Experiment No.: 01

Title: Formulation of a problem definition and Drawing ER /EER diagram.

Batch: SY-IT (B2) **Roll No.: 16010423076** **Experiment No.: 01**

Aim: Formulation of a problem definition for specific real world DMS system and Drawing ER/EER diagram for the same.

Resources needed: MS-office

Theory:

Entity relationship model is a data model which represent the overall logical structure of database and it is very useful in mapping the meanings and interactions of real world enterprises onto a conceptual schema.

The E-R model employs three basic notations:

Entity sets: An entity set is a set of entities of the same type that share the same properties .(an entity is a real world object)

Relationship sets: Relationship set is a set of relationships of the same type.(relationship is an association among several entities)

Attributes: Attributes are properties of entity set used to describe it. Different types of attributes are composite, multivalued, derived and simple.

In **extended E R model** we have three additional concepts:

Specialization: The process of designating the subgroupings within an entity set is called specialization(finding specialized attributes)

e.g. in entity set person we have two types of entities like customer and employee. Both are person but employee have specialized attribute salary and customer have rating.

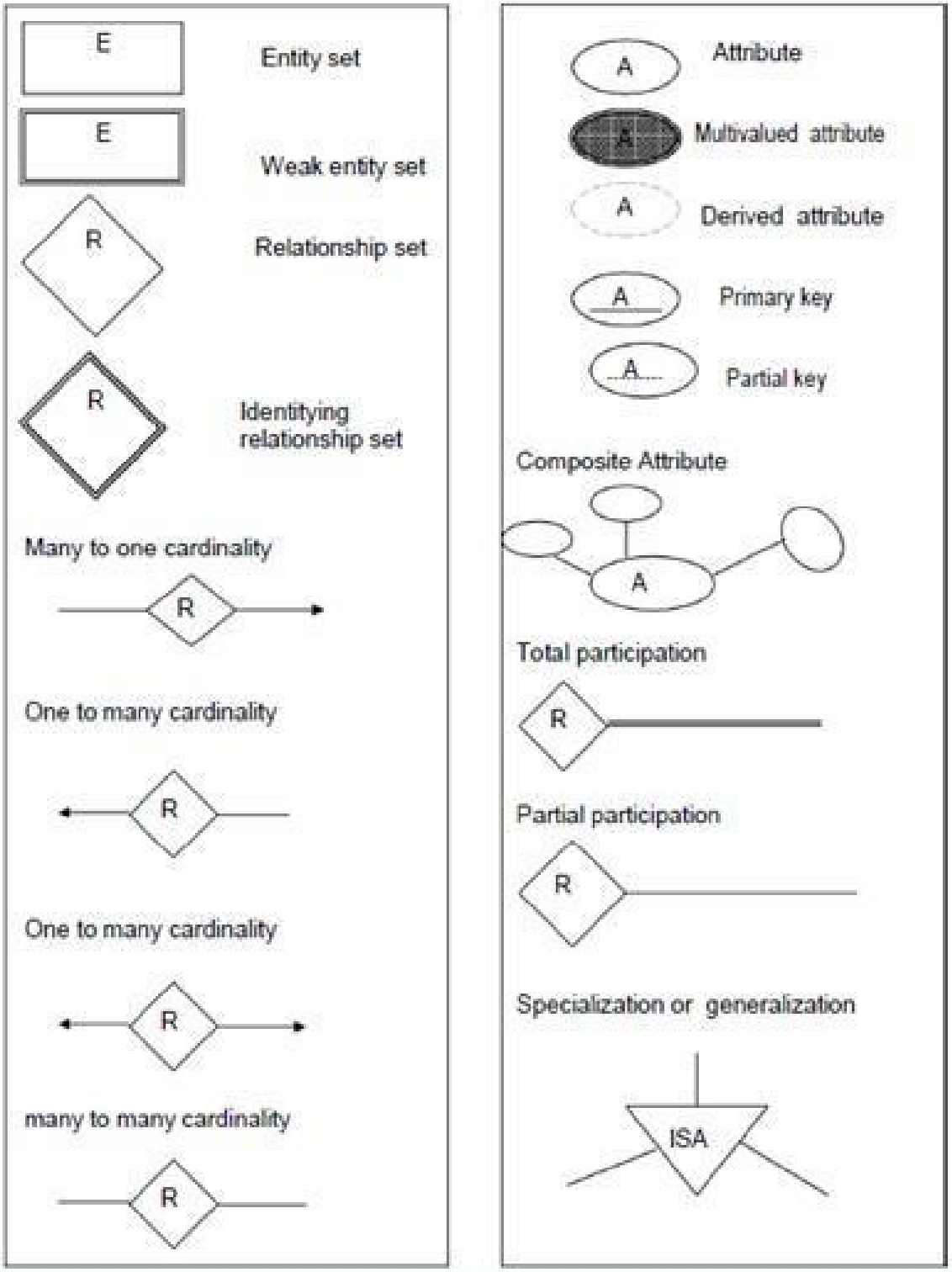
Generalization: It is a top down design process in which multiple entity sets are synthesized into a higher level entity set on the basis of common features.

e.g. customer entity set and employee entity set both have common attributes like name, address, age which can be used as attributes of higher level entity set person.

