Computer Science Department

University of Computer & Emerging Sciences (FAST-NU)

ASSIGNMENT COVER SHEET

COURSE TITLE DATABASE SYSTEMS COURSE CODE CS2005

INSTRUCTOR Teaching Team. TYPE [ ] Indiv. [√] Group (Please tick)

ASSIGNMENT NO 1

ASSIGNMENT Entity Relationship Diagram- Case studies

HAND OUT DATE 10-Feb-2025

DUE DATE 20-Feb-2025 (10:00 AM)

ASSESSMENT CRITERIA (or attached)	% Mark
Submission: Hard and **Scanned** copies are required. Submit **Hard Copies** to Mr. Amir or Mr. Fahad in the Academic Office (till the due date and time). The submissions that will be slided beneath Instructor's office doors or submitted elsewhere will not be graded. Also, Submit **Scanned Copies** of the assignment on Google Classroom. **Group of max 2 students is allowed, individual work is acceptable in extreme situations and with prior written (by email) permission of theory course teacher. Such permission should be sought at least 5 days before the deadline of the assignment.** **Any type of plagiarism will lead to 0% marks of both/all parties.** **Late submission (even 1 min) will result in zero marks.** **There will be no credit if the given requirements are changed.**	

TO BE COMPLETED BY STUDENT (TEAM LEAD)

NAME _____

ID NO _____

Time Taken

DECLARATION: I/We declare that this Coursework is my/our group's own work

SIGNATURES (All members)

GROUP MEMBERS ID

ID _____

ID _____

GRADE/ MARK AWARDED [ ]

COMMENTS _____

INSTRUCTOR'S SIGNATURE _____ DATE _____

Logical Modelling

QUESTION 1– Entity-Relationship Modelling (10 Marks)

Case Study:

ShopEase, a rapidly growing e-commerce platform, aims to streamline its operations and improve customer experience. The system must allow Customers to register with their Name, Address, and Email, browse Items produced by various Companies, and add them to a Shopping Cart. Customers should be able to place an Order, pay securely using a Credit Card, and have their items shipped to their address. The E-Commerce platform processes orders, verifies payments, and forwards them to the Shipping department. Each Order contains multiple Items and is uniquely tracked with an Order Number. As developers, your task is to design an Entity Relationship Diagram (ERD) that models the platform's database, incorporating all entities, attributes, relationships, and cardinalities to ensure efficient management of customers, orders, products, and shipping.

QUESTION 2– Entity-Relationship Modelling (20 Marks)

Case Study:

FitLife Gym is launching "FitLife Hub," an online platform designed to connect gym members, instructors, and fitness resources. They want to create a comprehensive system that allows members to manage their fitness journey, instructors to connect with clients, and the gym to offer personalized plans and track progress. The platform will rely on a robust database to store and manage all this information.

After several meetings with stakeholders, the development team has gathered the following requirements for the FitLife Hub database:

- Member Profiles: Each member needs a detailed profile including their full name, date of birth, complete address (street, city, zip code), and a contact phone number.
- Instructor Profiles: FitLife Hub will feature profiles for instructors, including their full name, their specific area of specialization (e.g., yoga, weightlifting, Pilates), and a contact phone number.
- Class Information: Members can sign up for various classes. Each class has a name (e.g., "Spin," "HIIT"), a scheduled date and time, a cost, and is taught by one instructor.
- Class Enrollments: FitLife Hub needs to track which members are enrolled in which classes.
- Exercise Library: The platform will include a library of exercises. Each exercise has a name, a detailed description, and specifies the primary muscle groups it targets (e.g., "quadriceps," "core").
- Class Content: Each class incorporates several different exercises.
- Diet Plan Library: FitLife Hub will offer a variety of diet plans. Each diet plan has a name, and a description.
- Personalized Diet Plans: Each member can have multiple diet plans assigned to them, and a diet plan can be assigned to multiple members.

Your Task:

Using the information provided above, design a comprehensive Entity-Relationship Diagram (ERD) for the FitLife Hub database. Your ERD should:

- Clearly delineate all entities (tables) and their attributes (columns).
- Show all relationships between entities, clearly labeled.

- Specify the cardinality of each relationship (one-to-one, one-to-many, many-to-many).

QUESTION 3– Entity-Relationship Modelling (20 Marks)

Case Study:

BankWise, a nationwide banking corporation is undertaking a significant upgrade to its ATM network. They want to ensure seamless and secure transactions for their customers while also streamlining maintenance and management of their extensive ATM infrastructure. To achieve this, they are building a comprehensive database to track every aspect of their ATM operations.

The project manager, Alex, has gathered information from various departments to define the requirements for the new database:

- ATM Machines: Each ATM machine needs details about its location (branch or standalone), model, and the date it was installed.
- ATM Technicians: BankWise employs a team of technicians who service the ATMs. Each technician has a name, contact information, and a record of his or her assigned service areas.
- ATM Maintenance: Whenever an ATM requires maintenance; a record needs to be kept, detailing the date and time of the service, a description of the issue, the technician who performed the work, and the parts replaced (if any).
- ATM Operators: In some locations, ATMs might have an operator present to assist customers. The operator's information (name) needs to be recorded if applicable.
- Customers: BankWise customers are identified by their name, and contact details.
- Bank Branches: Each branch has location details, and contact information.
- Customer Accounts: Customers can have multiple accounts, each with a unique Account Number, type (Savings, Current), and associated balance.
- Card Information: Customers access their accounts using cards. Each card has a unique Card Number, is associated with a specific customer, and has an expiry date.
- Transactions: All transactions made at an ATM need to be recorded, including the transaction ID, date and time, type (withdrawal, deposit, transfer), amount, the card used, and the account affected.

