



Sri Lanka Institute of Information Technology

B.Sc. Honours Degree in Information Technology

Final Examination
Year 1, Semester I (2024)

IT1090 – Information Systems and Data Modeling

Duration: 02 Hours

June 2024

Instructions to Candidates:

- ◆ This paper has 5 questions.
- ◆ The exam includes an additional 10 minutes as reading time.
- ◆ Answer all questions in the booklet given.
- ◆ The total mark for the paper is 100 and contributes 60% for the final grade.
- ◆ This paper contains 8 pages, including the cover page.
- ◆ Electronic devices capable of storing and retrieving text, including calculators and mobile phones are not allowed.

Question 1

[Total: 20 Marks]

- a) Consider a fitness training platform that allows users to connect with, and reserve sessions with certified trainers.

Users can create accounts on the platform by providing necessary information. This might include creating a unique username and password for login, along with personal details like name and email address for communication. Users can browse through a list of available trainers with their profiles highlighting expertise, experience, and potentially ratings or reviews from past clients. Users can then select their preferred trainer based on their needs. Once a user selects a trainer and chooses a session time, they are directed to a secure payment gateway to complete the transaction. The payment amount might vary depending on the trainer's rates and the chosen session duration. Upon successful payment confirmation, the user receives a unique link to join the online training session with their chosen trainer. This link can be accessed through the platform or potentially emailed to the user for convenience. If the payment fails due to insufficient funds or other reasons, the user is notified of the unsuccessful transaction.

Model the *Business Process Map* for the given scenario.

[10 Marks]

- b) Read-A-Lot bookstore relies on a robust inventory management system to track their book collection and sales. Consider the given description of Book Inventory Management System for "Read-A-Lot" Bookstore and answer the following questions.

The system maintains a detailed record of all books in stock. This includes information like a unique identifier, title, author, genre, and current quantity (quantity_on_hand). This allows staff to efficiently check book availability for customers. Every sale or purchase of a book is recorded in the system. Sales transactions capture details like the book being sold, sale date, and potentially the customer information if applicable. Purchases record details like the book being purchased, purchase date, quantity purchased, and potentially supplier information if relevant. After each sale or purchase, the system automatically updates the quantity_on_hand attribute for the corresponding book. This ensures the system reflects the real-time availability of books in the store. At the end of each month, the system generates reports summarizing various aspects of the bookstore's inventory and sales. These reports include:

- Current stock levels (quantity_on_hand) for all books in the system, allowing managers to identify potential stockouts and plan restocking needs.
- Sales statistics to identify best-selling books, sales trends by genre.
- Overall revenue generated during the month.

- i) Identify the inputs captured by the input function of the inventory control system. [02 Marks]
- ii) Identify the outputs presented by the output function of the inventory control system. [02 Marks]
- iii) Identify the stored data of the inventory control system. [02 Marks]
- iv) Identify the subsystems (processes) of the inventory control system. [04 Marks]

Question 2

[Total: 25 Marks]

a) A university requires a database system to manage course registration for students. Here's a breakdown of the requirements for the University's Course Registration System. Draw the Entity Relationship (ER) diagram for the database of the Course Registration System.

- Each student has a unique ID, name, and year of study.
- Each course has a unique identifier, name, and maximum enrollment capacity.
- Each professor has a unique ID, name, and title.
- A student must register for one or more courses offered by the university. A course can have many students registered in it, but the total number cannot exceed the capacity.
- It is required to maintain the calendar year in which the student registered for the particular course.
- A professor must teach one or more courses, and a course can have multiple professors teaching it.
- Some courses may have a prerequisite (another course that a student must have completed before registering for that particular course).

[15 Marks]

b) Consider an Online Movie Rental System that allows customers to sign up, browse movies, rent them for a specific duration, and leave reviews. Following are the specific attributes considered for each entity related to the database of this system.

