In-Semester Exam-I (Autumn'2017)
IT 214 Database Management Systems

Time: 90 minutes

Max Points: 90

IMPORTANT NOTE:
1. Write answers neat and clean. Answers that are difficult to read may simply be discarded.
2. Answer all queries in order. If you want to defer answering a query, may move to next by leaving sufficient blank space. You may follow a strategy of not answering more than two queries on a page.
3. In all questions marks awarding strategy will be discrete (i.e., 0, half, and full marks).
4. You may have to pay penalty for lengthier solutions.

Consider following relation schema **Company**. Note that it is slightly modified over the one that we have been discussing in Lectures/Labs.

DEP(dno, dname, head_eno)
-- attribute **head_eno** is emp no of the head of the department and refers into EMP relation
EMP(eno, name, gender, category, salary, supervisor_eno, dno)
-- attribute **supervisor_eno** is emp no of the employee's supervisor and refers to **eno** of EMP itself.
-- attribute **cat** is employee category and has domain of {worker, manager, engineer, staff}
PROJ(pno, pname, dno)
-- attribute **dno** is FK referring into DEP relation
WORK_HOURS(eno, pno, hours_per_month)
-- Attributes **eno** and **pno** are FKs referring into EMP and PROJ respectively.

1. Suppose, we want to have a constraint on Database that an employee can be head of department of only one department. Provide SQL code fragment for accomplishing this. [5]

head_eno should be unique.

Write **expressions in in Relational Algebra** to answer following queries [Questions 2 to 7]
(No marks will be awarded if answered in SQL)

[6x10]

2. List (ENO, Name, DNO, SALARY) of all workers (that is employees that belong to worker category)
3. List (ENO, Name, Salary) of all Female supervisors.
4. List departments (dname, ~~manager_name~~ head_name) where head of department is not a Manager (i.e. not belonging to manager category).
5. Compute Average salary for each category of employees.
6. List employee (ENO) who work on all projects on which employee with ENO=123 works.
7. Suppose a person gets Rs. 100 extra on top of salary for each hour he works on a project. Compute Total Salary for ~~#~~ every employees.

Continued on Page No 2.....

8. Study and understand following database requirement. You task is to draw ER Diagram for proposed database. Specify key attributes also along with attributes for all identified entities. Also specify Cardinality and Participation constraints.

While marking this question, the question will be split into few components, and there will be discrete (0, half, and full) marking for each component.

[25]

IBM organizes an annual event called The Great Mind Challenge (TGMC). A number of Teams from various institutes around the country participate in the event. There can be more than one team from an institute.

Every participating team has to register online at TGMC site www.tgmc.in. While registering teams are required to furnish following details- Team Name, Login ID, Password, and details team members - email id, name, email, and contact number. Each Team has a faculty mentor from same institute. Mentor Details- Name, Designation, email, and contact number are also furnished on the time of registration. A faculty can be mentor for more than one team.

At the end of event Winner, Runner teams are declared. In addition appreciation to other top-10 teams is also given.

The objective of building this database is that the organizer is able to maintain records of all teams registered for the event and for there after math. Motivated with various statistical summaries, city and state of institute is also recorded.

Teams : TeamName, LoginID, PWD, Score, Inst.
Member : email, name, email, contact
Mentor : Name, Desig, email, Contact,
Institute : Name, City, State.

In-Semester Exam-II (Autumn'2017)

IT 214 Database Management Systems

Time: 80 minutes

Max Points: 80

IMPORTANT NOTE:

1. Write answers neat and clean. Answers that are difficult to read may simply be discarded.
2. Answer all queries in order. If you want to defer answering a query, may move to next by leaving sufficient blank space. You may follow a strategy of not answering more than two queries on a page.
3. In all questions marks awarding strategy will be discrete (i.e., 0, half, and full marks).
4. You may have to pay penalty for lengthier solutions.