Aggregation: it is an abstraction through which relationships are treated as higher level entities.

The most important use of the E-R diagram is it represents some constraints like total and partial participation, one to one, many to many, many to one, one to many mapping etc.

Symbols used in EER diagram:



Procedure:

Identify the real world objects to start drawing the diagram

1. Entity – An real world object which can be converted into table name.
2. Entity type – It defines the collection of similar type of entities.
3. Attributes – Properties of entity which describes the entity. Attributes are of different types
    a. Atomic Attributes
    b. Composite Attributes
    c. Single valued attributes
    d. Multivalued Attributes
    e. Derived Attributes
4. Relationship – When one entity refers to another entity type a relationship exists between the two entities.
5. Relationship types – A relationship type R among n entity types defines a set of associations among entities of other types.
6. Weak entity – the entity depends on another entity is called as weak entity.
7. Specialization – this is process of defining a set of subclasses of an entity type .It is derived from a super class depending upon different attributes.
8. Generalization – It is the process of abstraction in which we suppress the differences among several entity types grouping some entities and eliminating common features. We generalize them into a single super class.
    a. Disjoint – In this, entity can be a member of any one of the subclass
    b. Overlap – In this, entity can be a member of more than one subclass.
    c. Total – All the entities are member of any one of the subclasses.
    d. Partial – Entity is not a member of any one the subclass.
9. Union – the subclass represent collection of objects.

This detailed problem statement gives the clarification about the database design.
This is tool to find out missing functional dependencies to convert the schema to the appropriate normal form.

Formulate the problem definition to get the detailed description of the problme domain so that entities can be easily identified from the problem definition.

There are many components used into EER.

1. First find out the real world objects as entities.
2. Find out the attributes which will describe the object.
3. Find the relationships and the participation constraints.
4. Apply object oriented fundamentals and get the specialization and generalization objects.
5. Draw the diagram.

Results: (Document printout/handwritten)

1. Problem definition
2. ER/EER diagram

Example:

Problem Definition for COMPANY database system

The company is organized into DEPARTMENTs. Each department has a name, number and an employee who *manages* the department. We keep track of the start date of the department manager.

Each department *controls* a number of PROJECTs. Each project has a name, number and is located at a single location.

It stores each EMPLOYEE's social security number, address, salary, gender, and birthdate. Each employee *works for* one department but may *work on* several projects. It keep track of the number of hours per week that an employee currently works on each project. We also keep track of the *direct supervisor* of each employee.

Each employee may *have* a number of DEPENDENTs. For each dependent, we keep track of their name, gender, birthdate, and relationship to employee.

Outcomes:

Problem Definition :

In many public bus systems, outdated methods lead to inefficiencies and inconvenience. The new app should address these issues by integrating modern functionalities.

USERS will need to securely *log in* using *personal details*, which involves storing user information and *login credentials*.

The app will feature real-time *GPS tracking* for BUSES, capturing *location* and *schedule data*. It should offer information on different BUSES and their *schedules*, linking BUSES with their respective *schedules*.

The app must include a *route planner* and *fare calculator*, providing details for *route planning* and *fare estimation*.

Efficient TICKET BOOKING will be a key function, involving details about *ticket bookings* and their association with USERS.

