



13th May 2022

COMSATS UNIVERSITY, ISLAMABAD
Department of Computer Science
Theory Midterm Examination, Spring-2022

Course / Class: Database Systems - I (CSC270) / BCS, BSE IV Date: May 13, 2022

Instructors: Dr. Basit Raza, Mr. Qasim Malik

Time Allowed / Total Marks: 1.5 Hrs / 25

1- [CLO-C1] Briefly explain the difference between: [3]

1a. Schema and Data

1b. Data Definition Language and Data Manipulation Language

1c. Role of Database Designer and that of Database Application Developer

2- [CLO-C2] In this question, you are to write relational algebra queries, against the following needs, over a small sample database. The database contains following four relations: [3]

→ MovieGoer(moviegoer_name, moviegoer_age, is_student) // moviegoer_name is the key

→ Likes(moviegoer_name, movie_title) // (moviegoer_name, movie_title) is the key

→ Visits(moviegoer_name, movie_theatre) // (moviegoer_name, movie_theatre) is the key

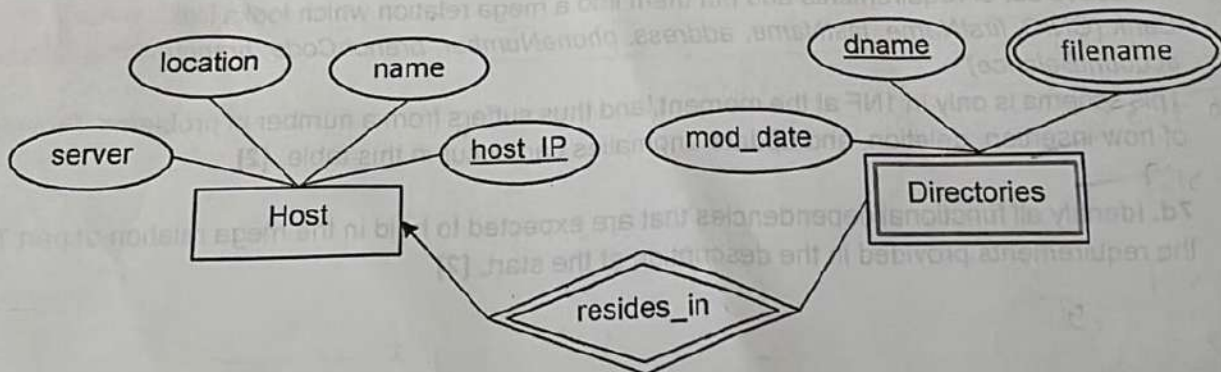
→ Shows(movie_theatre, movie_title, ticket_price) // movie_theatre is the key

2a. Find all movie theatres, showing movie liked by Ahmad, having ticket price less than 500 rupees.

2b. Find all movie theatres that are visited only by students.

2c. Find the names of all students who visit movie theatre showing movie they like.

3- [CLO-C3] Given the following Entity Relationship Diagram (ERD), modify it to include the following additional requirements:



3a. A host machine may have aliases i.e., it may have several names associated with itself. [1]

3b. We wish to store additional information about the files under a directory i.e., we wish to store the filename, the size of the file and the file type. [1]

3c. A directory can either be a root directory or non-root directory. For each directory, we need to specify if it's a root or non-root directory. If it's a non-root directory, we need to store the permission attribute. Change the ERD obtained in 3b. to Enhanced ERD modeling this requirement. [2]

4- [CLO-C3] Consider the table below:

A	B	C
a1	b1	c1
a1	b2	c2
a2	b3	c1
a2	b3	c2

Identify any two functional dependencies that hold on the above instance. [2]

5- [CLO-C3] Consider a relation R (A,B,C,D,E,F) with a following set of functional dependencies (FDs):

$$CDE \rightarrow B, ACD \rightarrow F, BEF \rightarrow C, B \rightarrow D$$

Find a minimal candidate key. [2]

6- [CLO-C3] Consider a relation R (A,B,C,D). For the following sets of FDs, is R in Boyce-Codd Normal Form (BCNF)? Show your steps. [2]

$$C \rightarrow D, CD \rightarrow A, AB \rightarrow C, A \rightarrow B$$

7- [CLO-C3] A small bank wants to redesign a database to manage the accounts of their clients. The bank has many local branches, each identified by a unique branch code. Accounts belong to a specific branch, and are identified by account numbers that are only unique within that branch. An account can be shared by several clients, and a client can have many accounts. The only other information necessary to store for the account is the account balance. For clients, the bank stores their CNIC, first and last names, as well as a contact address and phone number.

7a. Draw an Entity-Relationship Diagram (ERD) that models the above set of data requirements. [3]

7b. Map the ERD created in part 7a, to its corresponding relational schema. Specify all the primary key and foreign key constraints in the resultant schema. [2]

7c. Assume that we want to design schema through decomposition and have identified the attributes from the above set of requirements and put them into a mega relation which looks like:
Bank (CNIC, firstName, lastName, address, phoneNumber, branchCode, branchName, accountNumber, accountBalance)

This schema is only in 1NF at the moment, and thus suffers from a number of problems. Provide examples of how insertion, deletion, and update anomalies can occur in this table. [2]

7d. Identify all functional dependencies that are expected to hold in the mega relation of part 7c, based on the requirements provided in the description at the start. [2]