# CS2005 DataBases

# Assignment#1

06.03.2024

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BSCS-G

**Computer Science Department**

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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(ERD) & Enhanced Entity Relationship Diagram(EERD)- Case studies

HAND OUT DATE  **13-Feb-2024**        DUE DATE   **29-Feb-2024**

| 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.<br><br>**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.**<br><br>**Any type of plagiarism will lead to 0% marks of both/all parties.**<br><br>**Late submission (even 1 min) will result in zero marks.**<br><br>**There will be no credit if the given requirements are changed.** | |

| TO BE COMPLETED BY STUDENT (TEAM LEAD) | GROUP MEMBERS ID |
|---|---|
| NAME  **Tauha Imran**<br><br>ID NO  **22i-1239**<br><br>Time Taken  **2days**<br><br>DECLARATION: I/We declare that this Coursework is my/our group's own work<br><br>SIGNATURES (All members) | _____<br><br>**ID 22i-1293**<br>**ID 22i-1239** |

| GRADE/ MARK AWARDED ☐ | COMMENTS  _____ |
|---|---|

INSTRUCTOR'S SIGNATURE _____ DATE _____

# Overview

The Database assignment report includes sections covering database design,  analysis, conclusion, and assumptions . Each section provides essential information about the ERD's structure, functionality, performance, and overall findings.
Link to lucid chart,
**https://lucid.app/lucidchart/6ae90b3c-1355-4af8-a3fd-1f9b3407c117/edit?invitationId=inv_a806b77c-1a2f-44cf-8549-625b7f72c0c6&page=0_0#**

# Contents

# Question#1 - ERD

## Hatfield Recruitment (ERD)

### Introduction

The effective management of job vacancies is crucial for businesses seeking top talent. Recruitment agencies like Hatfield Recruitment play a vital role in streamlining this process for client companies. This case study delves into the data model that underpins Hatfield Recruitment's operations. We will explore the entities involved, their attributes, the relationships between them, and the underlying assumptions made in building this model. By examining this data structure, we aim to gain a clear understanding of how Hatfield Recruitment manages job vacancies, applicant information, and hiring manager allocation. This knowledge can be valuable for optimizing their recruitment processes and ensuring a smooth experience for both client companies and prospective candidates.

### Entities & Attributes

- Client Company
  - Attributes:
    - Company ID (Primary Key)
    - Company Name
    - Contact Name
    - Contact Number
    - Email Address

- Job Vacancy
  - Attributes:
    - Vacancy ID (Primary Key)
    - Position Description
    - Location
    - Salary Range

- - - Dates (Application Open & Close)
    - Prerequisites
    - Company ID (Foreign Key) - references Client Company(Company ID)

- Hiring Manager
  - Attributes:
    - Manager ID (Primary Key)
    - Name
- Applicant
  - Attributes:
    - Applicant ID (Primary Key)
    - Name
    - Date of Birth
    - Address
    - Contact Number
    - Email Address

# Relationships

- Client Company can have Many Job Vacancies (One-to-Many)
- Job Vacancy is associated with One Client Company (Many-to-One)
- Hiring Manager can be assigned Many Job Vacancies (One-to-Many)
- Job Vacancy can be assigned to Many Hiring Managers (Many-to-Many)
- Applicant can Apply for Many Job Vacancies (One-to-Many) (applicant can apply for multiple vacancies)
- Job Vacancy can have Many Applicants (One-to-Many) (a vacancy can have many applicants)
- One Client Company can have many Job Vacancies (1:N)
- One Job Vacancy is associated with one Client Company (N:1)
- One Hiring Manager can be assigned many Job Vacancies (1:N)
- One Job Vacancy can be assigned to many Hiring Managers (N:M)
- One Applicant can Apply for many Job Vacancies (1:N)
- One Job Vacancy can have many Applicants (1:N)

