CS482 – Test 1

5pm – 6:10 pm

September 18, 2003

Note:

- Names appearing in the text are fictiuous.
- There are 3 questions (105 points: 100 points for 20% of the total grade and 5 bonus points for 1% of the total grade).
- Be short and precise in your answers. (Remember: Time is precious and writting takes time.)
- Helpful notes: *It is always good to read the questions before starting to answer. It is also always good to start with something easy.*

Name:

Signature:

1. (60 points) From the Las-Cruces Sun News, January 1, 3001: ...*"Best of the Best" – a software company founded by NMSU graduates, specialized in the design and development of database applications – is one of best software companies in the US. Its customers include several governmental agencies such as the "Advance Home Land Security", the "Future and Treasury", the "Fast Transportation", the "Basic and Advanced Education" department etc. and local businesses such as "Cheap Home Improvment", "Lot of Rebates Office", and "Bank of People" of Las Cruces etc.*

"Best of the Best" has recently been contracted by the Veteran Medical Center (MC) of Las Cruces to design and develop a patient tracking system that the MC hopes to use for

- scheduling future appointments for patients
- collecting fees
- managing MC's resources (rooms, doctors, nurses, etc.)
- ...

The two sides agree that such a huge undertaking should be done step-by-step. They agree that a database with information about patients and doctors should be developed first. *Class03* – a system analyst of "Best of the Best" – is instructed to get an initial design withhin the first two weeks of the contract. *Class03* visits the MC several times during the first week. His note about the current information flow in the MC says the following:

- The MC keeps information about each patient in a folder. Each folder is assigned a unique string, called *reference number*, of length 40 that helps to identify the patient and makes the sorting of the folders easier.

  This folder contains the following information: SSN, Name, Date of Birth, Gender, Address, Contact Phone Number, more than one Emergency Contact (each has Name and Phone number), and a list of visits (to the doctor office or to the MC's hospital) made by the patient.

  Each visit has the folloing information: date, a doctor, a nurse, reason, fee, and the amount the patient has paid. As a rule, the fee is always greater or equal the amount the patient has paid, which is greater than or equal 0.

  The folder of a patient is created at his/her first visit.

- The MC keeps information about each doctor in a folder. Each folder is also assigned a unique string, called *reference number*, of length 40 that helps to identify the doctor and makes the sorting of the folders easier.

  This folder contains the following information: SSN, Name, Date of Birth, Gender, Address, Contact Number, Specialty, the first working day of the doctor at MC, and the doctor's salary. MC pays its doctors between US$ 100,000 and US$ 400,000.

- The MC keeps information about each nurse in a folder. Each folder is also assigned a unique string, called *reference number*, of length 40 that helps to identify the nurse and makes the sorting of the folders easier.

  This folder contains the following information: SSN, Name, Date of Birth, Gender, Address, Contact Number, the first working day of the nurse at MC, and the nurse's salary. MC pays its nurses between US$ 30,000 and US$ 70,000.

Help *Class03* in designing the database by completing the following:

1. Create an ER diagram for the information that he has collected. In your diagram, please spcify the key of entity types, the multiplicity of relationship types (one-to-many, many-to-many, etc.), and the constraints. Specify also the keys or constraints that cannot be represented in the ER diagram.
2. Translate your ER diagram into a set of relation schemas.
3. Provide the SQL (more precisely, the DDL) commands to create the relations. Be sure to include the (primary or foreign) key definition as well as the constraints.

Answer:

(continue for solution of **1.**)

(continue for solution of **1.**)

2. (25 points) The university theater has a reservation system that allows users to

- look up information about a show (number of seats available, title, duration, cast, etc.),
- make reservation, and
- cancel a reservation.

All inquires, reservations, and cancelations are made through the theater's website. Discuss the following:

- What would you consider as two appropriate transactions in this system? Justify your answer.
- Illustrate the desireable properties of a transaction using your transactions for this system. It will be enough if you state the properties and disscuss the problems that might arise if certain property is not satisfied.

Answer:

3. (20 points) Suppose that we have two relations *Couples* and *2Sisters* with the schema *Couples(Husband,Wife)* and *2Sisters(Older,Younger)*, respectively. In other words, the relation *Couples* consists of tuples of the from (h, w) where h is the husband and w is the wife and the relation *2Sisters* consists of tuples of the form (o, y) where o and y are two sisters, o is older than y. Answer the following:

- Can the first attribute in the relation *Couples* (i.e., the husband) be a candidate key of the relation? Justify your answer.
- Can the first attribute in the relation *2Sisters* (i.e., the older sister) be a candidate key of the relation? Justify your answer.
- Give a candidate key for the relation *Couples*.
- Give a SQL query that gets all tuples of the form (h, y) where y is a younger sister-in-law of h.

Answer: