Database Systems
Assignment #1 Solution
Spring 2018

Due Date: Before the start of the class (7nd February, 2018)
Instructions:

Please ignore the missing figures to identify constraints this solution is to just an idea what you are supposed to do.

Question 1: [10 marks]

An emerging mobile company wants to develop an online database of mobile apps (applications) available for
download to its users. You can assume that they want to develop a simpler version of Android PlayStore or IOs
AppStore.

You are given the following relational database schema
App(app-id, app-name, developer-id, cost, category)
User(user-id, user-name, country)
Developer(developer-id, developer-name, age, country)
Downloads(app-id, user-id, rating, review)

For each App they record the app id, app name, the app developer's id, cost of the app (some app may be free of
cost) and category. The category can be games, productivity, kids, entertainment etc. The system maintains the
download details such as which app is downloaded by which particular user. In addition to this it also records the
rating (on a scale of 1-5) and review (if any) given by each user to a particular app.

a) Identify the Domain of each attribute (4 marks)

Relation: ***App(app-id, app-name, developer-id, cost, category)***	
Attribute	**Domain**
app-id	dom(*app-id*) = the set of possible positive integer values
app-name	dom(*app-name*) = the set of alphanumeric strings with length of atmost 20 characters in which each value uniquely identifies application name
developer-id	dom(*developer-id*) = the set of positive four digit values
cost	dom(*cost*) = the set of possible whole numbers
category	dom(*category*) = the set of strings with length of atmost 20 characters that represent

	the application category like “Entertainment”, “kids”, “developers” etc.

Relation: ***User(user-id, user-name, country)***	
Attribute	**Domain**
user-id	dom(user-id) = the set of alphanumeric strings that represent the userid
user-name	dom(user-name) = the set of character strings with length of at most 25 characters
country	dom(*country*)=the set of alphabetical strings with length of at most 20 characters

Relation: ***Developer(developer-id, developer-name, age, country)***	
Attribute	Domain
developer-id	dom(*developer-id*)= the set of four digit numbers
developer-name	dom(*developer-name*) = the set of alphabetical strings that represent the names of the developers and can have at most 25 characters
age	dom(age) = set of two digit positive integer values
country	dom(*country*)=the set of character strings with length of at most 20 characters

Relation: ***Downloads(app-id, user-id, rating, review)***	
app-id	dom(*app-id*) = the set of positive integer values
user-id	dom(user-id) = the set of alphanumeric strings that represent the userid
rating	dom(rating) = the set of positive integers ranging from 1 to 5
review	dom(review) = the set of character strings with the length of at most 200 characters.

b) Identify the primary key of each relation. (2 marks)

App: *app-id*

User: *user-id*

Developer: *developer-id*

Downloads*: {app-id, user-id}*

c) Identify the foreign keys and referential integrity constraints (2 marks)

Foreign Keys	**Referential integrity constraints**
Downloads(app-id)	app-id references the app-id attribute in the App relation so it must contain the values that exists in the referenced table column
Downloads(user-id)	user-id references the user-id attribute in the User relation so it must contain the values that exists in the referenced table column
App(developer-id)	developer-id references the developer-id attribute in the Developer relation so it must contain the values that exists in the referenced table column

d) Populate the relations with a few sample tuples and give an example of an insertion in the Downloads relations that *violates* the referential integrity constraints and of another insertion that does not. (2 marks)

App				
1	ClueX	5001	10	Communication
2	TakeCare	4001	100	Health&Fitness
93	Tasbeeh	4002	0	Religion
100	Poems	4002	50	Kids

User		
khizar12	Khizar Ali	Pakistan
Rebecca	Rebecca Johnson	America
marc	Marc	America
James007	James Bond	England

Developer			
4001	Peg Johnson	25	America
5001	John	18	Australia
4002	Ali	20	Pakistan
4003	Zeeshan	20	Pakistan

Downloads			
100	marc	4	very interesting app for kids
2	James007	5	a good guide for a healthy life
2	khizar12	4	good
1	Rebecca	5	

Insertion

1) **Insert into Downloads values (3, marc, 2," best");'**

The tuple will not be inserted because app-id with value 3 do not exist in the referenced table App

2) **Insert into Downloads values (100, khizar12, 5, "Not better than others");**

The tuple will be inserted because it satisfies all constraints.

Question 2: [10 marks]

Consider the following relational database for the Baseball League. It keeps track of teams in the league, coaches and players on the teams, work experience of the coaches and which players have played on which teams.

Note the following facts about this environment:

• The database keeps track of the history of all the teams that each player has played on and all the players who have played on each team.

• The database only keeps track of the current team that a coach works for.

• Team number, team name, and player number are each unique attribute across the league.

• Coach name is unique only within a team (and we assume that a team cannot have two coaches of the same
name).

• In the Affiliation table, the Years attribute indicates the number of years that a player played on a team the batting average is for the years that a player played on a team.