# Normalization & Assumptions

- In this model, we assumed that a client company can have one contact person.  In reality, there could be multiple contacts.
- We also assumed that a hiring manager can be assigned to multiple vacancies, but a vacancy cannot be assigned to a team of hiring managers.
- The ERD does not show how the system tracks the application status or the hiring decision process.
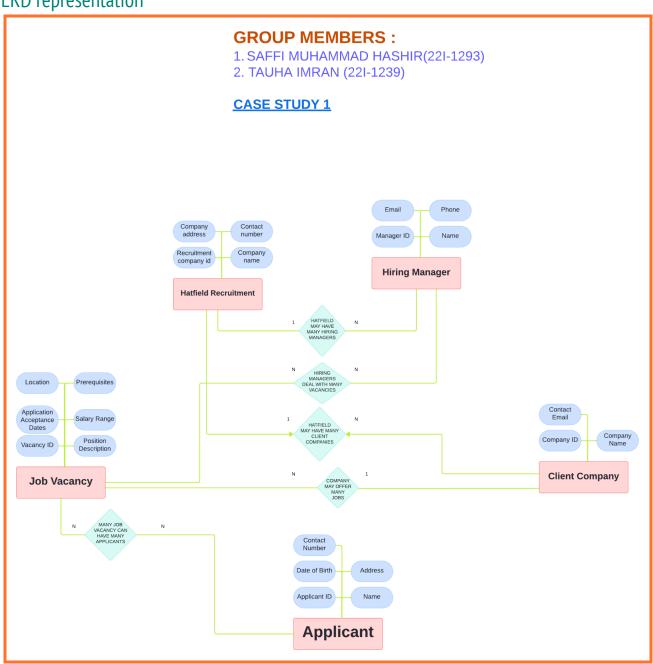
## ERD representation



Fig 1.1 (full ERD view)

# Question#2 - ERD

## Hertfordshire Restaurant Guide website (ERD)

### Introduction

This case study explores the entity relationship diagram (ERD) that underpins the Hertfordshire Restaurant Guide website. This website offers users up-to-date reviews of restaurants in Hertfordshire, England. The ERD will depict the entities involved in the system, their attributes, the relationships between them, and any assumptions made during the design process. By understanding this data model, we can gain insight into how the website stores information about restaurants, reviewers, and their visits. This knowledge can be valuable for improving the efficiency of the website's data management and ensuring a positive user experience.

### Entities & Attributes

- Restaurant
    - Attributes:
        - Restaurant ID (Primary Key)
        - Name
        - Location (Address, City)
        - Capacity
        - Opening Hours (Weekdays, Weekends)
        - Price Range (1-4 scale)
- Cuisine
    - Attributes:
        - Cuisine ID (Primary Key)
        - Cuisine Type (e.g., Italian, Indian)
- Restaurant_Cuisine (Associative Entity)
    - Attributes:
        - Restaurant ID (Foreign Key) - references Restaurant(Restaurant ID)
        - Cuisine ID (Foreign Key) - references Cuisine(Cuisine ID)

- Reviewer
    - Attributes:
        - Reviewer ID (Primary Key)
        - Name
        - Experience Level
- Visit
    - Attributes:
        - Visit ID (Primary Key)
        - Restaurant ID (Foreign Key) - references Restaurant(Restaurant ID)
        - Reviewer ID (Foreign Key) - references Reviewer(Reviewer ID)
        - Visit Date

- Review
    - Attributes:
        - Review ID (Primary Key)
        - Visit ID (Foreign Key) - references Visit(Visit ID)
        - Quality of Food (Rating)
        - Timeliness of Service (Rating)
        - Cleanliness (Rating)
        - Value for Money (Rating)

## Relationships

- Restaurant can serve Many Cuisines (Many-to-Many) - Represented by the associative entity "Restaurant_Cuisine"
- Cuisine can be served by Many Restaurants (Many-to-Many) - Represented by the associative entity "Restaurant_Cuisine"
- Reviewer can write Many Visits (One-to-Many)
- Visit is written by One Reviewer (Many-to-One)
- Visit is associated with One Restaurant (Many-to-One)
- Restaurant has Many Visits (One-to-Many)
- Visit has One Review (One-to-One)
- Review is associated with One Visit (One-to-One)

## Normalization & Assumptions

- This model is assumed to be in Third Normal Form (3NF), meaning there are no transitive dependencies.
- We assume a reviewer cannot visit the same restaurant on the same day.

