Student Name:

General Guidelines: *Exam duration: 70 min; Total: 7 questions, 50 marks; Aids allowed: only a 1-page, 1-sided cheat sheet.*

Question 1

[6 marks in total] TRUE or FALSE: 1.5 marks for each correct answer; 0 marks for each incorrect answer or if no choice is selected.

a) Every relational algebra query can be expressed in SQL.

( ) TRUE ( ) FALSE

b) A weak entity can be uniquely identified using its weak key and the primary key of its owner entity combined.

( ) TRUE ( ) FALSE

c) A view defined over the join of two relations is updateable if the join column is in the view.

( ) TRUE ( ) FALSE

d) Assuming R and S are two union-compatible relations, $S - (S - R) = R - (R - S)$.

( ) TRUE ( ) FALSE

Question 2

[4 marks] What is logical data independence? Give a concrete example that shows how logical data independence can be useful.

Question 3

[10 marks in total] You are modeling a grocery store that sells products, each identified by a UPC and have additional attributes quantity and price. Some products are seasonal and for each seasonal product, the store records the season when the product is available. The store runs weekly special sales, each sale marked with a start date and an end date. Selected products go on sale for discounted prices during these events; the store keeps track of all such sales.

a) **[6 marks]** Draw an ER diagram that captures the above information.

b) [**4 marks**] Translate your ER diagram into a relational schema. Describe your schema by listing all table names, column names and constraints including all primary and foreign key constraints (no need to give actual SQL statements).

Question 4

[16 marks in total] Consider the following relations about movies and their rentals. Keys are all underlined. The column *rent_type* in *movies* and the column *title* in *rents* are foreign keys respectively referencing *classes* and *movies*.

movies (title, category, rent_type)
e.g. row: ("it is a wonderful life", "family", 2)
classes (rent_type, price)
e.g. row: (2, 2.99)
rents (customer, title, checkout, return)
e.g. row: ("John Smith", "it is a wonderful life", "02/23/10", "03/01/10")

Write the following queries in SQL (in each case, write a single query).

a) Find customers who have rented out titles from both *action* and *family* categories.

b) Find titles and prices of movies that have the word 'star" in the title; order the list in an ascending order of the price.

c) Find pairs of different categories where at least five different customers have rented out titles from both categories.

d) For each rent type, find both the number of distinct titles and the number of rents of that type; the output includes the rent type in addition to these two quantities (don't list a rent type if there is no movie or rent of that type).

Question 5

[4 marks in total] Answer the following questions based on your SQL queries (or your solution) to Question 4.

a) Does your query for *Q4-c* return each qualifying pair only once in the output? If yes, explain. If no, change your SQL query to make sure each qualifying pair appears only once in the output.

b) Change your SQL query got Q4-d to list all rent types even if there is no movie or rent of that type.

Question 6
[6 marks in total] Consider the schema given in Question 4 and write the following queries in relational algebra.

a) Find all titles in the comedy category.

b) Find customers who have rented out all movies except the movie "it is a wonderful life."

Question 7
[4 marks in total] Based on the schema given in Question 4, and the following instance of the *rents* table, write the results of the following two queries

John Smith	ghost	02/26/10	null
Mary Smith	it is a wonderful life	02/28/10	03/05/10
Joe Allen	ghost	02/12/10	02/16/10

a) SELECT customer FROM rents WHERE return <> '03/05/10'

b) SELECT COUNT(return) FROM rents

Name: **Student Id:**

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Total