Alexandria University
Faculty of Engineering
Comp. & Comm. Engineering
CC471: Database Systems
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جامعة الاسكندرية
كلية الهندسة
برنامج هندسة الحاسب والاتصالات
مادة قواعد البيانات
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Sheet2
ER MODEL, RELATIONAL MODEL, RELATIONAL DESIGN

1) Design a database to keep track of information for an art museum. Assume that the following requirements were collected:
   - The museum has a collection of ART_OBJECTS. Each ART_OBJECT has a unique IdNo, an Artist (if known), a Year (when it was created, if known), a Title, and a Description. The art objects are categorized in several ways, as discussed below.
   - ART_OBJECTS are categorized based on their type. There are three main types:
   - PAINTING, SCULPTURE, and STATUE, plus another type called OTHER to accommodate objects that do not fall into one of the three main types.
     - A PAINTING has a PaintType (oil, watercolor, etc.), material on which it is DrawnOn (paper, canvas, wood, etc.), and Style (modem, abstract, erc.).
     - A SCULPTURE or a STATUE has a Material from which it was created (wood, stone,etc.), Height, Weight, and Style.
     - An art object in the OTHER category has a Type (print, photo, etc.) and Style.
   - ART_OBJECTS also have information describing their country/culture using information on country/culture of Origin (Italian, Egyptian, American, Indian,etc.) and Epoch (Renaissance, Modem, Ancient, etc.).
   - The museum keeps track of ARTIST'S information, if known: Name, DateBom (if known), DateDied (if not living), CountryOfOrigin, Epoch, MainStyle, and Description. The Name is assumed to be unique.
   - Different EXHIBITIONS occur, each having a Name, StartDate, and EndDate.EXHIBITIONS are related to all the art objects that were on display during the exhibition.

   Draw an ER schema diagram for this application. Discuss any assumptions you made, and that justify your ER design choice.

2) Consider the ER diagram shown in Figure 7.21 for part of a BANK database. Each bank can have multiple branches, and each branch can have multiple accounts and loans.
   a) List the strong (non-weak) 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) List the names of all relationship types, and specify the (min, max) constraint on each participation of an entity type in a relationship type. Justify your choices.
   e) List concisely the user requirements that led to this ER schema design.
   f) Suppose that every customer must have at least one account but is restricted to at most two loans at a time, and that a bank branch cannot have more than 1,000 loans. How does this show up on the (min, max) constraints?
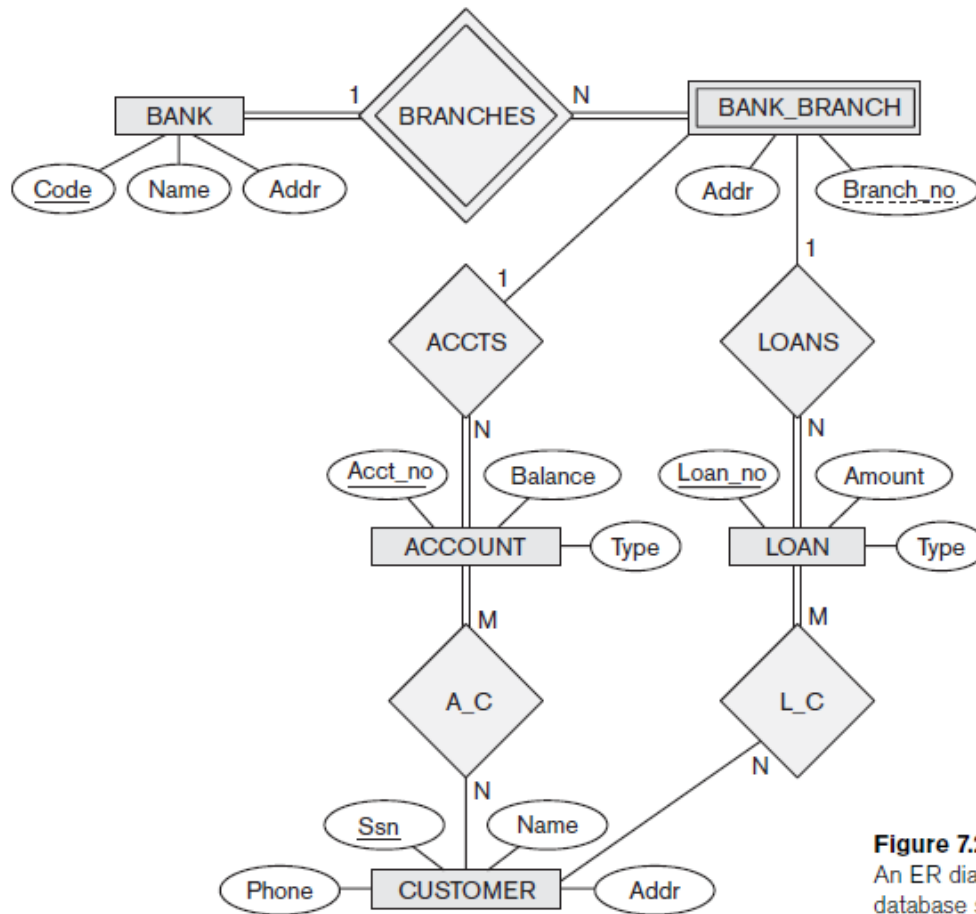
Figure 7.21
An ER diagram for a BANK database schema.

