Student Name:_____

Student ID: _____

CSC3170 Introduction to Database Systems (Fall 2019) Assignment 2

Please answer all the questions below (total 100 marks) and hand in your answer to the submission box at the 10/B of SHB **on or before 07th Nov 2019 4:00pm**

In this assignment, we consider a database about courses.

Student (sid: int, sname: string, age: int, sex: string)
Courses (cid: int, cname: string, teacher: string)
Credit (sid: int, cid: int, grade: int)

Write the following queries in relational algebra. Note that some of these queries may not be expressible in standard relational algebra taught in the lectures. For such queries, explain why they cannot be expressed.

Details:
* Sex is the gender of a student, which is male or female.
* Teacher is the name of teacher who teaches this course.
* "sid" and "cid" are the primary key of table "student" and "course".
* Table "Credit" contains all records of courses taken by students, including their final grades.

1. *(10 marks)* Find the cname(s) and cid(s) of courses which are taught by the teacher named Tom.

$$\Pi_{cname,cid}(\sigma_{teacher="Tom"}(Courses))$$

2. *(10 marks)* Find the sname(s) and sid(s) of male students whose age is larger than 21.

$$\Pi_{sname,sid}(\sigma_{age>21 \,\wedge\, sex="male"}(Student))$$

3. *(10 marks)* Find the sname(s) of students who take "database".

$$\rho(F1,\Pi_{sid}(\sigma_{cname="database"}(Credit \bowtie Course)))$$
$$\Pi_{sname}(F1 \bowtie Student)$$

4. *(10 marks)* Find the cname(s) of courses which are not taken by the student named Anne.

$$\rho(F1,\Pi_{cid}(Courses) - \Pi_{cid}(\sigma_{sname="Anne"}(Student \bowtie Credit)))$$
$$\Pi_{cname}(F1 \bowtie Courses)$$

5. *(10 marks)* Find the sname(s) of students who at least take two courses.

$$\rho(F2,\Pi_{sid}(\sigma_{Credit.cid \neq F1.cid}(Credit \bowtie_{Credit.sid=F1.sid} \rho(F1,Credit))))$$
$$\Pi_{sname}(F2 \bowtie Student)$$

6. *(10 marks)* Find the cname(s) and cid(s) of courses which are taken by all students.

$$\rho(F1, \Pi_{sid,cid}(Student \bowtie Credit)/\Pi_{sid}(Student))$$
$$\Pi_{cname,cid}(F1 \bowtie Courses)$$

7. *(10 marks)* Find the sid(s) of students who take at least one course taught by the teacher named Tom.

$$\Pi_{sid}(\sigma_{teacher=\text{``Tom''}}(Courses \bowtie Credit))$$

8. *(10 marks)* Find the sname(s) of students who take all available courses.

$$\rho(F1, \Pi_{sid,cid}(Credit)/\Pi_{cid}(Courses))$$
$$\Pi_{sname}(F1 \bowtie Student)$$

9. *(10 marks)* Find the sid(s) of students who take all the courses taken by the student with sid=2.

$$\rho(F1, \Pi_{cid}(\sigma_{sid=2}(Credit)))$$
$$\Pi_{sid,cid}(Credit)/F1$$

10. *(10 marks)* Find the sname(s) of students who only take all courses which are taught by the teacher named Tom.

$$\rho(F1, \Pi_{cid}(\sigma_{teacher=\text{``Tom''}}(Courses)))$$
$$\rho(F2, \Pi_{cid}(Courses) - F1)$$
$$\rho(S1, \Pi_{sid,cid}(Credit)/F1)$$
$$\rho(S2, \Pi_{sid}(Credit \bowtie F2))$$
$$\Pi_{sname}(Student \bowtie (S1 - S2))$$