Entity 1: Customer

- Create profiles with unique IDs (customer_id), full names (name), and email addresses (email) used for login (must be unique).
- Provide a billing address (billing_address) which can be further decomposed into street, city, state, and zip code for finer-grained location information.
- Choose a subscription tier (subscription_type) such as "Basic" or "Premium" which might offer different rental benefits.

Entity 2: Movie

- Each movie has a unique identifier (movie_id).
- Titles (title) and release years (release_year) are documented.
- Genres (genre) are associated with each movie, a single movie may have multiple genres.
- Movie durations (duration) are recorded in minutes.
- Director information (director(s)) is captured, some might have only one director whereas some might have a co-director too.

Entity 3: Rentals

- Each rental has a unique identifier (rental_id).
- Rental date (rental_date) and return date (return_date) are tracked (return date can be null if the movie hasn't been returned yet).
- The rental price (rental_price) is the price the customer has to pay, rental is calculated based on the movie's base price and the chosen rental period defined elsewhere in the system.

Entity 4: Reviews

- Each review has a unique identifier (review_id).
- Ratings (rating) are provided on a numerical scale (e.g., 1-5 stars).
- Reviews can include optional textual comments (comment), allowing customers to elaborate on their ratings (may be null if no comment is provided).

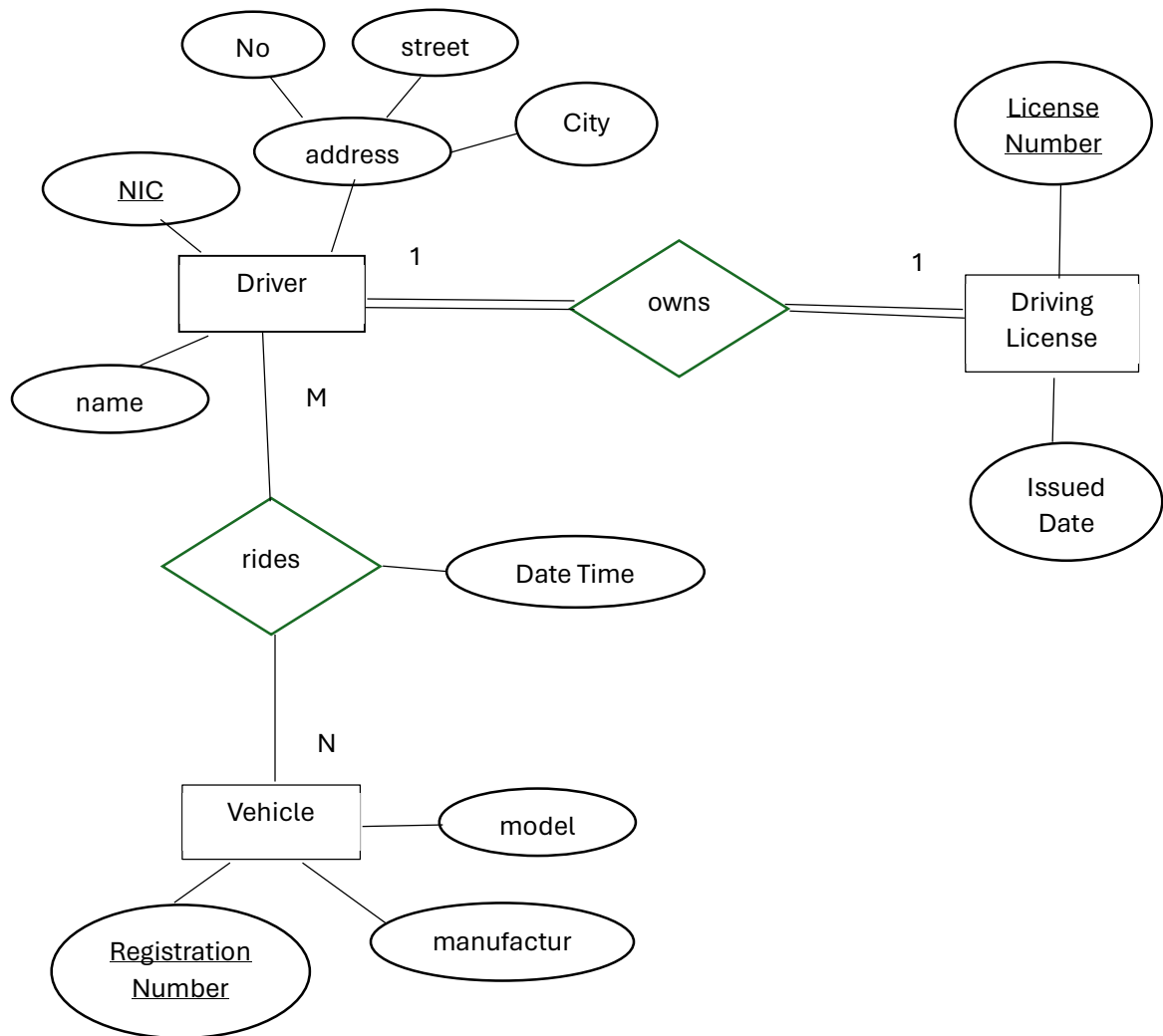
Explore the different attributes (given above) and their usage within the context of the Online Movie Rental System. List the identified attributes that suit best for each of the following.