- The ERD focuses on core entities and excludes additional details like reviewer contact information.
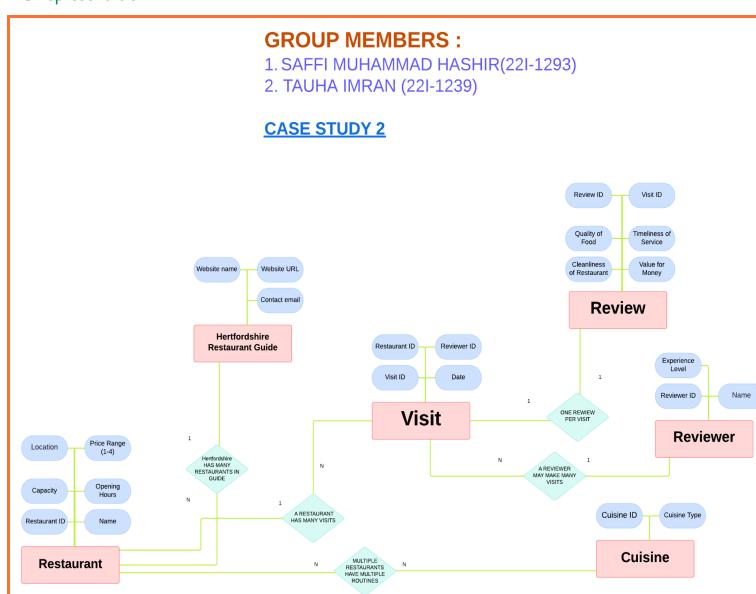
## ERD representation



Fig 2.1 (full ERD view)

# Question#3 - ERD

## Mango Brand (ERD)

### Introduction

This case study outlines the design of an Entity-Relationship Diagram (ERD) for Mango, a prominent global clothing retailer. The ERD incorporates entities encompassing Mango's supply chain, manufacturing, retail operations, and workforce.

### Entities & Attributes

- Vendor

    Attributes:

    - Vendor ID (Primary Key)
    - Vendor Name
    - Location (Address, City, Country)

- Material

    Attributes:

    - Material ID (Primary Key)
    - Material Type (e.g., Cotton, Linen)

- Product

    Attributes:

    - Product ID (Primary Key)
    - Product Name
    - Description
    - Material ID (Foreign Key) - references Material(Material ID)

- Store
    - Attributes:
        - Store ID (Primary Key)
        - Location (Address, City, Country)

- - - Store Type (Retail, Outlet)
- Employee

    Attributes:

    - ○ Employee ID (Primary Key)
    - ○ Name
    - ○ Job Title
    - ○ Department (e.g., Manufacturing, Retail, Marketing)


- Customer
    - ○ Attributes:
        - - Customer ID (Primary Key)
        - - Name
        - - Contact Information (Email, Phone)
        - - Customer Type (Online, In-Store)


## Relationships

- Vendor can supply Many Materials (One-to-Many)
- Material can be supplied by One Vendor (Many-to-One)
- Material can be used in Many Products (One-to-Many)
- Product can be made from Many Materials (Many-to-Many)
- Product is manufactured in Store (Many-to-Many) - Represented by associative entity "Product_Store"
- Store manufactures Many Products (Many-to-Many) - Represented by associative entity "Product_Store"
- Employee works in One Department (Many-to-One)
- Department has Many Employees (One-to-Many)
- Store employs Many Employees (Many-to-Many)
- Employee can work at Many Stores (Many-to-Many)
- Customer makes Many Purchases (One-to-Many)
- Purchase is made by One Customer (Many-to-One)
- Purchase is for One Product (Many-to-One)
- Product can be included in Many Purchases (One-to-Many)
- Store can facilitate Many Purchases (One-to-Many) (In-store purchases)
- Purchase can be made at One Store (Many-to-One) (In-store purchases)


