CSCI 5333.3 DBMS
Fall 2021
Final Examination

Last Name: _____ **First Name:** _____ **Student Id:** _____

Number: _____

I hereby pledge that I will stay truth to UHCL's Honor Code.

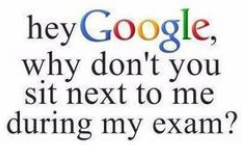
Signature: **Date:**

Time allowed: two hours. Total score: 100 points.
This is a ***closed*** book examination but you can bring an 'information sheet'.

Answer all questions. *Turn in question paper, any answer sheet, the cheat sheet and all rough work.* Plan your time well.

Academic honesty policy will be followed strictly. Cheating will be pursued vigorously and will result in a failing grade of D or below, a permanent academic record and possibly other more serious penalty.

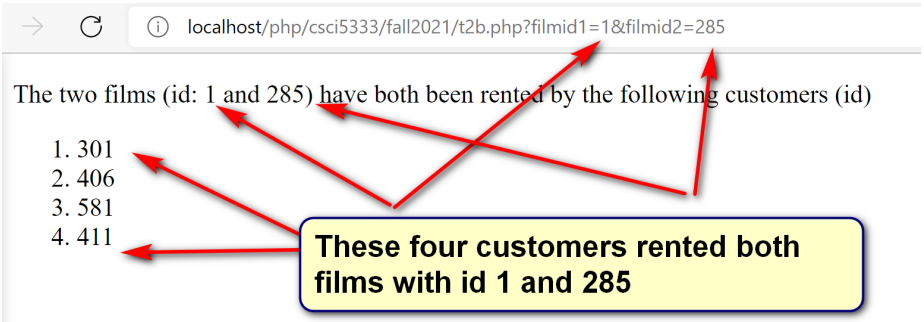
Many questions refer to the Sakila database we have used extensively in lectures and homework. Please refer to the relation schemas in the supplementary sheets to answer these questions.



(1) [25 points] Write a PHP program, t2.php, to accept two HTTP GET parameters *filmid1* and *filmid2*, which are the ids of two films in Sakila. The program displays the ids of all customers who have rented both films. For example, for

http://.../t2.php?*filmid1=1&filmid2=285*

It should display exactly the following in the browser.



Note that the customers may rent different inventory copies of the same film. If no customer has rented both films, a proper message should be provided. For example,

http://.../t2.php?*filmid1=1&filmid2=2*

Please answer your question in the next page. A skeleton is provided for you:

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
<meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
<title>CSCI 5333.1 DBMS Fall 2021 Final Examination, Question 1</title>
</head>
<body>
<?php
      // assume that dbconfig_sakila.php take care of db configuration
      // so you can use mysqli.
      include('dbconfig_sakila.php');

Your code to be entered in the next page.
No need to copy the skeleton again in your answer.

?>
</body>
</html>
```

(1) Answer question (1) here. Write in the back page if necessary.

(2) [21 points] Create a view f21t2 to provide actor ids, the numbers of the films the actors appear in, and the total numbers of copies of all films of the actors in the inventory. For example:

```
MariaDB [sakila]> SELECT DISTINCT *
    -> FROM f21t2
    -> ORDER BY filmCount DESC
    -> LIMIT 3;
+----------+-----------+-----------+
| actor_id | filmCount | copyCount |
+----------+-----------+-----------+
|      107 |        42 |       214 |
|      198 |        40 |       192 |
|      102 |        39 |       186 |
+----------+-----------+-----------+
```

The actor with id 107 appeared in 42 films. The company has a total of 214 copies of these 42 films in the inventory.

(b) Use the view defined in (a), provide the SQL statement to show the actors with the least number of films appearing in.

```
+----------+-----------+-----------+
| actor_id | filmCount | copyCount |
+----------+-----------+-----------+
|      148 |        14 |        62 |
+----------+-----------+-----------+
```

In general, there can be multiple actors in the query output.

(c) Define a stored function f21f1 to accept an argument categoryId (id of a category). It returns the number of copies of all films in the category in the inventory. For example:

```
MariaDB [sakila]> SELECT f21f1(2);
+----------+
| f21f1(2) |
+----------+
|      335 |
+----------+
```

This is because there are 35 copies of films in the category with id 2.

(3) [7 points] Use Armstrong's axioms and rules to prove that

F = {A->B, D->E. AB->C, AC->D} implies A->E

(4) [7 points] Consider R(A,B,C,D,E) with the set of FDs:

{A->C, CD->B, BC->AD, E->B}

R is decomposed into R1(A,B,C), R2(C,D,E) and R3(B,E).

Is the decomposition lossless? Show your reasoning. Write in the back page if necessary.

(5) [20 points] True (T) or False (F)

(a) In MySQL, a stored function cannot execute an INSERT statement on a table.

(b) If F is a canonical cover of G, and H is a canonical cover of G, then F is also a canonical cover of H.

(c) R(A,B,C,D) may have five candidate keys.

(d) In XML, XPath always returns well-formed XML results.

(e) AC-> A is always true.

(f) If AB->C, then A->C and B->C.

(g) In RDB, the ACID properties ensure that all foreign keys must have non-null values.

(h) In MySQL, when a transaction is committed, the changes are made permanent.

(i) There is one and only one canonical cover for a given set of function dependencies.

(j) R(A,B,C,D,E) may have two candidate keys and seven superkeys.

(6) [20 points] Consider R(A,B,C,D,E,F) with

F= {B->A, AB->C, CD->A, D->B, BC->E, E->FA}

(a) What are A+, B+, C+, D+, E+ and F+?

(6) continue: F= {B->A, AB->C, CD->A, D->B, BC->E, E->FA}

(b) What are the candidate keys? Show all prime attributes.

(c) Give a canonical cover of F.

(d) What is the highest normal form (up to BCNF) of R and why?

(e) If R is not in BCNF, can you provide a lossless FD preserving decomposition of R into BCNF relations? If yes, show such decomposition. If no, justify your answer.