ITEC 3335 Database Development
Fall 2019
Final Examination

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

Number: _____

Time allowed: *one hour 45 minutes.* Total score: 105 points.

Closed book examination but an 'information' sheet allowed. Answer all questions. Turn in both question and answer sheets (if needed).

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.

(1) [8 points] Short questions.

Consider the relation R(A,B,C,D). List the highest normal form (assume at least 1NF) for the following set of functional dependencies.

(a) {A->B, B->CD}

(b) {A->B, A->C, A->D}

(c) {A->BC}

(d) {A->B, B->A, AC->D}

(2) [20 points] Write a simple Python program, t2.py, to connect to the database **toyu**. The program accepts one command line argument, dept_code, and output the stuId, name and number of courses of all students majoring in dept_code in the following manner. Assume no error in the command line arguments. For example:

```
C:\...\test>python t2.py CSCI
Major students of the department CSCI:
----------------------------------------------------------------
[sid: 100000] Tony Hawk: enrolled in 6 classes.
[sid: 100001] Mary Hawk: enrolled in 2 classes.
[sid: 100002] David Hawk: enrolled in 3 classes.

C:\...\test>python t2.py ITEC
Major students of the department ITEC:
----------------------------------------------------------------
[sid: 100003] Catherine Lim: enrolled in 0 classes.
[sid: 100004] Larry Johnson: enrolled in 2 classes.
```

You program can use the following Python program to make the MySQL connection to the toyu database.

dbconfig.py:

```
import configparser

#  simplistic and no error handling.
def get_mysql_param(filename='dbconfig.ini', section='mysql'):

    config = configparser.ConfigParser()
    config.read(filename)

    return config['mysql']
```

A skeleton is provided for you:

```
from dbconfig import *
import pymysql

#   establish database connection to the Toy University DB.
db = get_mysql_param()
cnx = pymysql.connect(user=db['user'], password=db['password'],
                      host=db['host'],
                      database=db['database'])
cursor = cnx.cursor()

#   Your code here.

#   Answer in the next page.

#   No need to copy the skeleton again.

cnx.close()
```

Answer of (2):

(3) [35 points] Use the Toy University (toyu) to answer the following queries with SQL. The detail of toyu is provided in a separate sheet.

(a) List information (classId, course name, semester, year, instructor faculty id, and faculty's department code) taught by a 'Professor' in the following manner.

Result #1 (6×4)

classId	course	semester	year	Instructor facId	department
10,000	Data Structures	Fall	2,019	1,011	CSCI
10,001	Design of Database Systems	Fall	2,019	1,011	CSCI
11,000	Data Structures	Spring	2,020	1,011	CSCI
10,005	Database Development	Fall	2,019	1,015	CINF

(b) Course names that 'Tony Hawk' enrolled in.

course (1×5)

course
Data Structures
Design of Database Systems
DBMS
Introduction to Information Systems
Web Application Development

(c) List the number of majors per department and school in the following manner. Note that the student ‘Ben Zico’ is not counted in the result as he has not declared major.

Result #1 (3×4)

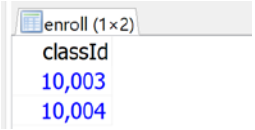
department	school	number of majors
Arts	Human Sciences and Humanities	2
Computer Information Systems	Science and Engineering	2
Computer Science	Science and Engineering	3
Information Technology	Science and Engineering	2

(d) List the CSE's department names with their number of faculty members in descending order of this number. Only list the CSE's department with 2 or more faculty members.

department (2×3)

department	n_faculty
Computer Science	4
Information Technology	2
Computer Information Systems	2

(e) List the classId of every class with *both* CSCI and ITEC (major) students enrolled in. For example, classId 10003 is in the result as the students 100,000 and 100,004 are enrolled in the class. Student 100,000 is a CSCI major. Student 100,004 is an ITEC major.


enroll (1×2)

classId
10,003
10,004

(4) [20 points] Cleary *circle* T (True) or F (False)

(a) [T or F] In SQL, an index can be created on more than one attributes.

(b) [T or F] Database's security management is usually a part of the job of a database administrator.

(c) [T or F] In SQL, an UPDATE statement can only update one row at a time.

(d) [T or F] It is possible that all attributes in R(A,B,C,D) are prime attributes.

(e) [T or F] In SQL, the count() function is a group function.

(f) [T or F] In SQL, the HAVING clause comes after the ORDER BY clause.

(g) [T or F] In PyMySQL, a cursor can be used to iterate through the results of a SQL statement.

(h) [T or F] The result of executing a DELETE statement will delete a row from a table.

(i) [T or F] If R(A,B,C,D) has two candidate keys, R may have 11 superkeys.

(j) [T or F] The relation R(A,B) is in BCNF.

(5) [10 points] Given R(A,B,C,D) with F = {C->D, CB->A, D->B}

(a) Find A+, B+, C+ and D+.

(b) What are the candidate key(s)?

(c) What is the highest normal form?

(d) If R is not in BCNF, can you decompose it into relations in 3NF and BCNF nicely? If yes, show the decomposition? If no, why?

(6) [10 points] Consider the following relation, Book, that stores book information.

Book(ISBN, authorId, authLname, authFname, title, publisherId, pubName).

ISBN is a unique Id for a book. A book may have many authors. An author has a unique id, authoId. A book is published by a publisher, with unique id and name.

ISBN	authorId	authLname	authFname	title	publiserId	pubName
123456789	13568	Jones	Mary	SQL now	P1234	Wiley
123456789	14443	Jim	Lee	SQL now	P1234	Wiley
123456789	20987	Kay	Bee	SQL now	P1234	Wiley
277111211	13568	Jones	Mary	SQL then	P1234	Wiley
100900901	13568	Jones	Mary	DB bye	P20014	Smith

(a) What are the functional dependencies?

(b) What are the candidate key(s)?

(c) What is the highest normal form and why?