UNIVERSITY OF VICTORIA
Faculty of Engineering
Department of Computer Science

CSC 370 (Database Systems)
Instructor: Daniel M. German

Midterm #2
5 July 2018

Duration: 75 minutes

Student ID: _____

This is a closed-book exam. You are only allowed one hand written sheet of paper (letter-size).

This examination paper consists of **5** pages (including this one). Please bring any discrepancy to the attention of an invigilator.
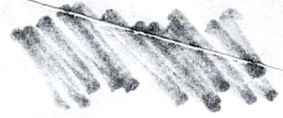
> Answer the questions in the spaces provided. If you run out of room for an answer, continue on the back of the page.

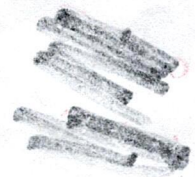**Please write your answers clearly.**

For instructors use:

Question	Points	Score
1	12	12
2	12	12
3	8	7
Total:	32	31

1. **Queries, first part**

   To answer these questions you should not use any joins (of any kind), cross product, nor aggregation.

   For each of the following questions, provide a relational algebra expression to answer them, and its equivalent SQL query:

   (a) [4 points] List the **cid** and **dept** of each course that has at least one student enrolled in it. Your result should have two attributes: **cid** and **dept**.

   $$\Pi_{cid,dept} \; \sigma_p \; Courses \qquad\qquad p \leftarrow Courses.cid \; IN \; (\Pi_{cid} \; Enrolled)$$

   ```
   SELECT cid, dept FROM Courses
   WHERE courses.cid IN (SELECT cid FROM Enrolled);   ES
   ```

   ④

   (b) [4 points] List the **sid** of students who are currently enrolled in both 'csc370' and 'seng360' (these are their **cids**). Your result should have only one attribute: **sid**.

   $$C3 = \Pi_{sid} \sigma_p \; E.dent;$$
   $$S3 = \Pi_{sid} \sigma_q \; E$$
   $$C3 \cap S3$$

   $$p \leftarrow E.cid = 'csc370'$$
   $$q \leftarrow E.cid = 'seng360'$$

   ```
   WITH C3 AS (SELECT sid FROM E where E.cid = 'CSC370'),
        S3 AS (SELECT sid FROM E where E.cid = 'seng360')
   SELECT sid FROM (TABLE C3 INTERSECT TABLE S3) AS JOINT;
   ```
   4

   (c) [4 points] List the **cid** of courses in which all students have a grade (i.e. all students enrolled in the course have a grade different from NULL).

   $$NO\_G = \Pi_{cid} \sigma_p \; E$$
   $$\Pi_{cid} \sigma_q \; E$$

   $$p \leftarrow grade \; IS \; NULL$$
   $$q \leftarrow cid \; NOT \; IN \; NO\_G$$

   4

   ```
   WITH NO_G AS (SELECT cid FROM E WHERE grade is NULL)
   SELECT cid FROM C WHERE cid NOT IN (TABLE NO_G);
   ```

   \# Includes courses with no students

2. **Queries, part 2, no aggregation**

   For these queries you cannot use aggregation.

   For each of the following questions, provide **only** an relational algebra expression to answer them. **DO NOT provide SQL**.

   (a) [4 points] List the **cid** and **dept** of courses that have at least one student enrolled and are from the same department (**dept**) than its instructor. The result should have two attributes: **cid** and **dept**.

   $$\Pi_{cid, \ C.dept} \ \sigma_p \ E \bowtie_{cid} C \bowtie_{iid} I \qquad \checkmark \qquad p \leftarrow C.dept = I.dept$$

   $$4.$$

   (b) [4 points] List the **sid** and **grade** of the student (or students—there might be more than one) with the highest grade recorded. Your result should have 2 attributes: **sid** and **grade**.

   $$\Pi_{sid, grade} \ \sigma_p \quad E \qquad \checkmark$$

   $$p \leftarrow grade >= ALL(\sigma \Pi_{grade} \ E \ )$$

   $$4.$$

   (c) [4 points] List the **sid** and **sname** of students who are not enrolled in any course offered by the 'CSC' department (**dept** equal 'CSC'). Make sure you include students who might not be enrolled in any course. Your result should have two attributes: **sid** and **sname**.

   $$CE = \Pi_{sid} \ \sigma_p \ (E \bowtie_{cid} C) \quad C) \qquad p \leftarrow dept = 'CSC' \quad \checkmark$$

   $$\Pi_{sid, sname} \ \sigma_q \ S \qquad q \leftarrow S.sid \ NOT \ IN \ CE \quad \checkmark$$

   $$4$$