Database Management Systems

(COP 5725)

Fall 2019

Instructor: Dr. Markus Schneider

TA: Kyuseo Park

Exam 1 Part 2 Solutions

Name:	
UFID:	
Email Address:	

Pledge (Must be signed according to UF Honor Code)

On my honor, I have neither given nor received unauthorized aid in doing this assignment.

_____

Signature

For scoring use only:

	Maximum	Received
Question 3	50	
Total Part 2	50	
Total Exam 1	100	

Question 3 (Relational Algebra) [50 points]

Consider the following relations. The primary key is underlined.

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Student(sID, name, campus, email, gpa: number)

Course(dept, cNum:number, name, core) (the value of core can be 'true' or 'false')

Course-offering(oID, dept, cNum:number, semester, instructor)

Took(sID, oID, score: number)
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The value of the semester can be like '2018F' or '2019S', etc.

Course-offering[dept, cNum] ⊆ Course[dept, cNum]

Took[sID] ⊆ Student[sID]

Took[oID] ⊆ Course-offering[oID]

Write Relational Algebra expressions for the following queries.

(a) [7 points] Find the names of students who took the core courses that Paul taught and got a score larger than 50.

- $\rho_{R1}\left(\sigma_{core=true \,\wedge\, instructor = Paul}\left(Course \bowtie Courseoffering\right)\right)$
  $\rho_{R2}\left(\pi_{sID}\left(\sigma_{score \,>\, 50}\left(R1 \bowtie Took\right)\right)\right)$
  $\pi_{name}\left(R2 \bowtie Student\right)$

(b) [6 points] Find the names of courses that the CISE department does not offer in 2019S.

- $\pi_{name}\left(\left(\pi_{cNum}\left(\sigma_{dept = CISE \wedge semester <> 2019S}\left(Courseoffering\right)\right) - \right.\right.$
  $\left.\left. \pi_{cNum}\left(\sigma_{dept = CISE \,\wedge\, semester = 2019S}\left(Courseoffering\right)\right)\right) \bowtie Course\right)$

(c) [7 points] Find the names of students whose GPA is greater than 3.0 and who did not take the course CISE 5725 in 2019S. (CISE: dept, 5725: cNum)

- $\rho_{Takers}\left(\pi_{sID}\left(\sigma_{dept = CISE \wedge cNum = 57\ 25 \wedge semester = 2019S}\left(Courseoffering\right) \bowtie Took\right)\right)$
- $\rho_{NonTakers}\left(\pi_{sID}\left(Took\right) - Takers\right)$
- $\pi_{name}\left(\sigma_{gpa > 3.0}\left(Student \bowtie NonTakers\right)\right)$

(d) [7 points] Find the ids of students who have a score of 100 at least twice in CISE 5725. (Assume students can take the same course multiple times.)

- $\rho_{Takers}\left(\pi_{sID,oID,score}\left(\sigma_{dept = 'CISE' \,\wedge\, cNum = 57\ 25}\left(Courseoffering\right) \bowtie Took\right)\right)$

$$\pi_{sID}(\sigma_{T1.oID \neq T2.oID \,\wedge\, T1.sID = T2.sID \,\wedge\, T1.score = 100 \,\wedge\, T2.score = 100}\,(\rho_{T1}(Takers)$$
$$\times\; \rho_{T2}(Takers)))$$

(e) [7 points] Find the department names and numbers of courses that have been offered in every semester when CISE 5725 was taught.

- $\rho_{Semesters}(\pi_{semester}(\sigma_{dept = \,'CISE'\, \wedge\, cNum\, =\, 57\,25}(Courseoffering)))$
  $\rho_{R1}(\pi_{dept,cNum,semester}(Courseoffering))$
  $\rho_{R2}((\pi_{dept,cNum}(Course) \times Semesters))$
  $\rho_{R3}(R1 - R2)$
  $(\pi_{dept,cNum}Course) - (\pi_{dept,cNum}\,R3)$

(f) [5 points] Find the names of students who took every course taught by Professor "Logics".

- $\rho_{LogicsCourse}(\pi_{oID}(\sigma_{instructor='Logics'}(Courseoffering))$
- $\pi_{name}((Took \div LogicsCourse) \bowtie Student)$

(g) [7 points] Find the names of students who have never taken the core courses offered by the CISE department.

- $\rho_{CoreCourses}(\pi_{dept,cNum}(\sigma_{core=true \,\wedge\, dept=CISE}(Course)))$
- $\rho_{Takers}(\pi_{sID}((\pi_{oID}(CoreCourses \bowtie Courseoffering)) \bowtie Took))$
- $(\pi_{name}((\pi_{sID}Student - Takers) \bowtie Student)$

(h) [4 points] Find the semesters when Paul and Raul were both teaching.

- $\pi_{semester}(\sigma_{instructor = \,'Paul'}(Courseoffering)) \,\cap$
  $\pi_{semester}(\sigma_{instructor = \,'Raul'}(Courseoffering))$