

CSE 444 Midterm Test

Spring 2007

Name: _____

Total time: 50'

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1 SQL [40 points]

Consider a database of social groups that allows people to become members of groups: a person can be a member of several groups and each group maintains a list of pictures that are accessible to all members. In addition to the groups, the database also maintains a list of friends. The schema is:

```
MEMBER(personName, groupName)
PICTURE(groupName, picture) /* picture = primary key */
FRIEND(personName1, personName2)
```

PICTURE stores for each picture the name of the group that owns that picture. The FRIEND table is symmetric, i.e. if X is friend with Y then Y is friend with X . Every person is a member of at least one group.

1.1

Write a SQL query that computes for every person the total number of pictures they can access through their group memberships. That is, a person X can access a picture Y if X is a member of some group Z and Z owns the picture Y . You need to turn in a SQL query that returns a result like this:

```
'Fred', 12
'Joe', 7
'Sue', 0
'Rick', 9
...
```

1.2

A “cool person” is one that has at least 40 friends. Write a SQL query that returns all the cool persons in the database. You need to turn in a SQL query that computes a list of names.

1.3

The marketing department has decided to recommend people to subscribe to additional groups. However, they do not want to issue phony recommendations. They would like to recommend to a person X to subscribe to a group Y if all X 's friends are members of the group Y , but X is not a member of Y . Write a SQL query that computes for each person X the set of groups to recommend that that person subscribes. You need to turn in a SQL query that returns a list of (person, group) pairs.

1.4

Create a new table `ACCESS(personName, picture)` that lists for each person the list of pictures that they can access. A person X can access a picture Y either if X belongs to a group that owns Y , or if X has a friend Z who belongs to a group that owns Y . Write SQL statements that insert the corresponding tuples in `ACCESS`. You need to turn in one or more `INSERT` queries.

2 Conceptual Design [30 points]

Consider an application that needs to manage data for a travel agency. It needs to store the following entities and relationships:

- **Hotels:** have attributes name, address, price
- **Resorts:** are Hotels, that also have an attribute minimum-stay
- **Activities:** have attributes name, season
- **Has:** is a relationship between Resorts and Activities

2.1

Design an E/R diagram for this application.

2.2

Write the `CREATE TABLE` statement for creating the SQL tables. You may choose very simple atomic datatypes for the attributes. Indicate all keys and foreign keys.

3 Functional dependencies and normal forms [30 points]

Consider a table $R(A, B, C, D)$. Recall that a set of attributes X is a superkey if $X^+ = ABCD$; a set X is a key if X is a superkey and no subset of X is a superkey; it is closed if $X^+ = X$.

3.1

Give a set of functional dependencies that satisfies the following conditions: the closed sets are AB , CD , and the keys are AD and BC .

3.2

For each of the statements below indicate if they are true or false. You need to answer only “true” or “false” and do not need to justify your answer. X and Y denote sets of attributes.

- (a) If AB is a key then ABC cannot be closed.
- (b) If AB is closed then ABC cannot be a key.
- (c) If X, Y are closed then $X \cup Y$ is closed.
- (d) If X, Y are closed then $X \cap Y$ is closed.

3.3

Consider the following FDs:

$$\begin{aligned} B &\rightarrow A \\ C &\rightarrow B \end{aligned}$$

Decompose the table in Boyce Codd Normal Form (BCNF). Show your decomposition steps.

End of paper. Good luck!