3) Consider the following relations for a database that keeps track of student enrollment in courses and the books adopted for each course:

STUDENT (SSN, Name, Major, Bdate)
COURSE (Course#, Quarter, Grade)
ENROLL (SSN, Course#, Quarter, Grade)
BOOK_ADOPTION (Course#, Quarter, Book_ISBN)
TEXT (Book_ISBN, Book_Title, Publisher, Author)

Specify the foreign keys for this schema, stating any assumptions you make.

4) Consider the AIRLINE relational database schema shown in Figure 1, which describes a database for airline flight information. Each FLIGHT is identified by a flight NUMBER, and consists of one or more FLIGHT_LEGs with LEG_NUMBERs 1, 2, 3, etc. Each leg has scheduled arrival and departure times and airports, and has many LEG_INSTANCEs--one for each DATE on which the flight travels. FARES are kept for each flight. For each leg instance, SEAT_RESERVATIONs are kept, as is the AIRPLANE used in the leg, and the 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_TYPEs to the AIRPORTs in 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. (http://en.wikipedia.org/wiki/Relational_database#Relational_operations)

b) What types 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 on Figure 1.

AIRPORT

Airport_code	Name	City	State

FLIGHT

Flight_number	Airline	Weekdays

FLIGHT_LEG

Flight_number	Leg_number	Departure_airport_code	Scheduled_departure_time
		Arrival_airport_code	Scheduled_arrival_time

LEG_INSTANCE

Flight_number	Leg_number	Date	Number_of_available_seats	Airplane_id
	Departure_airport_code	Departure_time	Arrival_airport_code	Arrival_time

FARE

Flight_number	Fare_code	Amount	Restrictions

AIRPLANE_TYPE

Airplane_type_name	Max_seats	Company

CAN_LAND

Airplane_type_name	Airport_code

AIRPLANE

Airplane_id	Total_number_of_seats	Airplane_type

SEAT_RESERVATION

| Flight_number	Leg_number	Date	Seat_number	Customer_name	Customer_phone

Figure 1: The Airline Relational database schema.

5) Consider the following relations for a database that keeps track of business trips of salespersons in a sales office:
SALESPERSON (SSN, Name, Start_Year, Dept_No)
TRIP (SSN, From_City, To_City, Departure_Date, Return_Date, Trip_ID)
EXPENSE (Trip_ID, Account#, Amount)
Specify the primary and foreign keys for this schema, stating any assumptions you make.
6) Consider the following Schema for an order-processing database application in a company:
Customer (customer#, Cname, City)
Order (order#, Odate, customer#)
Order_Item (order#, item#, Quantity)
Item (item#, Unit_price)
Shipment (order#, warehouse#, Ship_date)

Warehouse (<u>warehouse#</u>, City)

Choose the appropriate action (reject, cascade, set to null, set to default) for each referential integrity constraint both for deletion of a referenced key and for the update of a primary key attribute value in a referenced tuple. Justify your choices.

