UNIVERSITY OF TORONTO

Faculty of Arts and Science

MIDTERM TEST FALL 2011

CSC343H – Introduction to Databases
Instructor - Manos Papagelis

Duration – 50min

No aids allowed

This test is worth 15% of your final mark. Please answer all questions in the space provided. You may use the blank pages dispersed throughout the exam for rough work. In your answers try to be concise. **Good luck!**

Last Name	
First Name	
Student Number	

Marks

Q1	Q2	Q3	Q4	Total
10	30	30	30	100

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Total pages = (6)

[10 Marks] Question 1 (Warm Up)

Consider the following relations:

R

A	B	C
1	2	3
1	2	0
1	3	1
6	2	3
1	4	2
3	1	4

S

B	C	D
2	3	7
1	4	5
1	2	3
2	3	4
3	1	4

Q1: Compute the result of the following relational algebra expression: $\pi_{A, D} (R \bowtie S)$

R ⋈ S

A	B	C	D
1	2	3	7
1	2	3	4
1	3	1	4
6	2	3	7
6	2	3	4
3	1	4	5

$\pi_{A, D} (R \bowtie S)$

A	D
1	7
1	4
6	7
6	4
3	5

Q2: Compute the result of the following SQL query:
SELECT S.B, SUM(S.C) AS Total
FROM S
GROUP BY S.B
HAVING SUM (S.C) > 5;

B	Total
1	6
2	6

Total pages = (6)

[30 Marks] Question 2 (Relational Algebra)
Assume the following relational schema that represents hotels, customers, and reservations:

Hotel (<u>hname</u>, city, country, rate)
Customer (<u>cname</u>, city, country)
Reserve (<u>cname</u>, <u>hname</u>)

Answer the following queries in **Relational Algebra**.

Q1: Find the name and rate of all hotels located in Toronto, Canada.

Result:= $\pi_{hname, rate}(\sigma_{city="Toronto" \land country="Canada"}(Hotel))$

Q2: Find the name of the customers that live in Canada OR have stayed in a hotel in Canada.

R1:= $\pi_{cname}(\sigma_{country="Canada"}(Customer))$
R2:= $\pi_{cname}(Reserve \bowtie \sigma_{country="Canada"}(Hotel))$
Result:=R1 U R2

Q3: Find the name of the most expensive hotel in "Toronto".

Hotel2 :=Hotel
R1:=$\pi_{Hotel.hname}(\sigma_{Hotel.rate < Hotel2.rate}(\sigma_{Hotel.city="Toronto"}(Hotel) \mathbf{X} \sigma_{Hotel2.city="Toronto"}(Hotel2)))$
Result:= $\pi_{hname}(\sigma_{city="Toronto"}(Hotel)) - R1$

Total pages = (6)

[30 Marks] Question 3 (SQL Queries)

Assume the following relational schema that represents hotels, customers, and reservations:

Hotel (hname, city, country, rate)
Customer (cname, city, country)
Reserve (cname, hname)

Answer the following queries in **SQL**.

Q1: Find the name and rate of all hotels located in Toronto, Canada.

SELECT hname, rate
FROM Hotel
WHERE city="Toronto" AND country="Canada"

Q2: Find the name of the customers that live in Canada OR have stayed in a hotel in Canada.

SELECT cname FROM Customer WHERE country="Canada"
UNION
SELECT R.cname FROM Reserve R, Hotel H WHERE H,hname = R.hname AND
H.country="Canada"

Q3: Find the name of the most expensive hotel in "Toronto".

SELECT hname
FROM Hotel
WHERE city='Toronto' and rate >= ALL (
            SELECT rate
            FROM hotel
            WHERE city='Toronto')

Total pages = (6)

[30 Marks] Question 4 (True/False Statements)

For each of the following statements, indicate whether they are *true* (**T**) or *false* (**F**). A correct answer is worth **3** points, no answer is worth **0** points, and wrong answer is worth **-2** points.

Answer	Statement
[F]	The Union operation (∪) can be performed between any two relations.
[F]	In relational algebra selection (**σ**) operates on the columns or attributes of a relation and projection (**π**) operates on the rows or tuples of a relation.
[F]	The cardinality of a natural join between two relations **A** and **B** with no common attributes between them, is equal to the cardinality of **A** plus the cardinality of **B**.
[T]	Assume **R**(A, B) and **S**(C, D). Then, $R \bowtie_{B=C} S = \sigma_{B=C} (R \times S)$.
[T]	Let **R**(A, B, C, D) and **S**(C, D). Then the result of R/S (R divided by S) will be a relation **T** with schema **T**(A, B).
[F]	In SQL, attributes declared UNIQUE cannot have NULL values.
[T]	In SQL, a relation may have multiple foreign keys.
[T]	In SQL, "DELETE FROM XYZ" will delete only tuples from table XYZ, but not its schema.
[T]	In SQL, *views* can be used to hide data in the database from third-party developers.
[F]	In SQL, defining an *index* on an attribute always speeds up queries that involve it.