## Normalization & Assumptions

- This ERD is assumed to be in Third Normal Form (3NF).
- The associative entity "Product_Store" links products to stores where they are manufactured.
- The ERD focuses on core retail functions and excludes design aspects.
- Employee roles and department hierarchies can be incorporated for further detail.
- Online purchases are assumed to be directly fulfilled by Mango's distribution centers.
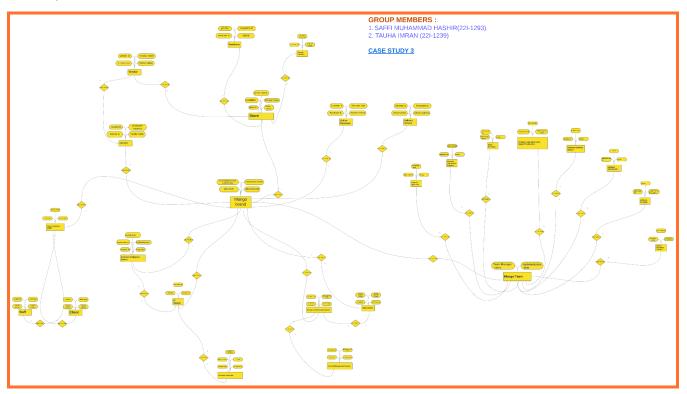
# ERD representation



Fig 3.1 (full ERD view)

# Question#4 - EERD

## Acme Corporation (EERD)

### Introduction

Acme Corporation, an enterprise celebrated for its broad spectrum of services and intricate company structure, is on the verge of a digital transformation. The initiative aims to introduce a sophisticated database system to streamline the administration of its ever-expanding workforce, the various departments, and the slew of ongoing projects. The crux of this endeavor is to devise a database schema that meticulously maps out the intricate network of roles, reporting lines, and the fine-grained relationships within the corporate hierarchy, all while adhering to the specific constraints and interdependencies that are characteristic of Acme's operations.

### Entities & Attributes

The following entities have the following attributes.

- ACME-PRODUCTION (major super-class)
  Subclasses:
    - Department (subclass)
    - Project (subclass)
    - Regions (subclass)

- Department
  Attributes:
    - Name (primary key)
    - Location (multivalued)

- Project
  Attributes:
    - Competition date (attribute)
    - Name (primary key)

- Regions
  Attributes:

- - Market places
    - Reach

  - Employee (superclass)
    Attributes:
    - Name (composite)
      Further Attributes:
      - First name (attribute)
      - Second name (attribute)
      - Third name (attribute)
    - SNN (primary key)

      Subclasses:
      - Manager (subclass)
      - Engineer (subclass)
        - Specialty (multivalued)
      - Sales Person (subclass)
  - Child
    Attributes:
    - Name (partial key)
    - DOB (derived attribute)
    - Age (attribute)

## Relationships

The EERD showcases the following relationships.

- Overseeing (N:1)
  - Regions : sales_person
- Works_in (N:N)
  - Engineer : Project
- Responsible_for (1:1)
  - Manager : Department
- Assigned (1:N)
  - Employee :  department
- Parent_of (1:N)
  - Employee : child

## Normalization & Assumptions

Subclasses and Superclasses were used to showcase hierarchical nature in this EERD , following the disjoint and overlapping behaviors.
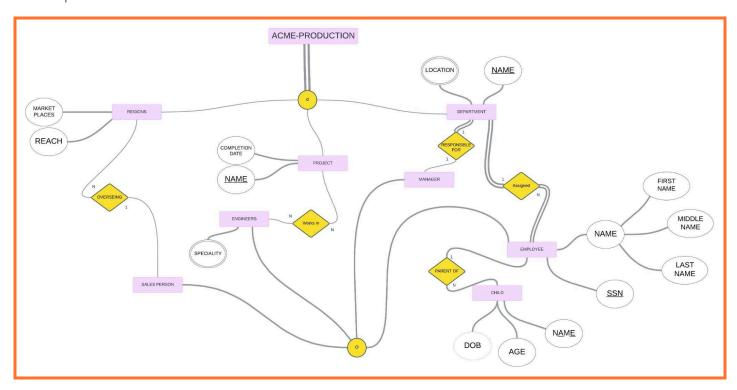
## ERD representation

Put the pictures here...