Consider relational schema given below, and write relational algebra expressions for following queries (NO SQL)-

Student(StudetID, StdName, ProgID, Batch, CPI)
Course(CourseNo, CourseName, Credit)
Faculty(FacultyID, FacultyName)
Offers(AcadYear, Semester, CourseNo, FacultyID)
Registers(StudetID, AcadYear, Semester, CourseNo, grade)
HoR_Room(rno, wing, floor)
Allot(sid, rno)
SBG(sid, Committee, Role)
-- **sid** is student id of sbg member, and role can be like convener, or member, committee is name of committee like "CMC", or Cultural, or so

[6x10]

1. List CourseNo, Number_of_Registrations, Faculty_Name for course offering (in term Autumn'2017) where number of registrations are less than 10.
2. List of ID and Name of students from B.Tech. (progid='01') and 2015 batch who do not reside in HOR.
3. List Room Nos' along with ID and Name of resident that are singly occupied.
4. List ID, Name, and Role of all members of "Cultural" committee who are residing in J and K wings.
5. Report (StudentID, Student-Name, Grade) of students who are residing in C wing, progid='01' and took course IT633 (in Autumn'16) and passed with grade >= 7.0.
6. Report (StudentID, Student-Name, CPI) that have scored more 7.0 grade in all of the courses given here {IT110, IT214, IT205, SC215, IT314, IT301}.
7. Consider maintaining database of books (let us say by an on-line book-store) with details of ISBN, Title, Price (consists of Currency, and Amount), Author-Name, Publisher-Name, Publisher-Address. A book has one (at least) or more authors, and published by exactly one publisher. ISBN is a universally unique number each book has. Some of books are reprinted by different publisher in some other country or region. In that case reprint of the book is given different ISBN, and will have different price in some other currency. Let us also maintain relationship of reprint with original publication.

   Draw ER Diagram for the said database requirement. Do not add any additional attribute from your own, unless you have proper justification.

[20]

72 1/2 + Q-2 10 Q-3 28.5 (51)

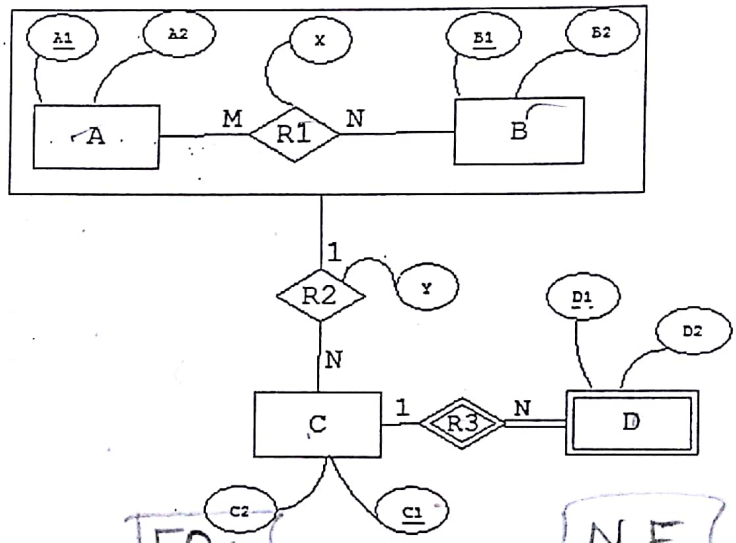
In-Semester Exam-III (Autumn'2017) IT 214 Database Management Systems	A

Time: 90 minutes Max Points: 70

Your ID: 201501099 Name: AKAM SHAH

IMPORTANT NOTE:
1. There are 4 pages in question paper, ensure that you have got all.
2. Answer questions in the space provide against the question itself. **Overwriting** is not allowed.
3. Write answers neat and clean. Answers that are difficult to read may simply be discarded.
4. In all questions marks awarding strategy will be discrete (i.e., 0, half, and full marks).

