTHORS(Book_id, Author_name)

PUBLISHER(Name, Address, Phone)

BOOK_COPIES(Book_id, Branch_id, No_of_copies)

BOOK_LOANS(Book_id, Branch_id, Card_no, Date_out, Due_date)

LIBRARY_BRANCH(Branch_id, Branch_name, Address)

BORROWER(Card_no, Name, Address, Phone)

Write down relational expressions for the following queries:

- How many copies of the book titled The Lost Tribe are owned by the library branch whose name is "Sharpstown"?

- b. How many copies of the book titled The Lost Tribe are owned by each library branch?
- c. Retrieve the names of all borrowers who do not have any books checked out.
- d. For each book that is loaned out from the Sharpstown branch and whose Due_date is today, retrieve the book title, the borrower's name, and the borrower's address.
- e. For each library branch, retrieve the branch name and the total number of books loaned out from that branch
- f. Retrieve the names, addresses, and number of books checked out for all borrowers who have more than five books checked out.
- g. For each book authored (or coauthored) by Stephen King, retrieve the title and the number of copies owned by the library branch whose name is Central.

6. Consider the two tables T1 and T2 shown in the figure below.

T 1

P	Q	R
10	a	5
15	b	8
25	a	6

T 2

A	B	C
10	b	6
25	c	3
10	b	5

Show the results of the following operations:

- a. $T1 \bowtie_{T1.P=T2.A} T2$
- b. $T1 \bowtie_{T1.Q=T2.B} T2$
- c. $T1 \Join_{T1.P=T2.A} T2$
- d. $T1 \Join_{T1.Q=T2.B} T2$
- e. $T1 \cup T2$
- f. $T1 \bowtie_{(T1.P=T2.A \text{ AND } T1.R=T2.C)} T2$