Fig 4.1 (full EERD view)
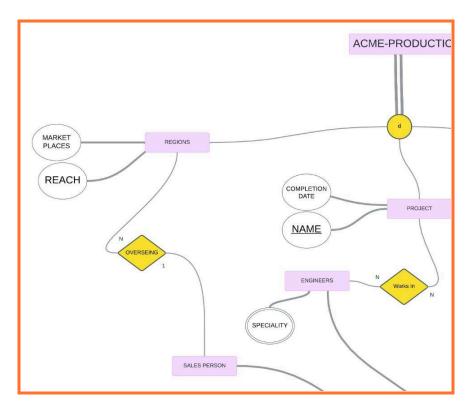
Fig 4.2 (partial EERD view-a)
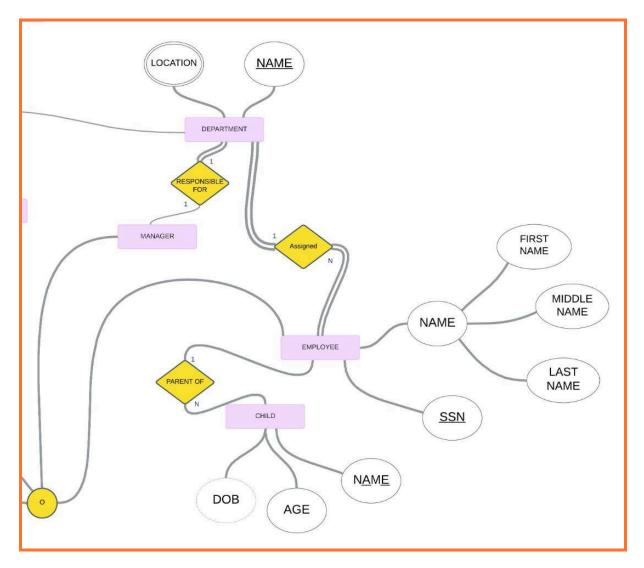
Fig 4.3 (partial EERD view-b)

# Question#5 - EERD

## ProximityConnect (EERD)

### Introduction

ProximityConnect is embarking on the development of a "Local Services Directory" Management Information System (MIS), aimed at revolutionizing the way people access essential local services such as drivers, technicians, electricians, plumbers, and more.

### Entities & Attributes

The following entities have the following attributes.

- Primary Users (super-class)
  Subclasses:
    - Service Seekers  (subclass)
    - Service Provider (subclass)

- Service Seekers
  Attributes:
    - CNIC (primary key)
    - Username (secondary key)
    - Zip Code (partial key)
    - Name (attribute)
    - Phone (partial key)
    - Market Places (attribute)
    - Reach  (attribute)
    - ACCOUNT (composite)
      Further Attributes:
        - Account number (partial key)
        - Account ID (primary key)
        - Card expiry date (multivalued)
        - Balance (multivalued)
        - CVV (attribute)

- Service Provider
  Attributes:
    - Location (multivalued)
    - Name (partial key)
    - CNIC (primary key)
    - Username (secondary key)
    - Zip Code (partial key)
    - Name (attribute)
    - Phone (partial key)

- Review
  Attributes:
    - Review ID (primary key)
    - Rating  (attribute)
    - Comment (multivalued)

- Booking
  Attributes:
    - Booking ID (primary key)
    - Booking date and time (multivalued)

- Payment
  Attributes:
    - Payment ID (primary key)
    - Amount (Attribute)
    - Payment date (multivalued)

- Payment Method (weak entity &sub- super-class)
  Subclasses:
    - CVV (sub-class)
      Attributes:
        - Receipt Number (Primary key)
    - Card (sub-class)
      Attributes:
        - Card Number (Primary Key)
        - Card Holder Name (secondary key)
        - Expiry date (multivalued)
    - Online (sub-class)
      Attributes:
        - Transaction ID (Primary key)

## Relationships

The EERD showcases the following relationships.

- Gives feedback (1:1:N)
    - Service Seeker : Review  : Service Provider
- Books (1:1:1)
    - Service Seeker : booking : Service Provider
- required upon completion (1:1:1)
    - Booking : Payment Method : Payment

## Normalization & Assumptions

The following normalization procedures and Assumptions have been made

- Ternary relationship structures have been established to conform with the nature of the problem
- Payment Method has been defined as a weak entity as they're definition was vague