7) Suppose each of the following Update operations is applied directly to the Company database taken in class. Discuss all integrity constraints violated by each operation, if any, and the different ways of enforcing these constraints:
   a) Insert < 'Robert', 'F', 'Scott', '943775543', '21-JUN-42', '2365 Newcastle Rd, Bellaire, TX', M, 58000, '888665555', 1 > into EMPLOYEE.
   b) Insert < 'ProductA', 4, 'Bellaire', 2 > into PROJECT.
   c) Insert < 'Production', 4, '943775543', '01-OCT-88' > into DEPARTMENT.
   d) Insert < '677678989', null, '40.0' > into WORKS_ON.
   e) Insert < '453453453', 'John', M, '12-DEC-60', 'SPOUSE' > into DEPENDENT.
   f) Delete the WORKS_ON tuples with ESSN= '333445555'.
   g) Delete the EMPLOYEE tuple with SSN= '987654321'.
   h) Delete the PROJECT tuple with PNAME= 'ProductX'.
   i) Modify the MGRSSN and MGRSTARTDATE of the DEPARTMENT tuple with DNUMBER=5 to '123456789' and '01-OCT-88', respectively.
   j) Modify the SUPERSSN attribute of the EMPLOYEE tuple with SSN= '999887777' to '943775543'.
   k) Modify the HOURS attribute of the WORKS_ON tuple with ESSN= '999887777' and PNO= 10 to '5.0'.

8) The figure below shows an ER schema for a database that may be used to keep track of transport ships and their locations for maritime authorities. Map this schema into a relational schema, and specify all primary keys and foreign keys.

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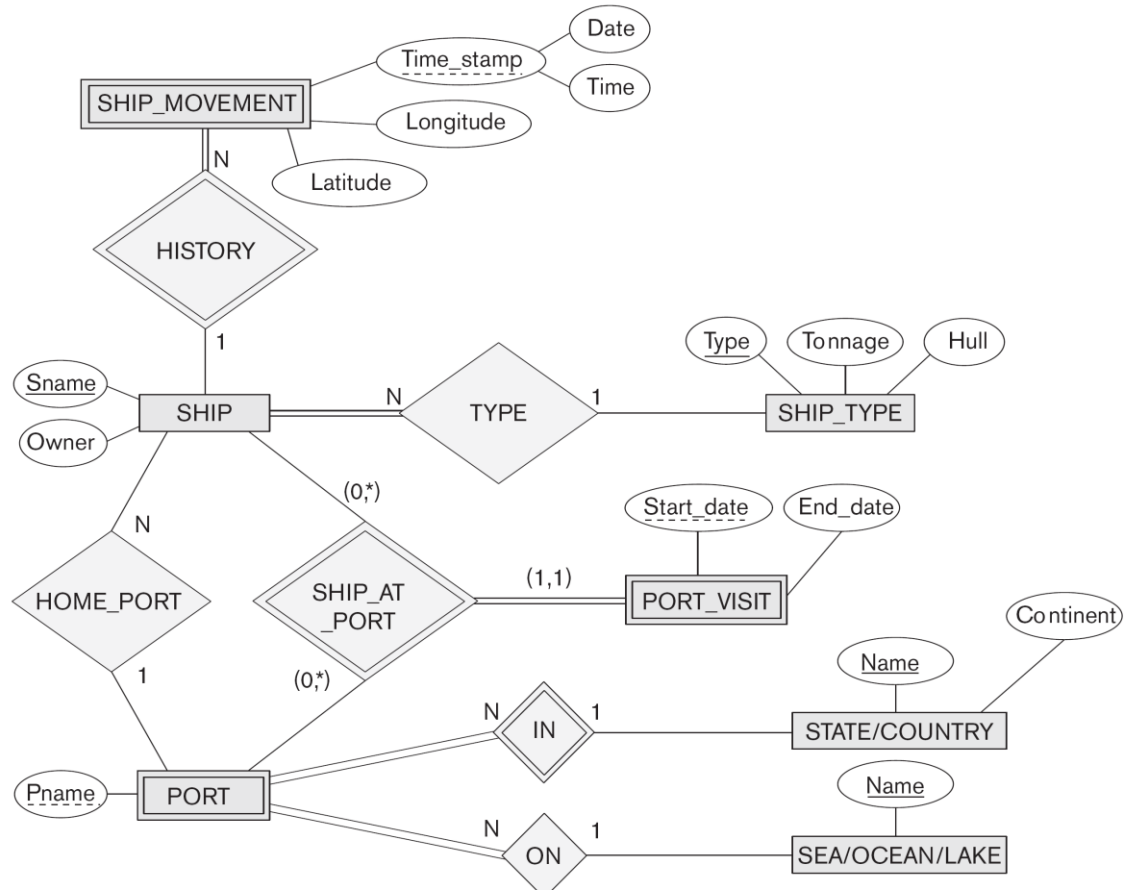
How to submit the homework assignments?
- Solve the sheet individually without looking up the solution on the Internet. The sheet is to practice; it is a learning tool not an exam.
- Assignments are to be **handwritten**.
- Papers are to be scanned (I like camscanner app). Put all images in a pdf file (camscanner does that for you)