CS448 Homework 1

Relational Algebra and Relational Calculus

February 6, 2020

This project is due on Friday, 02/21/2020 at 11:59PM on Blackboard. Note: There will be a 10% penalty for each late calendar day. After five calendar days, the Project will not be accepted.

1 Question 1 (40 Points)

Students (sid: integer, sname: string)
Course (cid: integer, iid, cname: string)
Instructors (iid: integer, iname: string)
Grades (sid, cid, ggrade: string)

The key fields are underlined, and the domain of each field is listed after the field name. Thus, sid is the key for Students, cid is the key for Courses, and iid is the key for Instructors.

Based on the above schema, write the following queries in Relational Algebra and Domain Relational Calculus:

1. (8 Points) Find the snames of the students who registered in the course with cname "Database".

2. (8 Points) Find the snames of students who got a ggrade "A" in all courses.

3. (8 Points) Find the cids of courses taught by at least two different instructors.

4. (8 Points) Find the sids of students who never received a ggrade "D".

5. (8 Points) If grades are graded by 100 scale. Consider Scheme:
   Grades (sid, cid, ggrade: int)
   instead. Find the sids of students who received the highest grade.

2 Question 2 (60 Points)

Books (bid: integer, btitle: string, bgenre: string)
Publishers (pid: integer, pname: string, paddress: string)
Catalog (bid, pid, ccost: float)

The key fields are underlined, and the domain of each field is listed after the field name. Thus, bid is the key for Books, pid is the key for Publishers, and bid and pid form the key for Catalog. Relation Catalog gives the prices charged for Books by Publishers.

1. (10 Points) What does the following RA query compute:

   $\rho(P, \pi_{P.pid}(\sigma_{pname=\text{"Pottermore"}} Publishers))$
   $\pi_{bname}((\sigma_{bgenre='fiction'} Books) \bowtie (\sigma_{ccost>30}$ Catalog$) \bowtie P)$

2. (10 Points) What does the following DRC query compute:

   $\{< P1 > | \exists P1N, P1S(< P1, P1N, P1S > \in Publisher \wedge \exists A, B, C(< A, B, C > \in Catalog \wedge B = P1 \wedge \neg(\exists P2, P2N, P2S(< P2, P2N, P2S > \in Publisher \wedge \exists D, E, F(< D, E, F > \in Catalog \wedge E = P2 \wedge C < F)))))\}$

3. (10 Points) What does the following DRC query compute:

   $\{< P1 > | \exists P1N, P1S(< P1, P1N, P1S >\in Publisher \wedge \exists A, C(< A, P1, C >\in Catalog \wedge \neg(\exists P2, P2N, P2S(< P2, P2N, P2S >\in Publisher \wedge \exists D, F(< D, P2, F >\in Catalog \wedge C > F)))))\}$

4. (10 Points) What does the following TRC query compute:

   $\{t1 | \exists p1 \in Publisher(t1.pid = p1.pid \wedge \exists c1 \in Catalog(c1.pid = p1.pid \wedge \neg(\exists p2 \in Publisher \wedge \exists c2 \in Catalog(c2.pid = p2.pid \wedge c1.ccost < c2.ccost))))\}$

5. (20 Points) Write the equivalent RA, DRC, and TRC expressions for the query:
   Find all the pnames of the Book with btitle "Gone with the Wind".