

COP 4710 Database Systems

Spring 2013

Midterm Exam

March 5, 2013

Time: 75 minutes

Your Name: _____

USF ID: U _____

Problem I. (20pts) True or false, mark your choice clearly. Ambiguous answers will get zero points. You do not have to explain how you reached your conclusion.

1. SQL is an implementation of tuple relational calculus. T(☐) F(☐)
2. In relational algebra, if we have $r \times s = T$, the **degree** of table T is the **product** of the degrees of tables r and s. T (☐) F (☐)
3. A candidate key must also be a superkey. T (☐) F (☐)
4. In relational algebra, the expression $r \cup s$ is meaningless unless the two operands r and s have exactly the same schema. T (☐) F (☐)
5. Relational algebra is a declarative language. T (☐) F (☐)
6. A foreign key is not necessarily a key in the **referencing** table. T (☐) F (☐)
7. In a relation, a candidate key is not necessarily a primary key. T (☐) F (☐)
8. **Cardinality** of a table is defined as the number of tuples in the table. T (☐) F (☐)
9. By default, the resulting table of an SQL query is duplicate free. T (☐) F (☐)
10. The EXISTS keyword in SQL tests if a following SQL statement returns an empty set. T (☐) F (☐)

Problem I. Query languages (50pts, 5 pts each)

Given the following relational database that stores Hollywood movie information

<p>Movies (<u>title</u>, year, length, genre, studioName, ProducerName) StarsIn (<u>movieTitle</u>, <u>starName</u>, pay) MovieStar (<u>name</u>, address, gender, birthdate) MovieExecutive(<u>name</u>, address, certificate_num, network)</p>
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where the underlined attributes are the primary keys. The following foreign keys also exist:

StarsIn.starName --> MovieStar.name

StarsIn.movieTitle --> Movies.title

Movies.ProducerName --> MovieExecutive.name

I-A. Write the following queries in SQL (Queries written in the wrong language will get zero points)

1. Print the names and addresses of movie stars who were born before 08/15/1945;
2. Print the title and year of movie(s) in which there is a movie star with a pay over 40 million dollars, and also print the movie star's name and birthdate.
3. Print the names of actors who starred in both an MGM (studio name) movie and a Universal (studio name) movie;

Movies (<u>title</u> , year, length, genre, studioName, ProducerName) StarsIn (<u>movieTitle</u> , <u>starName</u> , pay) MovieStar (<u>name</u> , address, gender, birthdate) MovieExecutive(<u>name</u> , address, certificate_num, networkth)

4. What is the average length of movies produced by Kevin Costner?

5. For each movie genre, find the total number of movies, but only return this number for those genres with at least 5 movies in it.

6. Print the names of movie stars who have acted in EVERY movie produced by Spielberg from 1990 to 1995.

Movies (<u>title</u> , year, length, genre, studioName, ProducerName) StarsIn (<u>movieTitle</u> , <u>starName</u> , pay) MovieStar (<u>name</u> , address, gender, birthdate) MovieExecutive(<u>name</u> , address, certificate_num, networth)
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II-B. Write the following queries in relational algebra:

7. Print the titles and years of movies in which Tom Hanks starred.

8. If, in any movie, a movie star's pay is more than 50% of the networth of the movie's producer, print the movie star's name and the producer's name.

9. Print the names of movie stars who have acted in EVERY movie produced by Spielberg from 1990 to 1995.

10. Print the names of producers who produced exactly ONE movie in 2009;

II. (30 pts, 5 pts each) Consider the following two relations:

Relation r

B	C	D
a	5	b
b	6	a
c	25	b
a	5	c

Relation s

D	E	F
b	10	6
c	25	3
b	10	5

give the resulting table of the following relational algebraic expressions. You should specify the schema as well as the values of all attributes for all tuples in your solutions. If you believe the expression does not make sense, put ϕ as your answer. Write down intermediate results for partial credits.

1. $\Pi_C(r)$

2. $\Pi_B \sigma_{r.C < 6}(r)$

3. $r \cap s$

$$4. \mathbf{r} \times \mathbf{s} \text{ (hint: cross product)}$$

$$5. \Pi_{B,F} (\mathbf{r} \bowtie \mathbf{s}) \text{ (hint: this is natural join)}$$

$$6. \Pi_{B,D} (\mathbf{r}) \div [\Pi_D \sigma_{r.D \neq a} (\mathbf{r})]$$