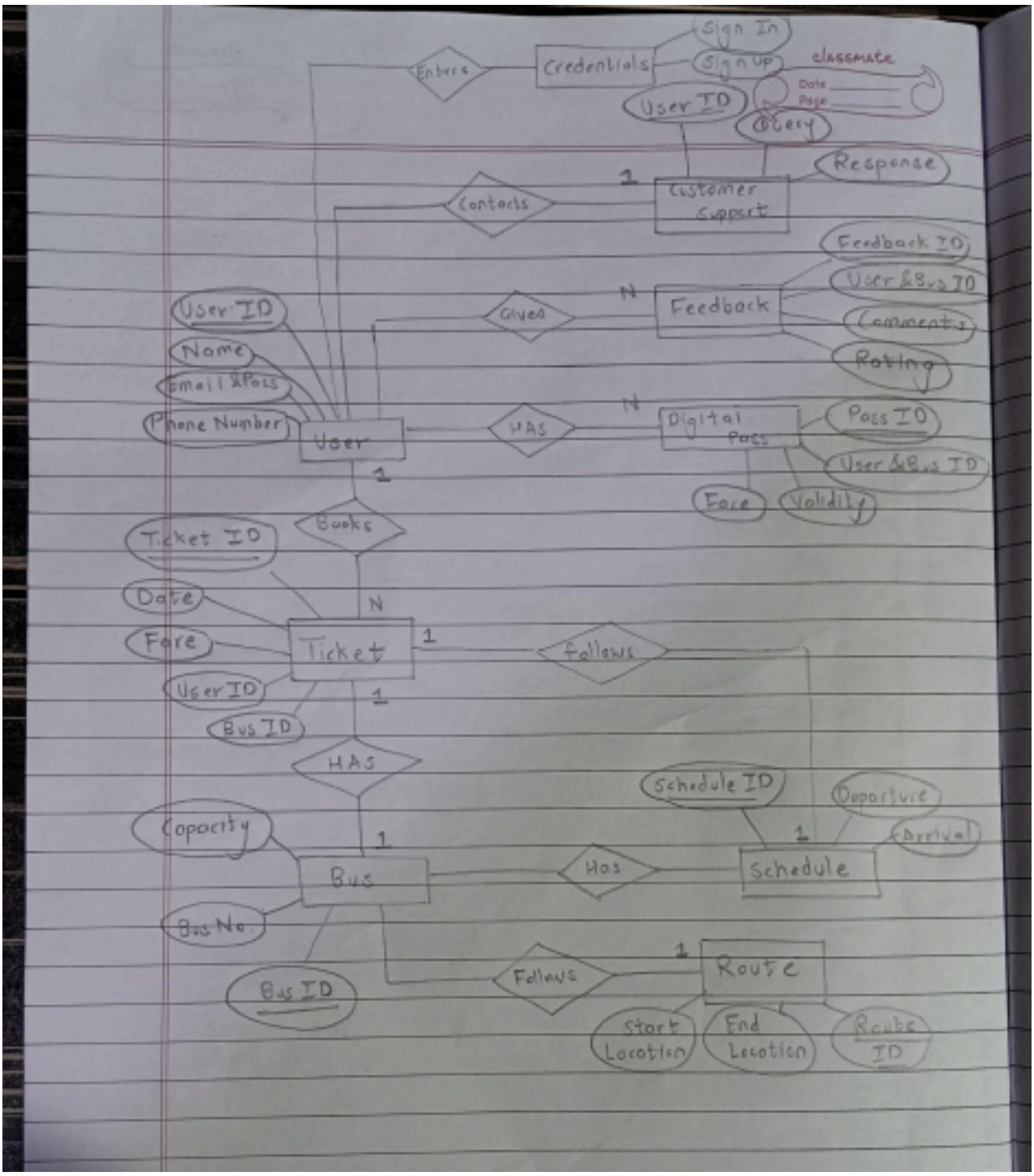
The app will also provide DIGITAL PASSES, replacing paper tickets, and connecting PASSES with USERS.

Additionally, a *feedback system* will allow USERS to share *experiences*, linking *feedback* with USERS and TICKETS.

In-app *customer support* and *secure logout* functionalities will enhance *user experience*, managing *support interactions* and *user sessions*.

These features combine to form a comprehensive system that improves bus commuting efficiency.

ER Diagram for problem statement :



Questions:

Q1 Explain total and partial participation with example

Total Participation

- Definition: Total participation occurs when every instance of an entity must be associated with at least one instance of another entity in a relationship.
- Notation: In ER diagrams, total participation is typically represented by a double line connecting the entity to the relationship.
- Example:

Consider the relationship between the entities Employee and Department where every employee must be assigned to a department. In this case, the participation of the Employee entity in the Works_In relationship is total. Every employee is associated with at least one department.

Partial Participation

- Definition: Partial participation occurs when some instances of an entity may not be associated with any instances of another entity in a relationship.
- Notation: In ER diagrams, partial participation is represented by a single line connecting the entity to the relationship.
- Example:

Consider the relationship between the entities Employee and ParkingSpot. Not every employee is assigned a parking spot. Here, the participation of the Employee entity in the Assigned_To relationship is partial. Some employees may have parking spots, while others may not.

Q2 differentiate between primary key and unique key

Primary Key:

- Uniquely identifies each record in a table.
- Cannot have `NULL` values.
- Only one primary key is allowed per table.

- Automatically creates a unique index on the column.

Unique Key:

- Also ensures all values in a column are unique.
- Can have one `NULL` value (in most databases).
- Multiple unique keys can be defined in a table.
- Also creates a unique index, but allows nulls.

Conclusion:
The transition from outdated methods to a modern app can greatly enhance public bus systems' efficiency and user experience. The problem definition outlines key functionalities like route planning, ticket booking, and digital passes, all crucial for a comprehensive and user-friendly system. Understanding ER concepts like total and partial participation helps in accurately modeling these functionalities, ensuring every entity's role is well-defined. Differentiating between primary and unique keys aids in designing a robust database structure, ensuring data integrity and uniqueness. Implementing these principles effectively will lead to a more efficient and user-centric public transportation system.

Reference books:

Elmasri and Navathe, "Fundamentals of Database Systems", 6th Edition, Pearson Hill Education

Korth, Slberchatz,Sudarshan, :"Database System Concepts", 6th Edition, McGraw

3. http://vlabs.iitkgp.ernet.in/se/4/