- | | |
|------------------------------|------------|
| i. Simple attributes | [02 Marks] |
| ii. Composite attributes | [02 Marks] |
| iii. Multi-valued attributes | [03 Marks] |
| iv. Derived attributes | [03 Marks] |

Question 3**[Total: 15 Marks]**

Convert the following ER diagram into the Relational Schema.

Note: Use the names given in the ER whenever possible.



Question 4**[Total: 15 Marks]**

Consider a relation named 'Product' in a supermarket database that stores the following details for each product.

Product (ProductID, ProductName, Brand, Category, Unit Price, StoreLocation)

- ProductID (Integer, Primary Key): Unique identifier for each product
- ProductName (String): Name of the product (e.g., "Milk")
- Brand (String): Brand of the product (e.g., "Clover Valley")
- Category (String): Category the product belongs to (e.g., "Dairy")
- Unit Price (Decimal): Price of the product per unit
- StoreLocation (String): Aisle and shelf location of the product in the store (e.g., "Aisle 3, Shelf B2")

Following are the non-trivial Functional Dependencies (FD) that exist for the relation 'Product'

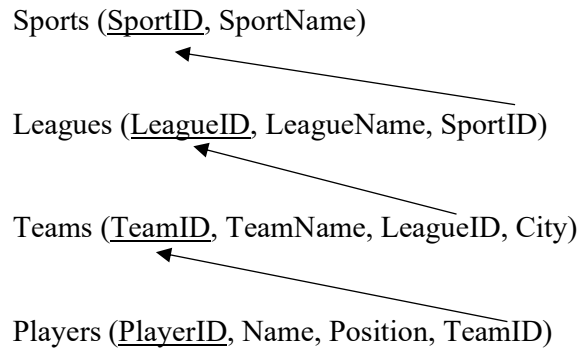
ProductName, Brand -> UnitPrice

Category -> StoreLocation

- a) In which Normal Form is the relation 'Products' in? [06 Marks]
- b) If the relation 'Products' is not in the 3NF, consider the Normalization guidelines and make it a relation in 3NF. [09 Marks]

Question 5**[Total: 25 Marks]**

This schema demonstrates a Sports League Management System with relationships between Sports, Leagues, Teams, and Players.



- a) Find all teams in 'Chicago' city playing the sport 'Hockey' [04 Marks]
- b) Write the SQL statement to add a new column named 'description' to the 'Sports' table. [05 Marks]
- c) Find the name and position of all players on the 'Golden Knights' team. [06 Marks]
- d) What is the name of the league which manages the highest number of teams? [10 Marks]