## ERD representation
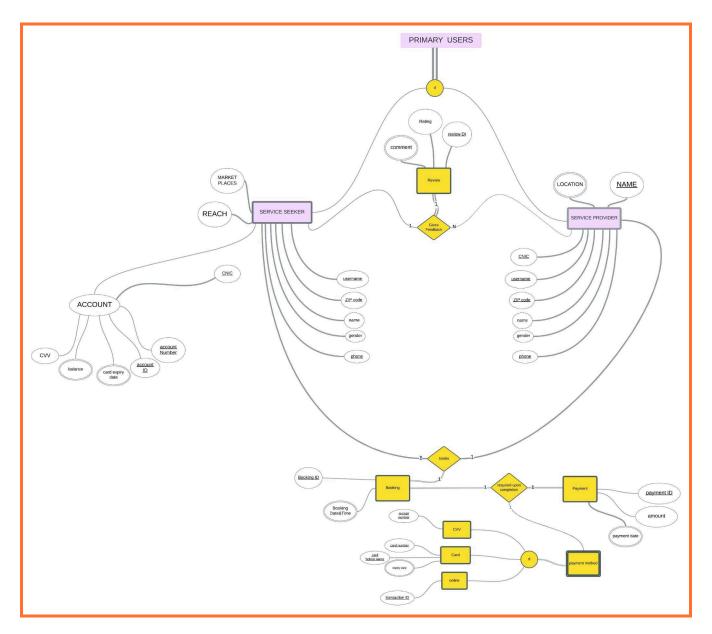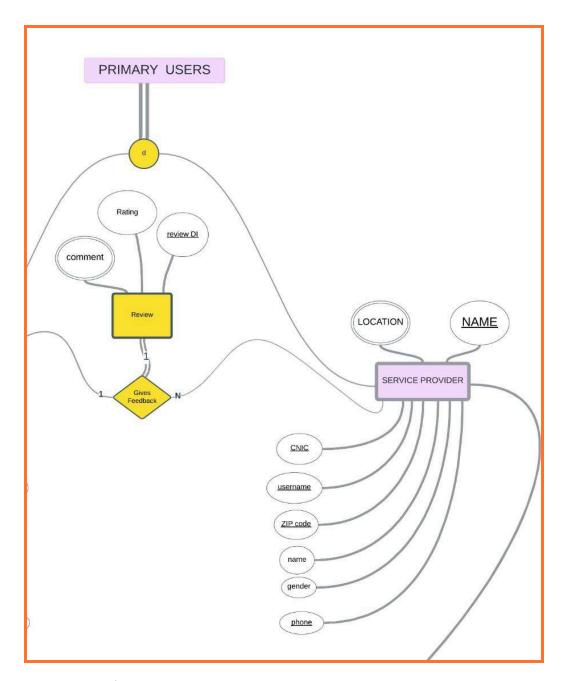
Put the pictures here…
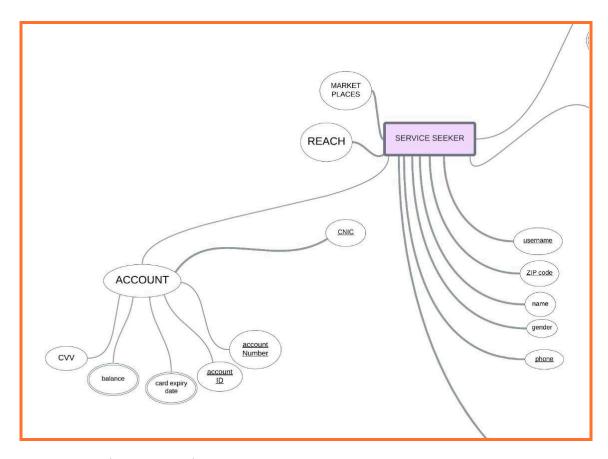
Fig 5.1 (full EERD view)

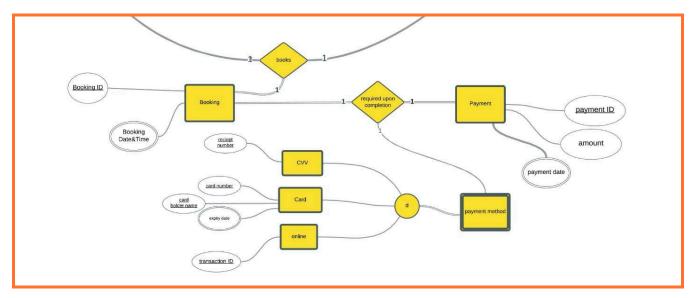Fig 5.2 (partial EERD view-a)

