Midterm I Review
CMSC 362
Marmorstein
Due Wednesday, Feb. 19 before class

Relational Algebra and Tuple Relational Calculus

Suppose we have a database with the schema:

Animals(<u>genus</u> : string, <u>species</u> : string, num_legs : integer, carnivorous : boolean)
ZooValues(<u>genus</u>: string, <u>species</u>: string, price: float)

1. **(5 pts)** Write a relational algebra query that lists the genus and species of all animals with fewer than 6 legs.

2. **(5 pts)** Write a relational algebra query that lists the genus and species of all carnivorous animals.

3. **(5 pts)** Is the TRC expression { t $\in$ ZooValues | price > 2000.00 } a safe expression?

Why or why not?

4. **(5 pts)** Write a relational algebra query which lists the genus and species of all the animals in the database. Keep in mind that not all of the animals may be in the Animals table.

5. **(5 pts)** Write a relational algebra query which prints the genus and species of all the carnivorous animals in the Animals table which do not appear in the ZooValues table.

Functional Dependencies

6. **(10 pts)** Suppose that we have the following functional dependencies:
   {Genus, Species} -> {num_legs, carnivorous}
   {Species} -> {Genus}

Answer the following with "True" or "False":

a. {Genus} -> {Species} must also hold in this database.

b. {Species} -> {num_legs} must hold in this database.

c. {Genus, num_legs} -> {carnivorous} must hold in this database.

d. {Species, num_legs} -> {Species} must hold in this database.

e. {Species, num_legs} -> {carnivorous} must hold in this database.

Normal Forms

7. **(5 pts)**

Decompose the table shown below into first normal form.

Unit	Officers	Call sign 1	Call sign 2
Adam-12	Malloy and Reed	KAX-1100	ACB-12
Squad-51	Gage and DeSoto	KMG-365	NULL

8. **(10 pts)** Decompose the following table into 3NF:

Assume the following non-trivial FDs (as well as all the trivial ones, of course):

{State}->{Governor}
{City, State} -> {Mayor, Governor}

City	State	Mayor	Governor
New York	New York	Bloomberg	Paterson
Farmville	Virginia	Newman	Kaine
Richmond	Virginia	Jones	Kaine

SQL Queries

9. **(10 pts)** Given the schema:

State(<u>name</u> : string, population : integer, governor : string)

Give SQL statements that insert appropriate rows for "Virginia" and "Maryland":

10. **(10 pts)** Given the schema:

Salaries(<u>job</u>: string, salary: float, benefits: boolean)
Employee(<u>last</u> : string, <u>first</u> : string, job: string, part_time : boolean)

Write SQL code that creates this table and assigns the appropriate foreign and primary key constraints.

11. **(10 pts)** Using the schema from the previous problem, write an SQL query that lists the names of all employees:

ER-Diagrams

12. **(20 pts)** Consider the scenario described below.

Suppose we want to create a web site that lists all the restaurants in the Farmville area and allows users to view their menus and leave ratings. The entities of our database are:

Restaurant   with attributes: name, address, and phone number
Dish   with attributes: name, spiciness, ethnicity
Rating   with attribute: username, score

The relationships of our database are between

Restaurant and Dish   with an attribute: price
Restaurant and Rating

A restaurant is uniquely identified by its name and address (not just the name, because a restaurant like Pino's may have multiple locations). A dish is uniquely identified by its name. A rating is uniquely identified by the restaurant it is related to and by the username. (Note that this means rating is a weak entity).

For each relationship, give the cardinality and justify your answer. Then draw an ER diagram representing this database.

Be sure to properly indicate the primary keys of each entity and mark the proper cardinalities for each relation (you may use either Korth notation or use "1" and "M" marks).