



EASTERN UNIVERSITY, SRI LANKA
DEPARTMENT OF MATHEMATICS

THIRD YEAR SECOND SEMESTER EXAMINATION IN SCIENCE – 2018/2019

(June/July/August, 2022)

CS 3072 - Advanced Database Management Systems

Answer all questions

Time Allowed: One hour

1. An Entity Relationship (ER) Model describes a database in an abstract way, primarily in terms of entities, relationships and attributes.

(a) Describe how relationship types of degree higher than *two* can be represented in an ER diagram and how these relationships can be converted into *relations*. [15 marks]

(b) In addition to the concepts covered by the ER model, Enhanced ER model (EER model) includes *subclass*, *superclass*, *specialisation*, *generalisation* and *category*. Give EER diagram notations to represent these concepts and describe these concepts through simple examples. [25 marks]

(c) An ART MUSEUM has approached you to build a database to keep track of information for that museum. Assume that the following requirements were collected:

The museum has a collection of *Art-Objects*. Each *Art-Object* has a unique *IdNo*, *Artist* (known), *Year* (of creation), *Title* and a *Description*. The *Art-Objects* are categorised in several ways, as discussed below:

- *Art-Objects* are categorised based on their types - *Painting*, *Sculpture/Statue* and *Other*
 - A *Painting* has a paint-type (like oil, watercolor, etc), a material on which it is drawn (like paper, canvas, wood, etc.) and style (like modern, abstract etc).

- A *Sculpture* or a *Statue* has a material from which it was created (like wood, stone etc.), height, weight and style. A *Statue* may have an honourer, the person that honoured.
- The *Other* category includes any object of types other than the above two. It has a type (like print, photo, etc.) and style.
- *Art-Objects* are also categorised as
 - permanent-collection, which are owned by the museum (these have information on the *date-acquired*, whether it is *on-display* or *stored* and *cost*).
 - *borrowed-item*, which has information of the Collection (from which it is borrowed), *date-borrowed*, and *date-returned*.
- *Art-Objects* also have information describing their origin (like Italian, Egyptian, American etc.) and epoch (like renaissance, Modern, etc.).
- The museum keeps track of artists information, if known: name, date-of-birth, date-of-death, country-of-origin, epoch, main-style and description. The name is assumed unique.
- Different Exhibitions occur, each having a name, start-date and end-date. Exhibitions are related to all the art objects that were on display during the exhibition.
- Information is kept on other collections about which the museum communicates, including name (unique), type (like museum, personnel, etc.), description, address, phone and current-contact-person.

Draw an EER diagram for the *ART MUSEUM* database. If you need to make any assumptions include them in your answer.

[60 marks]

2. Databases and database management systems are an essential component of life in modern society.

Most of us encounter several activities every day that involve some interaction with a database.

- (a) Describe the main characteristics of the database approach and explain how it differs from the traditional file system. [15 marks]
- (b) State what is meant by a database *transaction* and explain how execution of transaction in a *single user system* differs from a *multi user system*. [15 marks]
- (c) State and describe the desirable properties of a transaction known as *ACID* properties. [20 marks]

(d) State and describe *two* problems that would arise during concurrent execution of transactions.

[10 marks]

(e) Explain what is meant by *Serial*, *Non-Serial* and *Conflict-Serialisable* schedules.

[15 marks]

(f) Define *fourth* and *fifth* normal forms.

[10 marks]

(g) Answer the following questions based on the following table:

Movie_Name	Shooting_Location	Listing
Movie_One	UK	Comedy
Movie_One	UK	Thriller
Movie_Two	Australia	Action
Movie_Two	Australia	Crime
Movie_Three	India	Drama

i. The above table is not in fourth normal form. Explain briefly, why?

[05 marks]

ii. Normalise the above table into *4NF* relations.

[10 marks]