CSC 370 – Database Systems
Section F01
Fall 2003

Midterm Examination – October 21, 2003

Duration: 50 minutes

- This exam is closed book. You may not use notes and calculators.
- Answer all questions.
- Write your answers on the booklet provided.
- Ensure your full name and full student number are written on the booklet.
- State any assumptions you make.
- *Show all rough work.*
- Ensure all cell phones are turned off.

Read all questions carefully!

Question 1: General Database Concepts [20 marks]

a. What is an *external schema*? (5)
b. How does an external schema support *data independence*? Motivate your answer with a short example. (10)
c. When would you store data in a DBMS instead of within operating system files and vice-versa? (5)

Question 2: Entity-Relationship Diagrams [30 marks]

a. Define the term *key constraint*, and give an example. (5)
b. Define the term *participation constraint* and give an example. (5)
c. What is a *weak entity*? (5)

For parts (d) and (e) below, consider the following database schema:

- `Supplier(sname, itemname, price)` – supplier `sname` sells item `itemname` at `price`.
- `Customer(cname, address)` – customer `cname` lives at `address`.
- `Orders(cname, sname, itemname, qty)` – customer `cname` has ordered `qty` of item `itemname` from supplier `sname`.
- `Item(itemname, description)` – information about items.

d. Draw the E-R diagram from which the above schema might have been derived, and specify the keys. (10)
e. Suppose now that you want to add the following constraint to this diagram: *Every item is supplied by some supplier.* Indicate how the diagram must be modified to accommodate this constraint. (5)

Question 3: Relational Algebra and Tuple Relational Calculus [30 marks]

Consider the schema described in question 2. For parts (a) through (e), write the Relational Algebra version of the query. Conditional expressions may not contain the logical operators “or”, “and”, & “not” (i.e., to achieve their effects, you must use set operations).

a. Find the names of all items worth more than $20 at Lumberworld. (5)
b. Find the names of all customers with orders at Lumberworld. (5)
c. List the description of all items on order by George W. Bush. (5)
d. Find the names and addresses of all customers with orders at Lumberworld and Sammys Spanners. (Solution must be expressed in terms of set operations.) (5)
e. List the names of all items that are carried by every supplier. (5)
f. Choose one of (c), (d) or (e), and write the Tuple Relational Calculus version of the query. (5)

Question 4: SQL [20 marks]

a. Write the four CREATE TABLE commands required to build tables needed for the schema in Question 2. Your solution should indicate all key and participation constraints; *indicate when you have added fields to help satisfy such constraints*. (10 marks)
b. Given the query described in Question 3 (d) above, write the SQL version which uses a set operation (e.g., UNION, INTERSECT or EXCEPT). (5 marks)
c. Given the query described in Question 3 (d) above, write the SQL version which uses a nested query. (5 marks)

END OF EXAM