

CS411 Database Systems

Fall 2006

Department of Computer Science
University of Illinois at Urbana-Champaign

Midterm Examination

October 20, 2006
Time Limit: 75 minutes

- Print your name and NetID below. In addition, print your NetID in the upper right corner of every page.

Name: _____ **NetID:** _____

- Including this cover page, this exam booklet contains **9** pages. Check if you have missing pages.
- The exam is closed book and closed notes. No calculators or other electronic devices are permitted. Any form of cheating on the examination will result in a zero grade.
- Please write your solutions in the spaces provided on the exam. You may use the blank areas and backs of the exam pages for scratch work. Please do not use any additional scratch paper.
- Please make your answers clear and succinct; you will lose credit for verbose, convoluted, or confusing answers. *Simplicity does count!*
- Generally, we think one minute per point is a reasonable allocation of time; so plan your time accordingly. *You should look through the entire exam before getting started, to plan your strategy.*

Problem	1	2	3	4	5	6	Total
Points	10	12	18	20	15	25	100
Score							
Grader							

Turn over the page when instructed to do so.

Problem 1 (10 points) True/False Questions

For each of the following statements, indicate whether it is *TRUE* or *FALSE* by circling your choice. If you change your mind, cross out both responses and write "True" or "False". You will get 1 point for each correct answer, 0 point for each incorrect answer.

(1) True False

In a ER-model, multiway relationships can have attributes.

(2) True False

In a relational model, a relation can have many superkeys but only one key.

(3) True False

Relations that are in 3NF must also be in BCNF.

(4) True False

A functional dependency $A \rightarrow B$ implies multivalued dependency $A \twoheadrightarrow B$

(5) True False

The projection operation selects certain rows (tuples) of a relation.

(6) True False

Intersection is one of the six basic relational operators in relational algebra.

(7) True False

A subquery can reference attributes in the outer query.

(8) True False

An attribute can reference an attribute from another relationship with a foreign key constraint.

(9) True False

An attribute declared as UNIQUE can have NULL as its value.

(10) True False

It is possible using triggers to execute an insertion, deletion, or update operation on a view.

Problem 2 (*12 points*)

For each of the following statements, choose ONE answer among A,B,C,D. You will get *2 points* for each correct answer, *0 point* for each incorrect answer.

- (1) Which of the following matches “isa” type of relationship?
 - A. professors-students
 - B. sons-daughters
 - C. table-leg
 - D. appliance-dishwasher

- (2) What is NOT a good design principle in designing E-R models?
 - A. simplify by limiting the number of relationships
 - B. use redundancy in the model to prevent loss of data
 - C. keeping the design faithful to the part of real world you’re modeling
 - D. avoid complexity such as introducing extra entities which will reduce errors and space usage

- (3) How does one differentiate a relationship that refers to the same entity set multiple times?
 - A. using multiplicities
 - B. using indexes
 - C. using roles
 - D. using aggregations

- (4) Which approach is not among the approaches used for converting subclasses to relations?
 - A. Object-Oriented approach
 - B. SQL approach
 - C. ER approach
 - D. Null approach

- (5) Suppose $R(A, B)$ contains the tuple $(1, 2)$ and $S(B,C)$ contains the tuples $(1, 2), (2, 3)$. Which of the following is the result of the Natural Outer Join of R and S .
 - A. $(1,2,1,2), (1,2,2,3)$
 - B. $(1,2,3)$
 - C. $(1,2), (2,3)$
 - D. $(1,2,3), (\text{null},1,2)$

(6) Which of the following is a foreign key of the PurchaseOrder table?

```
CREATE TABLE PurchaseOrder(pid int PRIMARY KEY,  
    customerid int REFERENCES Customer(id),  
    ordertime datetime,  
    storename VARCHAR(255), UNIQUE KEYS(datetime));
```

- A. pid
- B. ordertime
- C. storename
- D. customerid

Problem 3 (*18 points*) ER Diagram

Consider the following information about banks:

- Banks have a FDIC id and a name.
- Service Locations have a name and an address.
- Branches are a type of Service Location. Each branch has an established year.
- ATMs are another type of Service Location. Each ATM has a service fee associated with them.
- Each Service Location is part of one and only one bank.
- Banks have many service locations.

Design and draw an ER diagram that captures the information about the bank. Be sure to indicate any key and participation constraints (multiplicity constraints).

Problem 4 (*20 points*) Functional Dependency and BCNF

Consider a relation $R(A, B, C, D, E)$, with FD's $AB \rightarrow C$, $C \rightarrow D$, $D \rightarrow B$, $D \rightarrow E$.

(a) Find the closures of D and AB .

(b) Find all the keys for this relation. (you don't need to list superkeys that are not keys.)

(c) Is this relation in BCNF? If your answer is *yes*, explain why. If your answer is *no*, decompose the relationship into BCNF. Show your decomposition steps.

Problem 6 (*25 points*) SQL Query

Consider the following relational schema:

Users(userid, popularity, name)

Sites(siteid, sitename, userid, viewcount)

Entries(entryid, siteid, rating, message, createdtime, tag)

- (a) Write a simple SQL statement to create the Entries table for the relational schema. You don't need to specify constraints except for primary keys.
- (b) Write a simple SQL statement to retrieve users' names with popularity greater than 2.
- (c) Define a view *ActiveUsers* that gives users with more than 5 sites. Your view must include the same attributes as the 'Users' table (userid,popularity,name).

(d) Find all of the sitenames of *Sites* that have entries with a tag equal to "Oracle" or NULL, but not any other tag values.

(e) What would you add to the SQL in (a) to create a check constraint for Entries that ensures that rating is between 0 and 5 inclusively and the message does not contain the banned word "dolphin".

END OF CS411 MIDTERM EXAM