University of Jaffna, Sri Lanka
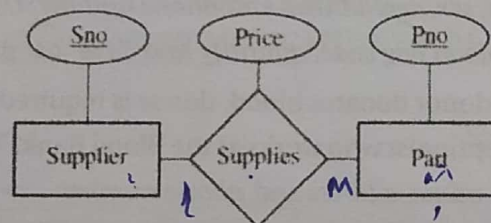## Bachelor of Science Degree Examination in Computer Science - Level 2S - 2019
(End of Semester Examination)
Computer Science
CSC201S2: Database Systems Concepts and Design

- Answer **Question 1 and Any Two of the Other Three.** (This paper has 4 questions on 4 pages.)
- At the bottom of the front page of your answer book, write the question numbers in the order you answered.
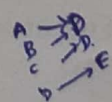- Time allowed: **Two Hours.**

1. (a) State the main characteristics of the Database Management System (DBMS) and spec-
   ify how it differs from traditional file system. [4%]

   (b) List three different types of database users and their tasks. [4%]

   (c) i. Explain the differences between user view, conceptual schema and an internal schema
   of a database. [5%]

       ii. Draw the three-tier schema architecture of the database system. [3%]

   (d) State what is meant by logical data independence and physical data independence
   aided with examples. [4%]

   (e) Consider the following fragment of an Entity-Relationship (ER) Diagram and assume
   that:

   A supplier can supply many parts. A supplier may not supply any part. A
   part should be supplied by a supplier. A part can be supplied by only one
   supplier.

       i. State what is meant by participation constraints. [4%]

       ii. Redraw the ER diagram representing cardinality and participation constraints. [1%]

       iii. Map the given ER model to a relational model. Justify your answer. [6%]

   (f) List the conditions that you can apply to determine whether a relation that is in first
   normal form is also in second normal form. [2%]

   (g) Consider the relation $R(A, B, C, D, E)$ under following functional dependencies and iden-
   tify in which normal form it is in. Justify your answer. [5%]

$$A, B, C \rightarrow D$$
$$C, D \rightarrow A, E$$

[Question 1 continues ...]

(b) Define the following:

    i. Primary vs secondary index.

    ii. Dense vs sparse index.

(i) i. Define what is meant by the term transaction in the context of DBMS and briefly describe the properties of a transaction.   [5%]

    ii. State what is meant by the term lost update problem that would arise when transactions are executed concurrently without any concurrency control measures.   [2%]

    iii. State clearly the Commit and Rollback operations in a DBMS transactions.   [2%]

    [50 Marks]

2. (a) State clearly the concepts of Entity Relationship(ER) diagram.   [2%]

  (b) Illustrate a ternary relationship in ER diagram using suitable example.   [5%]

  (c) Define the following types of attributes in ER diagram:

    i. Composite attribute

    ii. Multi-valued attribute

    iii. Derived attribute.   [3%]

  (d) Consider the following domain description.

    Blood Bank of the Jaffna Hospital wants to use a database to manage their information.

- A Blood Bank stores blood of various blood groups. Many donors donate blood, each of different blood group.
- A donor may donate blood more than once and donor is identified by a *donor_id (DID), name, sex, age, address* and *phone number.* Details of donated blood include *blood type, blood bag code, quantity* and date of donation.
- Before each donor donates blood, donor is required to register themself as a donor with the receptionist who works at the Blood Bank. The receptionist is identified by *employee id, name, address* and *phone number.*
- The Blood Bank receives orders for blood from many hospitals for emergency purposes and other surgical requirements and each blood bank issues the required blood type.
- Each blood bank has it's own blood bank number(BNO), issues, orders and blood types stored. The Blood Bank is managed by the blood bank manager who is identified by *employee_id, name, email-id* and *phone number.* He is responsible for the proper management of the blood bank. The hospitals are identified by name, address and phone number.

Represent the above description using an ER diagram.   [15%]

    [25 Marks]

3. (a) State clearly what is meant by the term normalisation and its importance in designing a database. [2%]

(b) Clearly define the following terms:

i. Full functional dependency.

ii. Partial dependency.

iii. Transitive dependency. [3%]

(c) The following relation records the information about the lecture rooms and the allocated course units in each room.

Course_no	Tutor	Room	Room_size	Number of students
CSC201	Raam	CSL	45	40
CSC 202	John	CUL1	100	60
CSC203	Arun	MainLab	80	50
CSC 204	Ravi	CUL2	75	60
CSC 205	John	CSL	45	40

i. Describe insertion, deletion and modification anomalies aided with above relation. [5%]

(d) An example of the patient medication form for the Jaffna hospital case study is shown below: You are requested to create a database to records all the details given in the form including patient, Admission and medication details.

JAFFNA HOSPITAL
PATIENT MEDICATION FORM

Patient no: 12345

Ward Number : Ward 11

Patient Name: A. Joseph

Ward Name : Orthopaedic

Bed Number : 84

Drug No	Drug Name	Description	Dosage	Method of Admin	Units per Day	Start Date	Finish Date
10223	Morphine	Pain Killer	10mg/ml	Oral	50	24/03/18	24/04/18
10334	Tetracyclene	Antibiotic	0.5mg/ml	IV	10	24/03/18	17/04/18
10223	Morphine	Pain Killer	10mg/ml	Oral	10	25/04/18	02/05/18
10224	Hydrocodone	Pain Killer	10mg/ml	Oral	10	15/04/18	20/04/18

i. State the possible functional dependencies.

ii. List all the relations of your database specifing the primary and foreign keys where appropriate. Ensure that each relation is in 3NF. [15%]

[25 Marks]

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4. (a) State the difference between procedural and non procedural query language. [2%]

   (b) List five various basic relational algebra operations and clearly state each of them. [4%]

   (c) Consider the following relational schema:

   - Supplier(**sid**: integer, sname: string, address: string)
   - Part(**pid**: integer, pname: string, color: string)
   - Catalog(**sid**: integer, **pid**: integer, cost: real)

   The primary key fields are stated in bold. The Catalog relation lists the prices charged for parts by Suppliers.

   i. Write a query in SQL for each of the following tasks:
      (α) Find the names of suppliers who supply some *red* part.
      (β) Find the sids of suppliers who supply some *red* part or are at *221 Packer Street*.
      (γ) Find the pids of the most expensive parts supplied by suppliers named *Sham*.
      (δ) Get suppliers names who supply part *P2*.
      (ϵ) Get all pairs of supplier numbers such that two suppliers are located in the same city. [8%]

   ii. Write the queries in part (i) as relational algebra expression. [8%]

   iii. Write the first three queries in part (i) as tuple relational calculus expressions. [3%]

   [25 Marks]