

Prob1	Prob2	Prob3	Prob4	Prob5	Total

## CSC6710: Database Management I Final Exam (Fall 2009)

ID# \_\_\_\_\_ Name: \_\_\_\_\_ Signature: \_\_\_\_\_

1. (20 pts) Consider the design of a message database system to store a collection of confidential messages so that only authorized users can read them. Each message is identified by a message id, subject, the content of the message, and a list of keywords to facilitate the search of messages. Messages are organized by categories and each category is identified by a unique category id, the name of the category, and a list of keywords to facilitate the search of categories. A message is posted to exactly one category. Each user of the message system is identified by a user id, password, name, and email address. If a category is assigned to a user, then the user will be able to read all the messages under that category unless we explicitly prohibit that the user cannot read a particular message. A category can be assigned to multiple users and a user can have multiple category assignments. Draw an E-R diagram for the above system. Use underlines, thick lines, and arrows to represent constraints. State your assumptions if necessary.
2. (20 pts) Translate your E-R diagram for problem 1 into a relational model, i.e., a set of CREATE TABLE/ASSERTION statements enforcing all stated constraints. In addition, write a CREATE ASSERTION statement to ensure that each user cannot read more than 5 messages under each category.
3. (20 pts) Consider the following tables where keys are underlined: `signup(userid, day, password, in, out)`, `user(userid, name, salary)`. Formulate a relational algebra expression for each query in the following.
  - a). Return the names of all users who signed in on Monday.
  - b). Return the names of those users who signed in every day except Monday.
  - c). Return the names of those users who signed in but didn't sign out on Friday.
  - d). Return the names of all users who signed in on Monday and then signed out on Friday.
  - e). Return the names of all users who worked exactly for two days in a row (signed in on one day and then signed out the next day).
4. (20 pts) Based on the above tables, formulate a SQL statement for each query in the following.
  - a). Delete those users who never signed in from Monday to Friday.
  - b). Increase the user's salary by 10% if she signed in and signed out every day from Monday to Friday.
  - c). Return the names of the users and the days on which the users signed in but didn't sign out.
  - d). Increase the user's salary by 20% if the user is the only user who signed in on a particular day (no other people signed in on that day).
  - e). Return the names of a pair of users who have exactly the same pattern: a user signed in or signed out on a particular day if and only if the others do so as well.
5. (20 pts) Consider the schema ABCDEF with the following FDs:  $V = \{FC \rightarrow EB, C \rightarrow A, EB \rightarrow CD, E \rightarrow AC, A \rightarrow B\}$ .
  - a). What are the keys for this table? Provide justifications.
  - b). Write a CREATE ASSERTION statement to enforce constraint  $FC \rightarrow EB$ .
  - c). Calculate the minimal cover of V. Show the results after each step.
  - d). Use the 3NF synthesis algorithm to obtain a lossless and dependency preserving decomposition into 3NF.