Your Task:

Design a comprehensive Entity-Relationship Diagram (ERD) for the BankWise ATM database based on the information provided. Your ERD should:

1. Clearly define all entities (tables) and their attributes (columns).
2. Illustrate all relationships between entities, clearly labeled.
3. Specify the cardinality of each relationship (one-to-one, one-to-many, many-to-many).

QUESTION 4–Extended Entity-Relationship Diagram (EERD) Modelling (20 Marks)

Case Study:

The City Museum is launching "ArtConnect," a dynamic online platform to showcase its collection, connect with patrons, and manage its operations more effectively. They have recognized the need for a robust database to support this initiative and have hired your team of database designers.

The museum's curator, Emily, has provided you with an overview of the information they need to track:

- Artworks: The core of the system is information about the artworks themselves. Each artwork needs to be uniquely identified and categorized. Details like the title, artist, creation date or era, a description, and its current location within the museum are essential. The museum also tracks how each artwork was acquired (purchase, donation, etc.) and its cost or appraised value. Some artworks might be on loan, requiring tracking of borrowing dates and return dates. Different types of art exist, such as paintings (with information about paint type and material), sculptures (with details about material, height, and weight), and other objects, each potentially having unique characteristics.
- Artists: Information about the artists is crucial, including their name, birth and death dates, and artistic style or movement.
- Exhibitions: The museum holds various exhibitions, and the system needs to track which artworks are displayed in each exhibition, along with the exhibition dates and a description of the exhibition theme.
- Collections: The museum's artworks are organized into collections. Each collection has a name, a description, and a contact person. Artworks can belong to one specific collection.
- Permanent vs. Borrowed: The museum distinguishes between artworks that are part of its permanent collection and those that are borrowed. For borrowed artworks, the source of the loan needs to be recorded.
- Honorees: Some sculptures are dedicated to specific individuals, and this information needs to be captured.

Your Task:

Design an Extended Entity-Relationship Diagram (EERD) for the City Museum's "ArtConnect" database, based on the information provided. Your EERD should:

1. Identify the key entities that need to be represented in the database.
2. Determine the relationships between these entities, clearly labeling each relationship.
3. Specify the cardinality of each relationship.
4. Specify the all basic constraints can apply to a specialization/generalization(Disjointness subclasses Overlapping subclasses, Total Specialization, Partial Specialization)

QUESTION 5–Extended Entity-Relationship Diagram (EERD) Modelling (20 Marks)

Case Study:

State University is modernizing its data management systems with the "CampusConnect" project, aiming to create a unified platform for managing student, faculty, and course information. They have brought in your database design team to build the underlying database.

After several meetings with the registrar, faculty representatives, and student services, the project manager, Dr. Lee, has compiled the following information requirements:

- Students: The University needs to track a variety of student information, including their name, and whether they are undergraduates, graduates, or "special" students (taking individual courses without pursuing a degree). They also want to track teaching assistants and graduate assistants separately, as they have different roles and responsibilities.
- Faculty: Information on faculty members is essential including their name, and the degrees they hold. The university distinguishes between tenured and non-tenured faculty.
- Courses: The system needs to store information about courses, including the course number, course name, and the number of credit hours it carries.
- Enrollment: The university needs to track which students are enrolled in which courses.
- Teaching Assignments: The system needs to record which faculty member is teaching which course.
- Car Information: The university wants to keep track of faculty members who drive cars on campus. For each car, they want to record the make and tag number. Each faculty member can drive only one car.

Your Task:

Based on the information provided, design a comprehensive Extended Entity-Relationship Diagram (EERD) for the State University "CampusConnect" database. Your EERD should:

1. Identify the key entities that need to be represented in the database.
2. Determine the relationships between these entities, clearly labeling each relationship.
3. Specify the cardinality of each relationship.
4. Specify the all basic constraints can apply to a specialization/generalization(Disjointness subclasses Overlapping subclasses, Total Specialization, Partial Specialization)

Deliverables:

Submit your work that should include:

- ERD: Complete ER diagrams for related scenarios. It is necessary to specify all entities, attributes, constraints, relationships and all the concepts that you have studied in Chapter 03.
- EERD: Complete Enhanced ERD for related scenarios. It is necessary to specify all.

1. Subclasses and Super classes.
2. Specialization and Generalization.
3. Category or union type.
4. Aggregation.
5. Specify the all basic constraints can apply to a specialization/generalization(Disjointness subclasses Overlapping subclasses, Total Specialization, Partial Specialization)

- Documentation: Paragraphs explaining details about the design regarding the following aspects

1. Mention the diagramming software that you have used for the assignment.
2. Any clarifications about your ERD, which are not evident in the model itself.
3. Any assumptions you had to make with respect to the requirements.
4. Any constraints (business rules) apparent from the requirements that you are unable to model via your ERD.