

**Comprehensive Exam**  
**Databases**  
**Spring 2006**

1) (25 points) Describe a method for converting an ER diagram to a collection of tables in a relational database. Note that your method should explain how all aspects of an ER diagram are converted, including entities, relationships, attributes, keys, etc. The method should also describe how *different types* of entities, relationships and attributes are converted as well.

2) (25 points) Consider the following relational schemes. Note that attributes forming the primary key for each relation have been underlined.

student( <u>student-name</u> , street, city)	-- Basic student information.
offering( <u>department</u> , <u>number</u> , <u>section</u> , time, location, population)	-- Courses currently offered; for CSE5260 department is "CSE" and number is 5260.
titles( <u>department</u> , <u>number</u> , title)	-- Course titles; "CSE5260" is "Database Systems"
enrollment( <u>student-name</u> , <u>department</u> , <u>number</u> , <u>section</u> )	-- Indicates which students are enrolled in which courses.

Give an SQL statement for each of the following.

(a) The department, number, section and title for every course section that has more than 25 students enrolled, i.e., population > 25.

<u>department</u>	<u>number</u>	<u>section</u>	<u>title</u>
CSE	5260	1	Database Systems
MTH	5100	3	Discrete Math
PSY	4260	2	Abnormal Psychology
PSY	4260	3	Abnormal Psychology
CHM	2035	3	Introduction to Chemistry

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(b) A list of student names along with the titles of those courses they are enrolled in, and the location where the student takes each course.

<u>student-name</u>	<u>title</u>	<u>location</u>
John Smith	Database Systems	ECE 127
Bob Jones	Discrete Math	Crawford 220
Mary Brown	Abnormal Psychology	Link 105

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(c) A list of the names of those cities that have at least two student residents. For this question you are required to use an aggregate function.

(d) The same query as in part (d). However, in this case your answer must *not* use an aggregate function.

(3) (25 points)

(a) Define the term *transaction*.

(b) Explain why transactions are important in a database system.

(c) Give an example of a non-trivial database transaction (for this question *non-trivial* means that simply giving or describing a single SQL statement will not receive full credit).

(d) Explain what a “commit” is.

(e) Explain what a “rollback” is.

4) (25 points)

(a) Give a formal definition for *functional dependency*.

(b) Give an example of a relational scheme and a functional dependency that holds on that relational scheme.

(c) Give a relational scheme and a functional dependency that *does not* hold on that relational scheme. Be sure to explain why the functional dependency does not hold.

(d) Give an example of a relational scheme, associated set of functional dependencies, and a decomposition of that relational scheme that *does not* preserve dependencies. Be sure to show which functional dependency is not preserved.

(e) Suppose the relational scheme  $R$  is decomposed into  $R_1$  and  $R_2$ . Give a condition that will guarantee the decomposition has a loss-less join.