Final Examination Computer Science 420 Dr. St. John Lehman College City University of New York 21 May 2002

NAME (Printed)	
NAME (Signed)	
E-mail	

## Exam Rules

- Show all your work. Your grade will be based on the work shown.
- The exam is closed book and closed notes.
- When taking the exam, you may have with you pens or pencils, and an 8 1/2" x 11" piece of paper filled with notes, programs, etc.
- You may not use a computer or calculator.
- All books and bags must be left at the front of the classroom during this exam.
- Do not open this exams until instructed to do so.

Question 1	10 points	
Question 2	10 points	
Question 3	10 points	
Question 4	10 points	
Question 5	10 points	
Question 6	10 points	
Question 7	10 points	
Question 8	15 points	
Question 9	15 points	
TOTAL	100 points	

1. True or False:

- (a) \_\_\_\_\_ All database management systems are relational.
- (b) \_\_\_\_\_ Relationships cannot have attributes in E/R diagrams.
- (c) \_\_\_\_ Every key is a superkey.
- (d) \_\_\_\_ Third Normal Form (3NF) is stronger than Boyce Codd Normal Form (BCNF).
- (e) \_\_\_\_\_ Attributes that are keys cannot appear in functional dependencies.
- (f) \_\_\_\_ In ODL, every relationship must have an inverse.
- (g) \_\_\_\_ Every bag is a set.
- (h) \_\_\_\_\_ Bags are used in theory but not in practical query languages like SQL.
- (i) \_\_\_\_\_ Views can be queried as if they were tables.
- (j) \_\_\_\_\_ Transactions are read-only statements executed in SQL.
- 2. For each of the following types of relationships, give an example and draws its E/R diagram:
  - (a) one-one:

(b) many-one:

(c) many-many:

3. Given the relation schema R(A, B, C, D) with the functional dependencies

$$\begin{array}{c} A \rightarrow C \\ BC \rightarrow D \\ D \rightarrow A \\ D \rightarrow B \end{array}$$

(a) List all the **keys** for the relation R:

(b) How many **superkeys** are there? Why?

4. Given the relation schema R(A, B, C, D) with the functional dependencies

$$\begin{array}{c} B \to C \\ B \to D \end{array}$$

(a) Indicate all the Third Normal Form (3NF) violations. Do not forget to consider dependencies that are not in the given set, but follow from them. However, it is not necessary to give violations that have more than one attribute on the right side.

(b) Decompose the relations, as necessary, into a collection of relations that are in Third Normal Form.

5. Using the database schema:

Product(maker, model, type)
PC(model, speed, ram, hd, cd, type, price)
Laptop(model, speed, ram, hd, screen, price)
Printer(model, color, type, price)

- (a) Write the statements that declares that the model in PC must occur in the Product table. Modifications that violate this constraint are rejected.
- (b) Give permission to insert to everyone for table Laptop:
- (c) Remove update privileges for the user db07 for the attribute price in the table Printer:
- 6. Assume you have two tables:
  - Movies(<u>title</u>, <u>year</u>, length, studioName) where title and studioName are strings, and year and length are integers.
  - Stars(<u>title</u>, <u>year</u>, starName) where title and starName are strings, and year is an integer.

Write the SQL statements that:

(a) Print out each star's name and the length of the longest movie they starred in:

(b) Grant insert privileges to everyone for table Movies:

(c) Grant update privileges to the user movieFan for the attribute starName:

7. For each pair of queries below, write "YES" in the third column if they are equivalent and "NO" if they are not equivalent. Remember that two queries are equivalent if they always return exactly the same answer on all databases.

All queries refer to a schema containing two relations:

R(A,B) where A is a key and B is a key

S(A,B) where A is a key

You may assume that the relations do not contain NULL values but do not make any other assumptions about the relations.

Query 1	Query 2	Equivalent?
SELECT A FROM R	$\pi_A(R)$	
SELECT B FROM R	SELECT B FROM R	
	GROUP BY B	
SELECT B FROM S	SELECT B FROM S	
	GROUP BY B	
SELECT R.B FROM R,S	SELECT B FROM R	
WHERE R.A=S.A	WHERE A	
	IN (SELECT A FROM S)	
$\pi_A(R-S)$	$\pi_A(R) - \pi_A(S)$	
$R \cap S$	$R \bowtie S$	
$\pi_{R.A=5}(R)$	$\sigma_{R.A=5}(\pi_{R.A,R.B}(R \times S))$	

8. Assume you have a database called dbStudents which contains a table Grades(name, examNum, grade) where name is character string of length 50, and examNum and grade are integers.

Write a **complete** Java program that inserts your information for the first exam into the database. If you do not remember your grade on the first exam, you may insert the grade you wish you had gotten on the exam. Assume that you are logged into your lab account and have all permissions needed to insert into the table **Grades**.

9. Assume your database has a single relation,

Flight(airline,depCity,arrCity,depTime,arrTime)

which contains the information about a flight, including the airline, the departure city, the arrival city, the departure time and the arrival time.

(a) Write a **SQL statement** that outputs all flights the depart from Chicago.

(b) Write a **SQL statement** that outputs all flights that take more than 2 hours.

(c) Write a **datalog program** that gives all pairs of cities between which you can fly, changing planes at most once.

(d) Write a **datalog program** that gives all pairs of cities between which you can fly, changing planes any number of times.