1. Consider ER Diagram given here, and do following [14]
   (a) Derive Relational schema from this ER diagram using ER to Relational mapping rules. Also indicate all keys and foreign keys.
   (b) Find out minimal FD set from semantics of attributes in given ER Diagram.
   (c) Indicate normal form of each derived relation in (a)



Relation	FDs	N.F.
1/2 → A(A1, A2)	A1 → A2 ✓1	BCNF
1/2 → B(B1, B2)	B1 → B2 ✓1	BCNF
→ R1(A1, B1, X) ✓ FK :- A1, B1	A1 B1 → X ✓1	BCNF
→ D(C1, D1, D2) ✓ C1 is FK refer to C	C1 D1 → D2 ✓1	BCNF
→ C(C1, C2, A1, B1, Y) FK :- A1, B1 refer to R1	C1 → C2 ✓1/2 C1 → Y ✓1	1NF

2

5 1/2

2

5 (R 1/2)

A

2. Again consider scenario of book database for an on-line store. Details of books are ISBN, Title, Price (consists of Currency, and Amount), Author-Name, Publisher-Name, Publisher-Address. You can assume publisher-name to be unique, and we record only one address of a publisher. A book has one (at least) or more authors, and published by exactly one publisher. ISBN is a universally unique number each book has. Some of books are reprinted by different publisher in some other country or region. In that case reprint of the book is given different ISBN, and will have different price in some other currency. However Title and author of book remain same as original print. Let us also maintain relationship of reprint with original publication.

[10+10]

Amount

Suppose all attributes here has been placed in a single universal relation
R(ORG-ISBN, Title, Currency, ~~Price~~, Author-Name, Publisher-Name, Publisher-Address, Reprint-ISBN, Reprint-Currency, Reprint-Price, Reprint-Publisher-Name)

For compact representation, let us rename attribute of R as following
R(OISBN, TITLE, C, P, AUTH, PUB, PUBADD, RISBN, RC, RP, RPUB)

Task #1. Use your understanding of attributes in R here, and give minimum set of functional dependencies.

OISBN → {TITLE, PUB, }
PUB → { PUBADD }
RISBN → { TITLE, RPUB, OISBN }
{OISBN, C} → {P }
{RISBN, RC} → {RP }

7

OISBN → P
C

Assumption:- There can be same title for different Book.

Task #2. Using BCNF decomposition algorithm, derive normalized relations for the said database requirement. In the derivation, give only final and intermediate results, and do not give any textual descriptions.

KEY :- {OISBN, RISBN, C, RC, AUTH}

R1 = { OISBN, TITLE, PUB, PUBADD }
F1 = { OISBN → {TITLE, PUB}
PUB → {PUBADD} }

R2 = { OISBN, C, P, AUTH, RISBN, RC, RP, RPUB }
F2 = { RISBN → {OISBN, RPUB}
{OISBN, C} → {P}
{RISBN, RC} → {RP} }

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A

BCNF → R_{11} = ∝ {PUB, PUBADD} F_{11} = PUB → PUBADD 1½

BCNF → R_{12} = ∝ {OISBN, TITLE, PUB}
OISBN → {TITLE, PUB}

BCNF → R_{21} = ∝ {RISBN, OISBN, RPUB}
F_{21} = RISBN → {OISBN, RPUB}

R_{22} = ∝ {RISBN, C, P, RC, RP, AUTH}

BCNF → R_{221} = ∝ {RISBN, RC, RP}
{RISBN, RC} → RP

BCNF → R_{222} = ∝ {RISBN, AUTH}
No FDs 1½

BCNF → R_{223} = ∝ {OISBN, C, P}
{OISBN, C} → P

Assumption: RISBN can determine OISBN.

3. In next question you are given a number of relations and FDs over them. You need to do following for each relation -
   a. Compute key(s)
   b. Determine highest normal form of the relation (consider only up-to BCNF, let further higher normal forms be out of scope here)
   c. ~~Name FD that "violates the requirement"~~ of the relation being in higher further higher normal form. If a relation is already in BCNF you have answer "NONE" here.
   d. Give BCNF Normalized relations. Make sure that decomposition is lossless and FD preserving. If you cannot decompose due to any loss, mention the same. Also underline key attributes of each normalized relation.

