University of Toronto at Scarborough
CSCD34HWinter 2001

Midterm Test

Duration: 90 minutes

Aids allowed: None

Make sure that your examination booklet has **??** pages (including this one). Write your answers in the spaces provided. Write legibly.

Family Name: ____________________

First Name: ____________________

Student # : ____________________

1.		/ 10
2.		/ 8
3.		/ 12
4.		/ 10
Total		/ 42

Question 1

[10 marks in total]

True or False: [1 mark each correct answer, -1 each incorrect answer, 0 each null answer]

1. In an E/R diagram, it is possible to have a weak entity set that does not participate in any relationship set.
2. For any relation r on relation scheme R, if V is an arbitrary subset of R, then it is always the case that the number of tuples in $\pi_V(r)$ is equal to the number of tuples in r.
3. Natural join is an associative operator.
4. A relation scheme with no functional dependencies has no candidate keys.
5. A relation scheme that is in 3NF must be in BCNF.
6. An SQL view based on two or more tables cannot be updated.
7. SQL requires a primary key constraint for every table.
8. A foreign key in SQL cannot refer to the same table where it is declared.
9. If a functional dependency $X \rightarrow Y$ holds over a relation scheme R and $X \cap Y$ is empty, then the decomposition of R into $R - X$ and $R - Y$ is lossless.
10. ISA relationships are used to identify class hierarchies in E/R diagrams.

Question 2

[8 marks in total]

You are asked to design an information system for the Parliament of Canada. The database will store information about Members of Parliament (MPs), their ridings (i.e. electoral districts), and political parties. There is at most one MP elected from each riding, and each MP is elected from exactly one riding. For each MP we wish to store their name, their riding, and the party they belong to. An MP may belong to one or no party. A riding has a unique name, a province where it is located, and a population. A party has a unique name and a status (government/official opposition/other opposition). Each party has a leader, who is an MP. The leader of the government party is the Prime Minister. The leader of the official opposition party is the Leader of the Opposition. One MP is designated as Speaker of the House.

(a) [4 marks]

Give an E/R diagram for this database. State any assumptions you make. Explain how the constrainst given in the description above are incorporated into your design. If some constraints cannot be expressed, explain this fact.

(b) [4 marks]
Give a set of SQL CREATE TABLE statements for the tables that result from the relational translation of your schema of part (a). Include all appropriate key and foreign key constraints. State any assumptions you make.

Question 3

[12 marks in total]

Consider the relational schema below, with the obvious meaning.

```
Student[Number, Name]
Taking[StudentNo, CourseNo ]
Course[Number, Name]
```

(a) [4 marks]
Give an example of a reasonable foreign key constraint that involves the `Course` relation. What are the options for enforcing this constraint when a user attempts to delete a `Course` tuple?

(b) [4 marks]
Write the SQL statements to create the above relations, including all appropriate primary and foreign key constraints.

(c) [4 marks]
In your answer to part (b), is every course guaranteed to have a name? If not, change the SQL definition of `Course` so that it is.

(d) [4 marks]
Write an SQL statement to insert "Puff Daddy" as a student with student number 991234567.

(d) [4 marks]
Write an SQL statement to delete the course with course number "CSCD34" from `Course`. Given the referential integrity constraints you chose for this schema, explain what happens when this statement is executed.

Question 4

[12 marks in total]

Consider a relation scheme R with attributes $\{A, B, C, D, E\}$ and the set of functional dependencies $F = \{AD \rightarrow E, AF \rightarrow C, B \rightarrow D, BC \rightarrow A, DE \rightarrow A\}$.

(a) [2 marks]
Find all candidate keys.

(b) [2 marks]
Compute $(BE)^+$.

(c) [2 marks]
Prove that $BF \rightarrow C$ follows from the given set of functional dependencies by deriving it using the inference rules.

(d) [2 marks]
Show that R is not in BCNF.

(e) [4 marks]
Give a BCNF decomposition of R.