BS(CS, SE, AI, DS, CT)-IV SEMESTER

Course: CSC270 -Database Systems

Maximum Marks: 50

Date: [redacted]08, 2024

Time Allowed: 80 Minutes

Instructor name: Farah Saeed

- *All questions are self-explanatory and require no further explanations during exam time.*
- *Make sure that you have signed the attendance sheet before leaving the examination room.*
- ***Return the question paper along with the answer sheet.***
- *Attempt all questions.*

***[CLO1: Explain database concepts and principles]* [10 Marks]**

Question No. 1

1.1 Define a database and explain how it differs from traditional file storage systems. What makes databases essential for modern applications? [02 Marks]

1.2 Describe the three-tier architecture in database systems. What are the main components of each layer, and how does this architecture improve data management and system scalability? [02 Marks]

1.3 Identify and explain the roles of key personnel involved in database management, such as *database administrators (DBAs)*, *database designers*, and *end-users*. How does each role contribute to the overall functioning of a database system? [03 Marks]

1.4 Explain how a DBMS can reduce data redundancy and why this is beneficial for database storage and maintenance. [03 Marks]

[CLO2: Apply the concept of domain and tuple relational calculus]

Question No. 2: For the following scenario, write relational algebra queries, against the following needs, over a small sample database. The database contains the following 3 relations.

[10 Marks]

student (SID: integer, SName: String, semester: string)
studies (SID: integer, CID: String)
course (CID: String, CName: String, CCode: String)

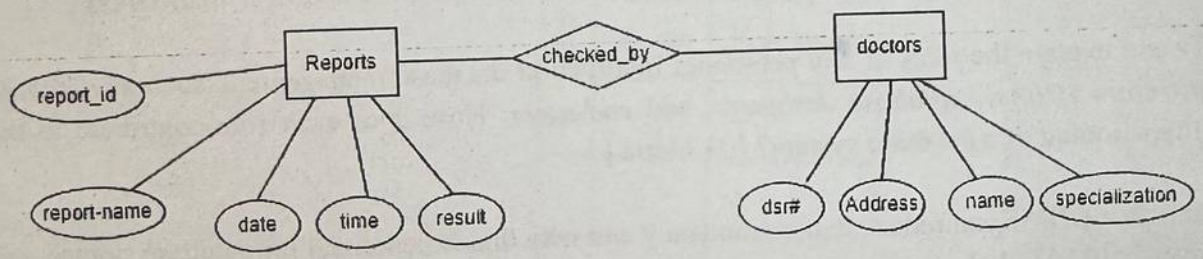
2.1 Find the names of all courses studied by 'Hassam'. [02 Marks]
2.2 List all students and their courses in semester 3. [02 Marks]
2.3 Find the total number of students who study 'DBMS'. [02 Marks]
2.4 List all students who are not studying any course. [02 Marks]
2.5 Find all courses that are not currently being studied by any student. [02 Marks]

[CLO3: Apply data modeling and normalization techniques to design database for small to medium size enterprise]

Question No. 3: Generate Entity Relationship Diagram (ERD), to meet the following requirements for a music collection system: **[12 Marks]**

3.1 The collection consists of albums. [1.5 Marks]
3.2 An album is made by exactly one artist. [1.5 Marks]
3.3 An artist makes one or more albums. [1.5 Marks]
3.4 An album contains one or more tracks. [1.5 Marks]
3.5 Artists, albums, and tracks each have a name. [1.5 Marks]
3.6 Each track is on exactly one album. [1.5 Marks]
3.7 Each track has a time length, measured in seconds. [1.5 Marks]
3.8 When a track is played, the date and time the playback began (to the nearest second) should be recorded; this is used for reporting when a track was last played, as well as the number of times music by an artist, from an album, or a track has been played. [1.5 Marks]

Question No. 4: Given the following Entity Relationship Diagram (ERD), modify it to include the following additional requirements to make it Enhanced ERD (EERD): **[18 Marks]**



4.1 Introduce a new entity called 'patients' with unique identifiers, insurance status, names, and records documenting admission and discharge dates from the hospital. Determine the relationships between 'patients' and existing entities and finalize the ER diagram accordingly." [02 Marks]
4.2 Ensure that both patient and doctor addresses include details such as street number, house number and city. [02 Marks]
4.3 Write the database schema for the generated ERD [02 Marks]
4.4 If we aim to capture the hospitalization period of a patient spent in the hospital (POT) using their admission date and check-out date, how should we represent this within the ER model?" [02 Marks]
4.5 If we want to add more details with insurance number like contact number for patients, how it would be reflected in ERD. [02 Marks]
4.6 We intend to incorporate details regarding the availability of doctors (appointments) as an entity into the system, including recording appointment days and checkup fees." [02 Marks]
4.7 Write the database schema for the generated ERD [02 Marks]
4.8 The doctors can have specialization in either Surgery or Neurology. For every doctor, we need to store their did# and Appointment Hours. For Surgeons, we need to store experience in years, Success rate, for Neurologists we need to store Specialization, Appointment Hours. [02 Marks]
4.9 Change the ERD obtained in Part 4.8 to Enhanced ERD modeling of this requirement. [02 Marks]

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