28.5

[6x6]

A

R(ABCD) AB → CD B → C C → D	Key: AB ✓	Normal Form: 2NF ✓	Culprit FD: B→C, C→D ✓
	Normalized Relations $R_1(\underline{CD})$ ✓ $F_1 = \{C \to D\}$ $R_2(\underline{BC})$ $F_2 = \{B \to C\}$ Now further FD can't preserve R(AB)		
R(ABCD) A → BC B → C A → B AB → C	Key: AD ✓	Normal Form: 1NF ✓	Culprit FD: A→BC, B→C, A→B, AB→C ✓
	Normalized Relations $R_1(\underline{BC})$ $F_1 = B \to C$ Now for further decomposition FD can't preserve.		
R(ABCD) AB → C C → D	Key: AB ✓	Normal Form: 2NF ✓	Culprit FD: C→D ✓
	Normalized Relations $R_1(\underline{AB}C)$ $F_1 = AB \to C$ $R_2(\underline{C}D)$ $F_2 = C \to D$ ✓		
R(ABCDE) A → BCD B → C C → E	Key: A ✓	Normal Form: 2NF ✓	Culprit FD: B→C, C→E ✓
	Normalized Relations $R_1(\underline{C}F)$ ✓ $F_1 = C \to E$ $R_3(\underline{A}BD)$ $R_2(\underline{B}C)$ ✓ $F_2 = B \to C$ FD can't preserve Now.		
R(ABCDE) A → CD B → DE C → D	Key: AB ✓	Normal Form: 1NF ✓	Culprit FD: A→CD, B→DE, C→D ✓
	Normalized Relations $R_1(\underline{C}D)$ $F_1 = C \to D$ Now further decomposition can't preserve FD.		
R(ABCDE) A → BC B → DE D → A	Key: A, D, B ✓	Normal Form: BCNF ✓	Culprit FD: NONE ✓
	Normalized Relations R(ABCDE) FDs:- A→BC B→DE D→A 3 Candidate Keys:- A, B, D		

099

In-Semester Exam-IV (Autumn'2017)
IT 214 Database Management Systems

Time: 75 minutes | Max Points: 75

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).

1. Consider Company Schema. Write a stored function (in pseudo code) that computes standard deviation of salary from EMPLOYEE relation and returns.

   Formula for standard deviation is given here for your reference.

   [20]

$$SD = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n}}$$

2. What are the parameters to getConncection message in JDBC?

   [5]

3. Consider Indian Railways scenario from one of a Lab. It has been copied here in the box below for your reference. A short name for every attribute is given in parenthesis.

   [20]

Train_Number(**TN**) – every train has unique number. For same pair of stations a train has different numbers for to and return.

Train_Run_Day (**DAY**) – like Monday, Tuesday or so; it is day of run from source station [note that train may not run on all days of a week]

Source_Station_Code (**SRC_SCODE**) – like ADI for Ahmedabad and is unique.

Destination_Station_Code (**DST_SCODE**)

Station_Code (**SCODE**) – any other station on train route

Date_of_Run (**DATE**) – a particular date of run

Scheduled_Arrival_Time (**SAT**) – on a station; assume that train arrives at a on same time on all days.

Scheduled_Departure_Time (**SDT**) – from a station

Expected_Arrival_Time (**EAT**) – on the run date on a station

   a. List down minimal FD set on all attributes given here.

   b. Beginning from a single schema R, given below, derives BCNF relations using BCNF decomposition algorithm. Make sure that no FD is lost.

R(TN, DAY, SRC_SCODE, DST_SCODE, SCODE, DATE, SAT, SDT, EAT)

4. Are following FD sets F and G are equivalent (Yes or NO, Give proofs) - [10]

$F = \{A \rightarrow B, AB \rightarrow C, D \rightarrow E\}$ and $G = \{A \rightarrow BC, D \rightarrow AE\}$

5. Give a relation R(ABCDEF), and following FD set F [10]

$A \rightarrow B; A \rightarrow C; CD \rightarrow E; CD \rightarrow F; B \rightarrow E$

Do following FDs are inferred from F? Yes/No, Give Proof.

$A \rightarrow E$
$CD \rightarrow EF$
$AD \rightarrow F$
$B \rightarrow CD$

6. Given a relation R(ABCDEF), and following FDs [10]

$ABC \rightarrow E$
$ABCD \rightarrow F$

What is the key? What normal form it is in? Name FD that violates requirement of next immediate higher normal form.

Can you loss-lessly decompose R into BCNF? If yes, give decomposed relations.