100

University of Sri Jayewardenepura

B.Sc. (General) Degree Second Year

Second Semester Terminal Course Unit Examination – October 2017

CSC 209 2.0 Database Management Systems
(Time: 2 hours)

Answer all questions.

Question 1 (20 marks)

(a) What are the main components that compose a database system?

(4 marks)

(b) What is the role played by a conceptual schema in database design?

(3 marks)

(c) In relational data modeling, explain how relationships among tables (relations) are maintained.

(3 marks)

(d) What is the purpose of defining a primary key for a relation?

(3 marks)

(e) Explain what is meant by "Insertion Anomaly" with an illustrative example.

(4 marks)

(f) Why null values should be avoided as much as possible in database design?

(3 marks)

Question 2 (20 marks)

(a) Define the terms entity, entity type, relationship type, key attribute and cardinality.

(5 marks)

(b) A database is needed to create to store information about soccer teams, players and matches of a particular soccer tournament. Suppose following data requirements are given for the database.

Many teams participate in the tournament. Each team is identified by a unique identifier. A team has a name, playground, and city to which team belongs. A team has many players, and a player can belong to only one team. A player has a unique number, name, date of birth, year in which the player started to play and shirt number that the player uses. The teams play matches and in each match there is a host team and a guest team. The matches are played in the playground of the host team.

For each match we need to keep track of the following: date on which the game is played, result of the match and players participated in the match. For each player in the match, 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 to capture this substitution and the time at which it took place.

For each match there are exactly three referees involved. Each referee has a unique identifier, name, date of birth, and years of experience. One referee is the main referee, and the other two are assistant referees.

Draw an ER diagram to capture the above data requirements by identifying all its essential elements. Clearly state any assumptions if made.

(15 marks)

Question 3 (20 marks)

(a) How a multivalued attribute in an ER diagram will be mapped to a relational model?

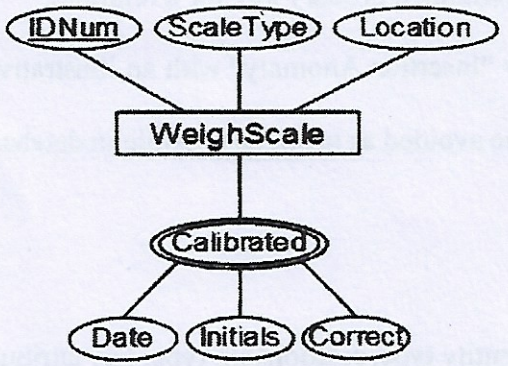
(2 marks)

(b) How a weak entity type in an ER diagram will be mapped to a relational model?

(2 marks)

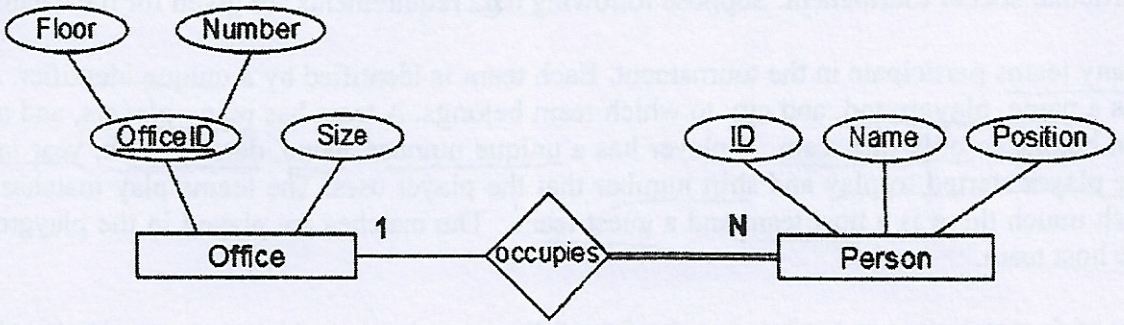
(c) For each of the following EER diagrams, map the diagram to an equivalent relational database schema. Specify the attributes and keys of the relation schemas, any attribute constraints. You do not need to model attribute domains.

(i) A database that records calibration history of all the measuring scales in the facility.