Fig 5.3 (partial EERD view-b)



Fig 5.4 (partial EERD view-c)

# Question#6 - EERD

**Interstellar Space Exploration Consortium | ISEC (EERD)**

## Introduction

Interstellar Space Exploration Consortium (ISEC). ISEC is a groundbreaking initiative that brings together multiple member organizations, advanced AI-driven spacecraft, and celestial bodies to embark on ambitious missions to explore distant galaxies, exoplanets, and celestial phenomena.

## Entities & Attributes

The following entities have the following attributes.

- ISEC - (superclass of this EERD)
  Attributes:
    - Celestial bodies (sub-class)
    - Mission (sub-class)
    - Member Organization (sub-class)

- MEMBER ORGANIZATION
  Attributes:
    - HQ-location (multivalued)
    - Founding Date (multivalued)
    - Organization ID (primary key)
    - Organization Name  (secondary key)

- COLLABORATION AGREEMENT
  Attributes:
    - ID (primary key)
    - Type (attribute)

- CELESTIAL BODIES (entity)
  Attributes:
    - Location Coordinates (multivalued)
    - Celestial Body ID (primary key)

- - Celestial Body Name (primary key)
    - Type (partial key)

- MISSION(super-class)
    - AI Driven Spacecraft (sub-class)
    - Celestial Bodies (sub-class)

- DATA
  Attributes:
    - Data ID (primary key)
    - Data Time Stamp (multivalued)
    - Data Content (multivalued)

- AI DRIVEN SPACECRAFT
  Attributes:
    - Launch date (attribute)
    - Manufacturer (attribute)
    - Propulsion type (multivalued)
    - Spacecraft ID (primary key)
    - Spacecraft name (secondary key)

- AI SYSTEM
  Attributes:
    - Manufacturer (attribute)
    - Name (attribute)
    - AI system ID (Primary key)

- MISSION CREW
  Attributes:
    - Crew ID (primary key)

- SCIENTIFIC INSTRUMENTS
  Attributes:
    - Instrument ID (primary key)
    - Type (attribute)
    - Instrument Name (attribute)

- INDIVIDUALS
  Attributes:
    - Crew ID (Primary key)
    - Crew member name (Partial Key)
    - Gender (attribute)

- ROLES (weak entity w/ specialized classes)
    - ENGINEER
        Attributes:
        - Specialization (attribute)
        - Experience (attribute)
        - Certification (attribute)
    - ASTRONAUT
        Attributes:
        - Training center (attribute)
        - Experience (attribute)
    - SCIENTIST
        Attributes:
        - Education (attribute)
        - Research Projects (attribute)
        - Field of Experience (attribute)

## Relationships

The EERD showcases the following relationships.

- Formalizing Partnership (N:1)
    - Member Organization : Collaboration Agreement
- Collaborate on Missions (N:1)
    - Member Organization : Mission
- Yield (1:N)
    - Mission : Data
- Exploration of (1:N)
    - AI Driven Spacecraft : Celestial Body
- Manufacture (1:N)
    - Member Organization : AI Driven Spacecraft
- Integrated into (1:1)
    - AI Driven Spacecraft : AI system
- Mounted on (1:1)
    - AI Driven Spacecraft : Mission crew
- Consist of (1:N)
    - Mission crew : Scientific Instruments / Individuals
- Consist of (1:1)

- ○ Individuals : Roles

## Normalization & Assumptions

The following normalization procedures and Assumptions have been made

- Ternary relationship structures have been established to conform with the nature of the problem
- Roles have been defined as a weak entity as they're definition was vague
- CrewID , is a shared Primary key between two entities as there is not enough data in the case study to clarify two unique and different IDs