Team (TeamNum, TeamName, City, Manager)
Coach (TeamNum, CoachName, Address)
WorkExperience (TeamNum, CoachName, ExperienceType, YearsExperience)
Player (PlayerNum, PlayerName, Age)
Affiliation (PlayerNum, TeamNum, Years, BattingAvg)

a) Identify the Domain of each attribute (4 marks)

Relation: ***Team (TeamNum, TeamName, City, Manager)***	
Attributes	**Domain**
TeamNum	dom(TeamNum) = the set of positive integers
TeamName	dom(TeamName) = the set of strings that represent the team names with max length of 25 characters
City	dom(City) = the set of strings that represent the city names with max length of 25 characters
Manager	dom(Manager) = the set of strings with the max length of 25 chars that represent the manager name

Relation: ***Coach (TeamNum, CoachName, Address)***	
Attribute	**Domain**
TeamNum	dom(TeamNum) = the set of positive integers
CoachName	dom(CoachName) = the set of alphabetical strings with the max length of 25 characters that can represent name of the coach
Address	dom(Address) = the set if alphanumeric strings with the max length of 200 characters

Relation: ***WorkExperience (TeamNum, CoachName, ExperienceType, YearsExperience)***	
Attribute	**Domain**
TeamNum	dom(TeamNum) = the set of positive integers
CoachName	dom(CoachName) = the set of alphabetical strings with the max length of 25 characters that can represent name of the coach
ExperienceType	dom(ExperienceType) = the set of alphabetical strings can have length of at most 25 char
YearsExperience	dom(YearsExperience) = the set of two digit natural numbers

Relation: ***Player (PlayerNum, PlayerName, Age)***	
Attribute	**Domain**
PlayerNum	dom(PlayerNum) = set of positive integers starting from 0
PlayerName	dom(PlayerName) = the set of alphabetical strings that can represent person name and can have length of at most 25 char
Age	dom(Age) = positive integers that can represent possible age

Relation: ***Affiliation (PlayerNum, TeamNum, Years, BattingAvg)***	
Attribute	**Domain**
PlayerNum	dom(PlayerNum)= set of whole numbers
TeamNum	dom(TeamNum) = the set of positive integers

Years	dom(Years) = 2 digit possible whole numbers
BattingAvg	dom(BattingAvg) = set of positive floating point numbers that can represent possible batting average runs.

b) Identify the primary key of each relation. (3 marks)

Team: TeamNum/ TeamName

Coach: {TeamNum, CoachName}

WorkExperience: {TeamNum, CoachName, ExperienceType}

Player: PlayerNum

Affiliation: {PlayerNum, TeamNum}

c) Identify the foreign keys and referential integrity constraints. (3 marks)

Foreign Keys	**Referential integrity constraints**
WorkExperience (TeamNum)	TeamNum references the TeamNum attribute in the Team relation so it must contain the values that exists in the referenced table column
WorkExperience (CoachName)	CoacName references the CoacName attribute in the Coach relation so it must contain the values that exists in the referenced table column
Affiliation (PlayerNum)	PlayerNum references the PlayerNum attribute in the Player relation so it must contain the values that exists in the referenced table column
Affiliation (TeamNum)	TeamNum references the TeamNum attribute in the Team relation so it must contain the values that exists in the referenced table column

Question 3: [10 marks] NUCES BOOKSHOP

We want you to automate the NUCES Lahore BOOKSHOP. It would be great if you can design the database system
for the bookshop that can keep track of the books required by each course offered in different departments in
NUCES, Lahore. You need to maintain the basic details about the books like title, first author,

publisher and
edition. In addition to this you need to keep details regarding the number of copies of each book purchased and
the number of books sold in each semester. You can assume that the bookshop has the information regarding the
number of students enrolled in each course, so they can figure out how many books they must purchase. Note
bookshop don't need information about the course section since we assume that all sections of a course follow the
same books. However, a course may need more than one book.

Think about the details that the bookshop need to maintain for smooth operations and answer the following questions:

a) Does it need 2-tier architecture or 3-tier architecture for DBMS? Justify (**2 marks**)

It will be 2-tier architecture because

1. The application is user specific and it has very little processing, memory and storage usage.
2. The business rules are not so complex that it requires middle tier. This will result in faster access to the database.
3. As the application is to be only used by a single user in its local network it do not require middle layer for security.

b) What do you think are the main objects (entities) that need to be represented in the database? (**2 marks**)

1. Book
2. Course
3. Department
4. BooksInventory

c) What relationships do you think exist between these main objects (entities)? (**2 marks**)

1. Department Offer Courses
2. Course recommend Books
3. BooksInventory keep record of books

d) For each of the objects, what details do you think need to be held in the database (attributes)? Also identify keys and foreign keys. (**2 marks**)

Book: ISBN (PK)**,** Title, Publisher, Edition, First Author Name, CourseCode(FK)

Course: Course Code (PK), CourseName, DeptId(FK), NumberOfStudents,

Department: DeptId (PK), DeptName

BooksInventory: ISBN (FK), Purchased, Sold, Semester PK={ISBN, Semester}

e) What **queries** do you think are required? List just five queries **(2 marks)**
An example of a query would be: List all the books purchased in spring 2005.

1. List all the coursed offered in CS department
2. List the number of students enrolled in Database course
3. List all the books of Database Course
4. How many books have been purchased with ISBN let say 090988N?
5. How many books of Database have been sold till now?
6. How many students have been enrolled in all courses?