

Homework Assignment #2

Database Systems course (Fall 2012-2013)

Objectives

Understanding and manipulating E/R diagrams.

Understanding functional dependencies, BCNF and 3NF.

Understanding the use of views in queries

Tools

For this assignment, you may need a database to help and validate your answers. For this purpose you can use MySQL database as discussed in the first assignment.

Submission

Please print your solution and submit it (hardcopy) to Yael's mailbox – 372 (on Schreiber's Floor no. 2)
The Ex. should be done in pairs.

Questions 1 (ER Diagram → Schema) [30 Points]

Assume you have been hired to design a database for the following scenario. You may add any necessary attributes, but overall try to keep your design simple. Don't forget to add unique identifier(s) for each relation.

- a. Design an E/R schema diagram for this database using as much of the E/R model as appropriate.
- b. Map the schema that you designed above to relations. For each relation, give all attributes and keys. For example:
 - Table1(field1, field2)
 - Table2(field3, field4)

The scenario:

You were hired to design a database for an image sharing website. The website contains folders, each with a name, an owner, visibility status (public or private), creation date and a link in the website. The folders may contain multiple images, each with a name, file type, file size, creator, creation time and last modification time. Users can register to the website with a user ID, their full name, password and email. Then, they can create folders, join public folders and invite other users to see their private folders. For each invitation we will save the date, the inviting user, the invited user and the folder. When users create a folder, register to a public folder or accept an invitation they are marked as registered to this folder. The folder creation and registration operations are saved in a log with the folder, user and type of operation (creation/registration).

In addition, users can add pictures to the folders they are registered to. They can also edit or delete pictures in these folders. Each such edit operation is recorded in a log with the folder, user, image and type of operation (add/edit/delete).

Each time a user logs in to the website, a transaction is created with the user and time of log in, later to be updated with the log out time. The registration operations as well as the edit operations are associated with the transaction in which they were performed.

Question 2 (Functional Dependencies and BCNF) [20 Points]

Given below is the set of functional dependencies for the relational schema:

$R = \{A, B, C, D, E, F, G, H, I, J, K\}$.

$A \rightarrow D, K$

$C, G \rightarrow H$

$C, J \rightarrow D, G$

$G \rightarrow B, E, I$

$H \rightarrow C, G$

- Find a minimal key for this relation
- What are all the nontrivial functional dependencies that follow?
- Decompose the relation into a collection of relations that are in BCNF

Question 3 (Function Dependencies and 3NF) [20 Points]

Given below is the set of functional dependencies for the relational schema:

$R = \{A, B, C, D, E, F, G\}$

$A \rightarrow C, E$

$E \rightarrow G$

$G \rightarrow A, B$

- Find **ALL** the minimal keys for this relation
- What are all the nontrivial functional dependencies that follow?
- Decompose the relation into a collection of relations that are in BCNF
- Now decompose this relation into a collection of relations that are in 3NF.

Question 4 (Relationship between BCNF and 3NF) [5 Points]

- If a schema is in BCNF is it also true that it is in 3NF? Explain why or why not in a sentence or two.
- If a schema is in 3NF is it also true that it is in BCNF? Explain why or why not in a sentence or two.

Question 5 (Views in queries) [25 Points]

Consider the following relational schema:

Journal(journal_id, journal_name, topic)
Edition(journal_id, volume, publication_date)
Article(article_id, article_title, article_abstract, article_text)
ArticleEdition(journal_id, volume, article_id)
Author(author_id, author_name, author_title)
ArticleAuthor(article_id, author_id, comments)

This schema describes published journal, which has an ID, a name and a topic (e.g., biochemistry). Each edition of this journal is signified by its volume number, and has the date in which it was published. Journal articles have an ID, a title, an abstract and text. These articles may be published in different journal editions. Finally, for each article there is a list of authors. Each author has a record with their ID, name and title (Dr., Prof., etc.). Then we can record who wrote which article in the ArticleAuthor table, along with relevant comments (e.g., "main author").

- Write a view which returns the journal editions (journal_id, journal_name, volume and publication date) in which there was an article about DNA (containing the word "DNA" in the title) written by a Prof.
- Write a view which returns all the journals (journal_id and journal_name) in which at least one of the top authors has published an article. The top authors are those with more than 10 articles.
- For the following 2 queries, consider whether it is possible to use just the given view to answer each one. If yes, show the query that uses the view. If not, explain why.

Query 1

SELECT DISTINCT

a.author_name

FROM

Author a,

ArticleAuthor ae

WHERE

a.author_id = ae.author_id

Query 2

SELECT

MAX(publication_date) **AS** last_publication

FROM

Edition e,

ArticleEdition ae,

Article a

WHERE

ae.journal_id = e.journal_id

AND ae.volume = e.volume

View

CREATE VIEW MyView **AS**

SELECT

au.author_id,

au.author_name,

MAX(e.publication_date) **AS** last_published

FROM

Author au,

Article ar,

Edition e,

ArticleAuthor aa,

ArticleEdition ae

WHERE

au.author_id = aa.author_id

AND aa.article_id = ar.article_id

AND ar.article_id = ae.article_id

AND ae.journal_id = e.journal_id

AND ae.volume = e.volume

GROUP BY au.author_id