Question 1

Use the following five tables to answer all questions in this section. The primary keys are underlined. The foreign keys have the same name as the primary key in another table. Assume that peerAdvisorID is a reference to another student (the studentID of another student).

Publisher(publishernname, address, city, state)
Book(isbn, title, datePublished, publishernname)
BookCopy(bookID, isbn, condition, datePurchased, price)
BookCheckout(bookID, studentID, dateIn, dateOut)
Student(studentID, firstname, lastname, city, state, email, peerAdvisorID)

Write relational algebra commands to do the following tasks.

1. Output the First Name and Last Name for all students from New Jersey.

   \[ \Pi \text{firstname, lastname} (\sigma \text{state} = \text{'New Jersey'} (\text{Student})) \]

2. Output the bookID, title, and condition of all book copies.

   \[ \Pi \text{bookID, title, condition} (\text{BookCopy} \ast \text{Book}) \]

3. Output the first and last name of students along with the title of every book they have checked out.

   \[ \Pi \text{firstname, lastname, title} (\text{Student} \ast \text{BookCheckout} \ast \text{BookCopy} \ast \text{Book}) \]

4. Output the average price of all books.

   \[ \mathcal{F} \text{AVERAGE (price)} \ (\text{BookCopy}) \]

5. Output the average price of books checked out by a student from New Jersey.

   \[ \mathcal{F} \text{AVERAGE (price)} (\sigma \text{state} = \text{'New Jersey'} \ (\text{Student} \ast \text{BookCheckout} \ast \text{BookCopy})) \]

6. Output the name of each publisher and the number of books published by that publisher.

   \[ \text{publishernname} \mathcal{F} \text{COUNT isbn} (\text{Publisher} \ast \text{Book}) \]
7. Output the names of all students and the name of their peer advisor.

\[ \prod \text{firstname, lastname, PAfirstname, PAlastname} \left( \sigma (\text{studentID} = \text{peerAdvisorID}) \left(\text{Student} \ast \rho (\text{studentID}, \text{PAfirstname, PAlastname, city, state, email, peerAdvisorID}) \right) \right) \]

8. Output the bookid for all book copies that have been checked out by every student.

\[ (\prod \text{studentID, bookID} (\text{BookCheckout})) \div (\prod \text{studentID} (\text{Student})) \]

9. Output the bookid for all book copies that have never been checked out by a student.

\[ (\prod \text{bookID} (\text{BookCopy})) - (\prod \text{bookID} (\text{BookCheckout})) \]
Question 2

Draw an E-R diagram to model the following situation. You must either use ER Assistant or the symbols used in the textbook.

You are developing a database for a community-supported agriculture network. If you’re curious what this is, here’s a Wikipedia link: http://en.wikipedia.org/wiki/Community-supported_agriculture

You will keep track of all crops that are grown. For each crop, you will keep track of the crop name (assume they are all unique), the date the crop was planted, the date the crop will first be available for harvest, the date the crop will be last available for harvest, and the total quantity planted.

You will keep track of the households that participate in the network. For each household, you will keep track of the household name (assume unique), phone, and the amount that household has already paid to participate.

You will keep track of the first name, last name and email of everyone in each household.

You will keep track of what crops are picked up by each household. You will keep track of both the date and the quantity of the pickup. A certain crop could be picked up by a household on more than one date (for example, a household could pick up tomatoes on more than one date).

You will keep track of all work done by members of households. You will keep track of the date and the number of hours worked on that date by that person.

Households have to fill out a questionnaire concerning how much they like each crop. For each crop, each household ranks that crop on a scale from 1 to 10.

You will also keep track of which people like to work with each other.
Question 3

Let’s start with the following ER diagram:

Assume that there are actually three Kinds of guides – nature guides, logistics guides, and cultural guides.

For both nature and cultural guides, we keep track of their years of experience and their academic degree. For logistics guides, we keep track of their people skills (on a scale from 1 to 10), whether they can drive a bus, and whether they can drive a boat. For cultural guides, we also keep track of all languages they speak. For nature guides, we keep track of all first aid skills they have.

All guides must be a nature guide, a cultural guide or a logistics guide, but someone could be more than one type of guide.

Assume that there are actually two kinds of tours – cultural tours and ecological tours. All tours must be one of these, no tour is both.

For a cultural tour, we keep track of all museums that are visited. For a museum, we keep track of the name, city, and country of the museum.

For an ecological tour, we keep track of all natural areas that are visited. For a natural area, we keep track of its name and its ecosystem.

Logistics guides are used for all tours, but nature guides are only used for ecological tours and cultural guides are only used for cultural tours.

Create an EER diagram for this. You must either use ER Assistant or the symbols used in the textbook.
Question 4.

Map the following E-R diagram into a set of relations:

Person(PersonID, Name, DateOfBirth, email, BusinessID)

Caller(CallID, CallerName)

Organization(OrganizationID, OrgName, OrgWebsite)

Donation(Person, CallID, OrganizationID, DonationDate, DonationAmount)

Business(BusinessID, BusinessName, BusinessAddress)

Fair(FairID, FairDate, FairName)

Participates(OrganizationID, FairID, BoothNumber)

FriendOf(Person1ID, Person2ID, Relationship)
Question 5

Map the following EER diagram into a set of relations.

Instructor(InstructorID, Name)
Course(courseNum, name, desc, numHours, level)
JuniorProf(InstructorID, HireDate)
SeniorProf(InstructorID, TenureDate)
GradCourse(courseNum, OnLine)
UndergdCrse(courseNum, LiberalEd)
TeachUndergrad(InstructorID, courseNum)
TeachGrad(InstructorID, courseNum)