



University of Kelaniya – Sri Lanka
Centre for Distance & Continuing Education
Bachelor of Science (General) External
Second year second semester examination - 2019 (2024 February)
(New Syllabus)
Faculty of Science

Computer Science
COSC 27583 – Database Management Systems

No. of Questions: Four (04)

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Time: **Two and half (2 ½) Hours.**

Answer **all** questions.

1. (i) Briefly explain four (04) types of databases.
 - (ii) Explain the following terms.
 - i. Data
 - ii. Database
 - iii. Mini-world
 - (iii) State five (02) advantages of using database approach.
 - (iv) Briefly discuss two (02) situations where a database management system cannot be used.

- (b) (i) Briefly explain a database schema and a database instance.
 - (ii) Define the levels in three-schema architecture.
 - (iii) Briefly discuss the three (03) categories of data models.

- (c) (i) State the difference between logical data independence and physical data independence.
 - (ii) Distinguish the distributed database systems from centralized database systems.

2. The **University** database stores details about university students, courses, the semester a student took a particular course (and his mark and grade if he completed it), and what degree program each student is enrolled in.

Consider the following requirements list:

- The university offers one or more programs.
- A program is made up of one or more courses.
- A student must enroll in a program.
- A student takes the courses that are part of her program.
- A program has a name, a program identifier, the total credit points required to graduate, and the year it commenced.
- The programs are categorized as undergraduate and postgraduate programs.
- A course has a name, a course identifier, a credit point value, and the year it commenced.
- Students have one or more given names, a surname, a student identifier, a date of birth, age, address and the year they first enrolled.
- When a student takes a course, the year and semester he attempted it are recorded. When he finishes the course, a grade (such as A or B) and a mark (such as 60 percent) are recorded.
- Each course in a program is sequenced into a year (for example, year 1) and a semester (for example, semester 1)

Considering the above description and answer the following questions.

- (i) Identify the entities that could be used for the above requirements.
- (ii) Identify suitable attributes and the primary keys for each of the entity, and for each of the entities that you have identified, list the multi-valued, composite, and derived attributes if any.
- (iii) Is/Are there any weak entity/entities. If so, give the identifying owner/owners.
- (iv) Identify a superclass/subclass relationship from this description. Justify your answer.
- (v) Draw a suitable EER (Enhanced Entity Relationship) diagram for the **University** database. State any assumptions that you make.

3. The following table contains sample data of items and brands at ABC Company.

Item_code	Description	Brand_name	Location	Unit_Cost
P001	Refrigerator	LG	Colombo	50000
		Samsung	Kandy	48000
P002	Washing Machine	LG	Colombo	36000
		Sisil	Galle	38500
		Samsung	Kandy	35000

- (i) Convert this table to a relation (named ITEM_SUPPLIER) which is in first normal form.
- (ii) Draw a relational schema for ITEM_SUPPLIER and show the functional dependencies.
- (iii) Identify a candidate key for the above relation.

(b) Consider the following relation **INVOICE** and functional dependencies FD1, FD2, FD3 and FD4.

INVOICE (OrderID, OrderDate, CustomerID, CustomerName, CustomerAddress, ProductID, ProductDescription, ProductStandardPrice, OrderedQuantity)

FD1: OrderID → OrderDate, CustomerID, CustomerName, CustomerAddress

FD2: CustomerID → CustomerName, CustomerAddress

FD3: ProductID → ProductDescription, ProductStandardPrice

FD4: OrderID, ProductID → OrderedQuantity

- (i) Draw the functional dependency diagram.
- (ii) Identify the primary key for the given relation.
- (iii) Discuss the insertion and modification anomalies using the suitable examples for the relation, **INVOICE**.
- (iv) Assume that the relation has a row, <121, '05-JAN-22', 'C005', 'A Perera', 'Kelaniya', 'P010', 'Refrigerator', 80000.00, 1>. If the product is finished and if we removed this product from the table, what is the possible anomaly that can be violated? Give reasons.
- (v) What is the highest normal form of the **INVOICE** relation? Justify your answer.
- (vi) Decompose the **INVOICE** relation and state the reason behind each decomposition.
- (vii) Clearly indicate the primary key(s) and foreign key(s) in each relation.

4. Consider the following database instance and give the output for the given relational algebra expressions.

Student	
SId	Research_Area
S416	Data Mining
S417	Computer Architecture
S418	Data Mining
S420	Graphic & visualization
S417	Network
S417	Computational Biology
S420	Robotics & AI
S418	Computer Architecture

Lecturer	
Lid	Name
101	Albert
102	Richard
103	Jenny
104	Lima

Supervision	
Lid	Sid
101	S416
101	S418
101	S417
102	S417
102	S418
103	S420
102	S420
103	S417

- (i) $\Pi\langle\text{Research_Area}\rangle(\text{Student})$
- (ii) $\Pi\langle\text{Name}\rangle(\sigma\langle\text{Sid}=\text{S417}\rangle(\text{Supervision})) * (\text{Lecturer})$
- (iii) $(\Pi\langle\text{Lid}\rangle(\text{Lecturer}) - \Pi\langle\text{Lid}\rangle(\text{Supervision}))$
- (iv) $\text{Lecturer} * \text{Supervision}$

(b) Consider the following relations that are constructed to store the information of a medical center. In this schema it is assumed that a patient never visits the same doctor more than once in one day and a single diagnosis is recorded for each visit made by the patient.

DOCTOR (lic_no, doctor_name, specialty)
PATIENT (patient_id, patient_name, address, phone, DOB (Date of Birth))
VISIT (lic_no, pat_id, type, date, diagnosis, charge)

Express each of the following queries using relational algebra.

- (i) Get the list of all the different specialties the doctors have.
- (ii) Find the lic_no of all doctors who treated a patient "Kamani Dissanayake".
- (iii) Get the list of names and addresses of all patients who visited "Dr. H. Fernando" on "February 23rd of 2015".
- (iv) Find the names and specialties of all doctors who have not diagnosed a patient as having hypoglycemia.
- (v) Find the names of doctors who have treated all the patients.

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