In-Semester Exam-I (Autumn'2019)

IT 214 Database Management Systems (SOLUTION)

Time: 90 minutes Max Points: 100

IMPORTANT NOTE:
1. Write answers neat and clean. Answers that are difficult to read may simply be discarded.
2. In all questions marks awarding strategy will be discrete (i.e., 0, half, and full marks).
3. You may have to pay penalty for lengthier solutions.

Consider following relational schema for storing various students' related data. Brief description is also given alongside.

student(id, name, prog_id, batch, cpi)
-- attribute **prog_id** is like '01' for BTech, '11' for M.Tech, '12' for MScIT, and so
-- Assume that this relation stores data of only current students of the institute; say all past data
-- have been archived.

room(rno, wing, floor)
-- the relation stores details of rooms
-- floors are represented by numbers 0 (Ground), 1(First), and 2 (Second), and so

allot(sid, rno)
-- The relation records residential facts of students. Note that that RNO cannot be NULL.
-- SIDs' of students who are not residing hostel does not appear here.

registers(studid, courseno, grade)
-- let this relation be storing academic performance of students.
-- let us not record year/sem of student taking the course, grade is latest grade in course, if repeated
-- let the grades be stored as AA, AB, and so forth.

grade2point(grade, point)
-- the relation records mapping from letter grade to numeric value.
-- as AA --> 10, AB --> 9, and so forth

clubs(clubid, club_name)
-- ~~the relation records all the offers that are made to students in 2018~~.

clubmembers(sid, clubid)

Write **expressions in Relational Algebra** to answer queries in following ~~five~~ seven questions. (No marks will be awarded if answered in SQL)

7x10

1. Give list (id, name, progid, cpi) of students who are residing in E wing, second floor.

$$r1 \leftarrow \sigma_{wing='E' \text{ and } floor=2}(allot * room)$$
$$result \leftarrow \pi_{id,name,progid,cpi}\left(r1 \overset{\bowtie}{\boxed{studid = id}} student\right)$$

2. Give list (id, name) of students from B.Tech. 2nd second year (2018 batch) who are residing in E wing.

$$r1 \leftarrow \sigma_{wing='E'}(allot * room)$$
$$result \leftarrow \pi_{id,name}(\sigma_{progid='01' AND\ batch=2018}\left(r1 \overset{\bowtie}{\boxed{studid = id}} student\right))$$

3. Give list (id, name) of students who are singly occupying rooms. (Note that a room is to be allocated to multiple students, typically two)

$$r1 \leftarrow \ _{rno}\mathcal{F}_{count(*)\rightarrow scount}(allot)$$
$$r2 \leftarrow \sigma_{scount=1}(r1)$$
$$result \leftarrow \pi_{id,name}\left(r2 * allot \overset{\bowtie}{\boxed{studid = id}} student\right)$$

4. Give list of students (*) B.Tech. 1st year (2019 batch) who do not reside in hostel.

$$result \leftarrow \sigma_{progid='01' \text{ and } batch=2019}\left(student \overset{SemiDiff}{\boxed{id = studid}} allot\right)$$

OR

$$r1 \leftarrow \sigma_{progid='01' \text{ and } batch=2019}(student)$$
$$r2 \leftarrow \pi_{id}(r1) - \pi_{studid}(allot)$$
$$result \leftarrow r2 * student$$

5. What is average grade point in the course 'Algorithms' (IT215) of students who are member of 'Programming Club'?

$$r1 \leftarrow \sigma_{club\_name='Programming\ Club'}(clubs)$$
$$r2 \leftarrow \sigma_{courseno='IT215'}(registers)$$
$$r3 \leftarrow r1 * clubmembers \overset{\bowtie}{\boxed{sid = studid}} r2 * grade2point$$
$$result \leftarrow \mathcal{F}_{avg(point)}(r3)$$

6. Give program wise count of students in 'Programming Club'.

$$r1 \leftarrow \sigma_{club\_name='Programming\ Club'}(clubs)$$
$$r2 \leftarrow r1 * clubmembers \overset{\bowtie}{\boxed{sid = id}} student$$
$$result \leftarrow {}_{progid}\mathcal{F}_{count(*)\rightarrow scount}(r2)$$

7. Give program wise percentage of students residing in hostel for each program. Assume that student relation contains data of current students only.

$$r1 \leftarrow {}_{progid}\mathcal{F}_{count(*)\rightarrow scount}(students)$$
$$r2 \leftarrow {}_{progid}\mathcal{F}_{count(*)\rightarrow rcount}(allot \overset{\bowtie}{\boxed{studid = id}} student)$$
$$result \leftarrow \pi_{progid,rcount/scount*100}(r1 * r2)$$

8. Consider relations - R1(StudID, CourseNo, Grade) and R2(StudID, EventID).
Suppose, we need to compute CourseNos in which all students that are participating in event-id=3 have taken. Let us say this problem can be solved by division operation. Write sequence of operations performing division operation without using division operator.

$$r3 \leftarrow \Pi_{studid}(\sigma_{eventid=3}(R2))$$
$$r4 \leftarrow \Pi_{courseno,studid}(R1)$$

Now compute: r4 DIV r3

$$r5 \leftarrow \Pi_{courseno}(r4) \times r3$$
$$r6 \leftarrow r5 - r4$$
$$r7 \leftarrow \Pi_{courseno}(r6)$$
$$result \leftarrow \Pi_{courseno}(r4) - r7$$

9. Read following description for a database design and produce a **Neat ER Diagram**.

Suppose we need to design database for an online book store ***Abazon***. Let us say *Abazon* wants to have a database to store required data for books, authors, publishers, and distributers. For Books we record ISBN, Title, PubYear, Price, Authors information. ISBN is a unique number that every published book has. Book can be authored by multiple authors. For Authors, let us say we record ID, Name, Email, Affiliation, BriofBio. Every book is published by some Publisher. For publisher, let us say we record ID, Name, City. A publisher can be located in multiple cities. Also there is concept of Distributors. Publishers do not sale book directly. Books are sold through distributers, and book stores buy book from distributors. Let us say, we record ID, Name, and Address (location, City, PIN) for distributors. *Abazon* is on a policy that they buy a book (one ISBN) from single distributor. This gives *Abazon* a good bargain in buying books. However *Abazon* can buy multiple books from a distributor. We also record in what price *Abazon* gets a book from the distributer.

Your ER Diagram should be clearly depicting Entities, Attributes and Key Attributes, Relationships and related constraints. If you find do not find explicit mention of any constraints, you can make necessary assumption, and depict accordingly. However, you should not be ignoring explicit mention of a constraint. You are not expected to add additional attribute, and drop any of attributes.

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