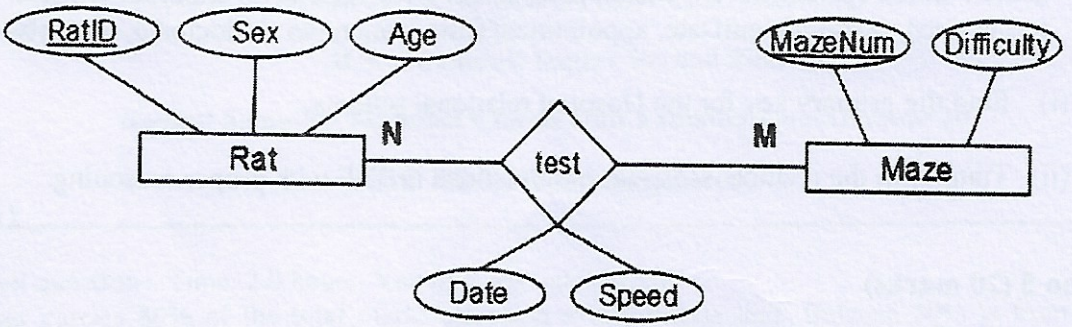
(4 marks)

(ii) A database of the allocation of staff to offices.



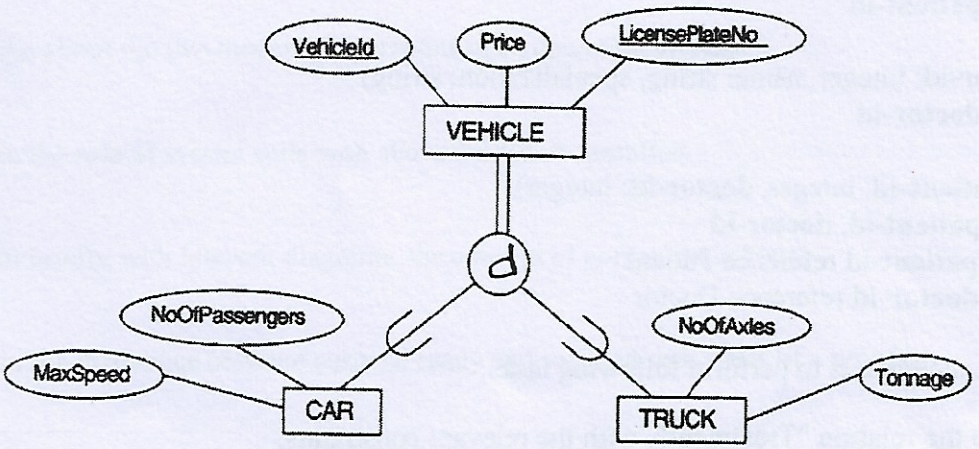
(4 marks)

(iii) A database that stores of experiment results that involves rats and maze.



(4 marks)

(iv) A database that stores information about motor vehicles.



(4 marks)

Question 4 (20 marks)

(a) The normalization of a relation schema is the process during which unsatisfactory relation schemas are decomposed by breaking up their attributes into smaller relations schemas that meet the desirable properties. There are number of normalization states among them are 1NF, 2 NF and 3 NF. Define each of these states by stating the conditions that need to be fulfilled in order to be in the state.

(6 marks)

(b) Consider the following relational schema used in hospital management system

Hospital(doctorId, appointmentDate, appointmentTime, doctorName, patientNo, patientName, surgeryNo)

with the following set of functional dependencies.

F = {(doctorId, appointmentDate, appointmentTime→ patientNo, patientName), (doctorId → doctorName), (patientNo→ patientName, surgeryNo), (doctorId, appointmentDate → surgeryNo), (appointmentDate, appointmentTime, patientNo → doctorId, doctorName)}

(i) Find the primary key for the Hospital relational schema.

(4 marks)

(ii) Transform the relation, Hospital into relations in 3NF with proper reasoning.

(10 marks)

Question 5 (20 marks)

Consider the relational schema given below designed to use for a hospital Patient Management system.

Patient (**patient-id**: integer, name: string, insurance: boolean, date-admitted: date, date-checked-out: date)
Primary key: **patient-id**

Doctor (**doctor-id**: integer, name: string, specialization: string)
Primary key: **doctor-id**

Treatment (**patient-id**: integer, **doctor-id**: integer)
Primary key: **patient-id, doctor-id**
Foreign Key: **patient-id** reference Patient
Foreign Key: **doctor-id** reference Doctor

(a) Write SQL statements to perform following tasks.

(i) Create the relation "Treatment", with the relevant constraints.

(4 marks)

(ii)Insert the record ("1100", "P. Manual", "Pediatrician") to the relation "Doctor".

(4 marks)

(iii) Alter the table "Doctor" to include a new attribute "experience" in years.

(4 marks)

(iv) Find the names of patients treated by the doctor "Saman Kumara".

(4 marks)

(b) Formulate the query in (a) (iv) in Relational Algebra.

(4 marks)

***** END OF PAPER *****