## ERD representation

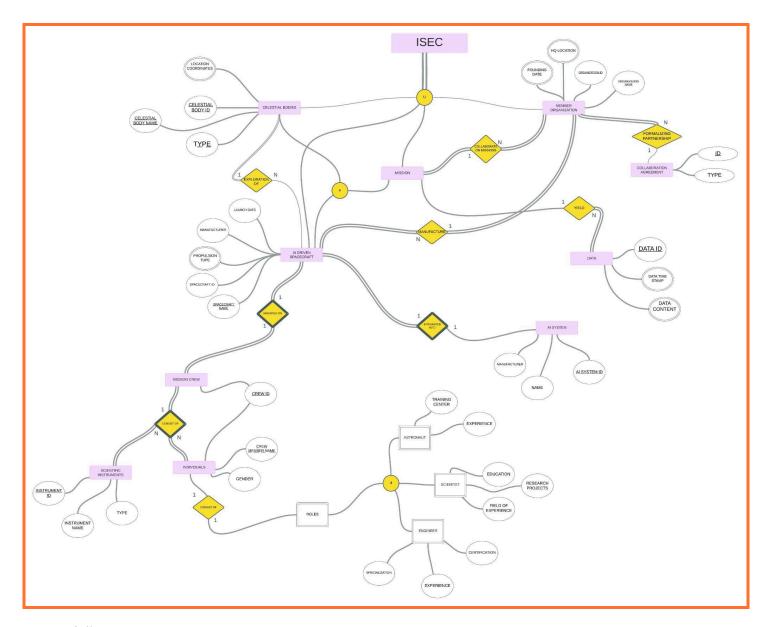Here are the images of the constructed EERD
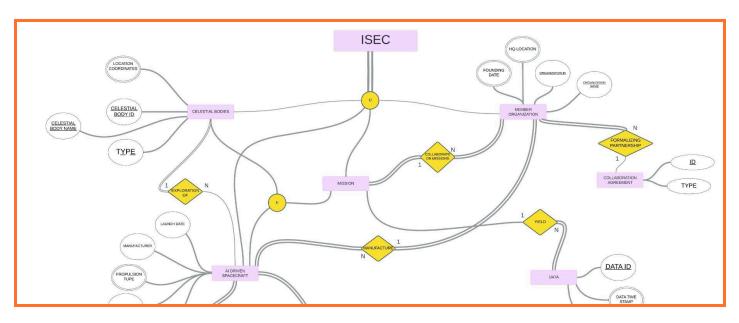
Fig 6.1 (full EERD view)
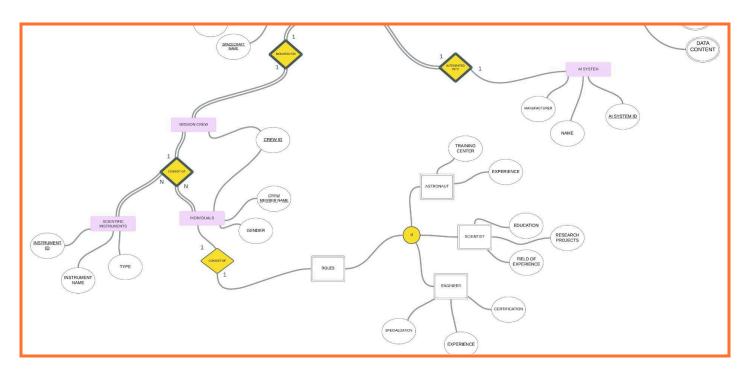
Fig 6.1 (partial EERD view-a)



Fig 6.1 (partial EERD view-b)

# Conclusion:

In conclusion, the process of designing both the Entity-Relationship Diagram (ERD) and Enhanced Entity-Relationship Diagram (EERD) has been instrumental in providing a structured blueprint for the database system. Through meticulous analysis of requirements, identification of entities and their attributes, definition of relationships, and normalization, the ERD and EERD have successfully captured the essential aspects of the problem domain.

The division of work is as follows

- Saffi Muhammad Hashir (22i-1293)
  - Divisions of work:
    - Q1 design+build+documentation
    - Q2 design+build+documentation
    - Q3 design+build+documentation
    - Q4,5 build

- Tauha Imran (22i-1239)
  - Divisions of work:
    - Q1,3 design
    - Q4 design+build+documentation
    - Q5 design+build+documentation
    - Q6 design+build+documentation

This process has not only equipped us with a deeper understanding of database design principles but has also underscored the significance of collaboration and iterative refinement in achieving robust and effective database solutions.