SOUTH EASTERN UNIVERSITY OF SRI LANKA

083

DEPARTMENT OF INFORMATION & COMMUNICATION TECHNOLOGY
FIRST EXAMINATION IN BICT - 2019/2020
SEMESTER I - AUGUST 2022
CIS-11022 DATABASE DESIGN

Answer **ALL** Questions — Time allowed: **TWO (02)** Hours

1 a) Define the following terms:
   a. Data
   b. Information
   c. Data independency
   d. Data dictionary (20 Marks)

b) Explain followings with suitable examples:
   i. Data model
   ii. Database instance (20 Marks)

c) i. What are the benefits of a database management system over a manual system? Provide three (03) examples.
   ii. What are the five (05) disadvantages of file processing system. (30 Marks)

d) Explain the three-tier architecture of DBMS along with followings:
Levels, schema, and mappings. You are advised to explain with the illustration. (30 Marks)

[Total 100 Marks]

2 a) Define the following terms:
   a. Multivalue attribute
   b. Weak entity
   c. Entity set
   d. Null values (20 Marks)

b) Assume we have the following application that models soccer teams, the games they play, and the
Players in each team. In the design, we want to capture the following:

- We have a set of teams, each team has an ID (unique identifier), name, main stadium, and to which city this team belongs.
- Each team has many players, and each player belongs to one team. Each player has a number (unique identifier), name, DoB, start year, and shirt number that he uses.
- Teams play matches, in each match there is a host team and a guest team. The match takes place in the stadium of the host team.
- For each match we need to keep track of the following:
  - The date on which the game is played
  - The final result of the match
  - The players participated in the match. For each player, how many goals he scored, whether or not he took yellow card, and whether or not he took red card.
  - During the match, one player may substitute another player. We want (80 Marks)

to capture this substitution and the time at which it took place.

- Each match has exactly three referees. For each referee we have an ID (unique identifier), name, DoB, years of experience. One referee is the main referee and the other two are assistant referee.

Design an ER diagram to capture the above requirements. State any assumptions you have that affects your design

[Total 100 Marks]

3) a) Define the following terms:
   a. Relation schema
   b. Functional dependency
   c. First Normal Form
   d. Referential integrity (20 Marks)

b) Explain the distinctions among the terms primary key, candidate key, and super key. (15 Marks)

c) What are the three (03) advantages and two (02) disadvantages of normalization in database? (20 Marks)

d) Answer the followings.
   a. Given a relation R(A, B, C, D) and Functional Dependency set FD = { AB → CD, B → C }, determine whether the given R is in 2NF? If not convert it into 2 NF.
   b. Given a relation R(P, Q, R, S, T, U, V, W, X, Y) and Functional Dependency set FD = { PQ → R, PS → VW, QS → TU, P → X, W → Y }, determine whether the given R is in 2NF? If not convert it into 2 NF.
   c. The following relations R = (A, B, C, D, E) is given below with following functional dependencies {BCE → ADE , D → B }
      i. Find all candidate keys.
      ii. Identify the best normal form that R satisfies (1NF, 2NF, 3NF or BCNF? Explain your answer in detail. (45 Marks)

[Total 100 Marks]

a) Consider the following relations and answer the questions given below using relational algebraic notations.

Doctor (SSN, FirstName, LastName, Specialty, YearsOfExperience, PhoneNum)
Patient (SSN, FirstName, LastName, Address, DOB, PrimaryDoctor_SSN)
Medicine (TradeName, UnitPrice, GenericFlag)
Prescription (Id, Date, Doctor_SSN, Patient_SSN)
Prescription_Medicine(Prescription Id, TradeName, NumOfUnits)

i. List the name of the doctors.
ii. List down the patients those who have been consulted by "Dr. Raji"
iii. List the trade name of generic medicine with unit price less than $50.
iv. List the first and last name of patients whose primary doctor named 'John Smith'.
v. List the SSN of patients who have 'Aspirin' and 'Vitamin' trade names in one prescription. (50 Marks)

b) Answer the following questions using SQL statements by referring the following relational schema.

```
CREATE TABLE Student (
StudentId int PRIMARY KEY,
Stud_Name varchar NOT NULL);

CREATE TABLE Course (
CourseId char(7) PRIMARY KEY,
Cour_Name varchar NOT NULL,
NoOfPts int NOT NULL);

CREATE TABLE Enrolled (
StudentId int NOT NULL REFERENCES Student,
CourseId char(7) NOT NULL REFERENCES Course,
Grade char(2),
PRIMARY KEY (StudentId, CourseId));

CREATE TABLE Stud_Sport (
StudentId int NOT NULL REFERENCES Student,
Sport_Name varchar NOT NULL,
PRIMARY KEY (StudentId, Sport_Name));
```

i. Retrieve names of students that have enrolled the course with the name Database Systems.

ii. Use either substring (string [from int] [for int]) function, or LIKE expression, or SIMILAR TO operator to retrieve students whose name start with capital letter S.

iii. Retrieve student id's and student names of students that passed at least one course with a grade better than B+ (i.e. A-, A, or A+). Avoid duplicates.

iv. Retrieve the students those who were enrolled in **Database Design** and playing **cricket**.

v. Retrieve the students those who were enrolled in **Database Design** and not playing **chess**.

(50 Marks)

[Total 100 Marks]