Lab 1 and Lab 2 – E R Diagram

Objective: To understand a given case study, notations used for ER Diagram and design the ER Diagram using a tool of following scenarios.

A Group of students (Max 2) will be assigned a case study (from Exercise -2 moderate level) to design the ER Diagram.

Student has to submit a file named as < Group No._Branch_Lab Group_Day1_2> with the complete solution.

Students have to submit the entities, relationships, constraints, details of relationship and constraints, individual diagrams of entities, relationships with constraints and a complete diagram in the file.

Exercise-1 (Basic Level)

Case Study 1:

Draw E-R diagrams to indicate the following relationships between entity set Operator and entity setMachine: - Each Machine can be operated by many Operators but each Operator can operate only one machine. An operator can operate many machine and each machine can be operated by many Operators.

Case Study 2:

An organization having a set of employees to execute a set of projects. Each employee may be workingonmore than one project, each project is managed by a manager and a manager is also one of the employees.

Case Study 3:

Preparation of time table of an Engineering College, catering for a number of Sections (Year/Branch/Section),a number of courses, a number of faculty members teaching the courses and a number of class rooms (ignorelabs).

Case Study 4:

Construct an E-R diagram for a car-insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents.

Case Study 5:

Consider a university database for the scheduling of classrooms for final exams. This database could be modelled as the single entity set exam, with attributes course-name, section-number, room-number, and time. Alternatively, one or more additional entity sets could be defined, along with relationship sets to replace some of the attributes of the exam entity set, as

• Course with attributes name, department, and c-number
• Section with attributes s-number and enrolment, and dependent as a weak entity set on course
• Room with attributes r-number, capacity, and building

Exercise-2 (Moderate Level)

Entity Relationship Model

Case Study 1:

Draw the ER diagram of airline Reservation Systems with the following details:-

FLIGHT_SCHEDULE (**FLT_NO**, FROM_PLACE, TO_PLACE, ETD, ETA)
AIRCRAFT (**AC_NO**, AC_TYPE, CAPACITY)
CREW (**CREW_ID**, CREW_NAME, DESIGNATION)
FLIGHT (**FLT_NO, DATE, AC_NO**, ATD, ATA)
FLT_CREW (**FLT_NO**, **DATE**, **CREW_ID**)
TICKET (**TICKET_NO**, ISSUE_DATE, FARE, P_NAME, P_ADDR, P_TEL_NO)
RESERVATION (**TICKET_NO**, **FLT_NO**, **DATE**, CONFIRMED, SEAT_NO)
CANCELLATION (**TICKET_NO**, **FLT_NO**, **DATE**, VOUCHER_NO, C_DATE)
REFUND (**VOUCHER_NO**, AMOUNT)

Case Study 2:

Draw the ER diagram of a College Management System with the following details:-

a. A college contains many departments
b. Each department can offer any number of courses
c. Many instructors can work in a department
d. An instructor can work only in one department
e. For each department there is a Head
f. An instructor can be head of only one department
g. Each instructor can take any number of courses
h. A course can be taken by only one instructor
i. A student can enrol for any number of courses
j. Each course can have any number of students

Case Study 3:

A university registrar's office maintains data about the following entities: (a) courses, including number, title, credits, syllabus, and prerequisites; (b) course offerings, including course number, year, semester, section number, instructor(s), timings, and classroom; (c) students, including student-id, name, and program; and (d) instructors, including identification number, name, department, and title. Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled. Construct an E-R diagram forthe registrar's office. Document all

assumptions that you make about the mapping constraints. and instructor. The entity set course-offering is a weak entity set dependent on course.
The assumptions made are:
a. A class meets only at one particular place and time. This E-R diagram cannot model a class meeting at different places at different times.
b. There is no guarantee that the database does not have two classes meeting at the same place and time.

Case Study 4:

Draw the Entity- Relationship Diagram (ERD) for the following scenario: A salesperson may manage many other salespeople. A salesperson is managed by only one salespeople. A salesperson can be an agent for many customers. A customer is managed by one salespeople. A customer can place many orders. An order can be placed by one customer. An order lists many inventory items. An inventory item may be listed on many orders. An inventory item is assembled from many parts. A part may be assembled into many inventory items. Many employees assemble an inventory item from many parts. A supplier supplies many parts. A part may be supplied by many suppliers.

Case Study 5:

Congratulations! You have gotten a job planning databases for the European Union. Your first on job assignment is to help the various countries maintain information about their inhabitants. Your model should capture the following information:
• In each country, there are provinces, which contain towns. There cannot be two provinces with the same name in a single country. Similarly, there cannot be two towns with the same name in a single province.
• People live in towns. Men and women work in a town. Children learn in a school in a town.
• A person can be a man, a woman, or a child, and has a first-name, last-name, id, and birthday. Children are any people under the age of 18.
• A man can be married to a woman (polygamy is not allowed, i.e., one man can be married only to one woman). Although the Pope strongly disapproves, divorce, and subsequent remarriage, is possible

For each marriage, store the date of the marriage and information about who are the children of the married couple. You should assume that the parents of a child were married at the time of his birth. Draw an entity relationship diagram to model the information described above. Remember to put edge constraints and participation constraints where needed. Underline the key attributes of each entity in the diagram. If you use the ISA relationship, state any covering and overlap constraints that hold. Make any necessary and logical assumptions. State any such assumptions clearly. If there are any constraints in the problem that could not be expressed in the diagram, state these clearly.

Case Study 6:

Suppose you are given the following requirements for a simple database for the National Hockey League (NHL):

- the NHL has many teams,
- each team has a name, a city, a coach, a captain, and a set of players,
- each player belongs to only one team,
- each player has a name, a position (such as left wing or goalie), a skill level, and a set of injury records,
- a team captain is also a player,
- a game is played between two teams (referred to as host_team and guest_team) and has a date (such as May 11th, 1999) and a score (such as 4 to 2).

Construct a clean and concise ER diagram. List your assumptions and clearly indicate the cardinality mappings as well as any role indicators in your ER diagram.

Case Study 7:

Assume we have the following application that models soccer teams, the games they play, and the players in each team. In the design, we want to capture the following:

- We have a set of teams, each team has an ID (unique identifier), name, main stadium, and to which city this team belongs.
- Each team has many players, and each player belongs to one team. Each player has a number (unique identifier), name, DoB, start year, and shirt number that he uses.
- Teams play matches, in each match there is a host team and a guest team. The match takes place in the stadium of the host team.
- For each match we need to keep track of the following:
    - The date on which the game is played
    - The final result of the match
    - The players participated in the match. For each player, how many goals he scored, whether or not he took yellow card, and whether or not he took red card.
    - During the match, one player may substitute another player. We want to capture this substitution and the time at which it took place.
- Each match has exactly three referees. For each referee we have an ID (unique identifier), name, DoB, years of experience. One referee is the main referee and the other two are assistant referee.

Case Study 8:

A university database contains information about professors (identified by social security number, or SSN) and courses (identified by course_id). Professors teach courses; each of the following situations concerns the Teaches relationship set. For each situation, draw an ER diagram that describes it (assuming that no further constraints hold).

- Professors can teach the same course in several semesters, and each offering must be recorded.
- Professors can teach the same course in several semesters, and only the most recent such offering needs to be recorded (assume this condition applies in all subsequent questions)

- Every professor must teach some course.
- Every professor teaches exactly one course.
- Every professor teaches exactly one course and every course must be taught by some professor.
- Now suppose that certain courses can be taught by the team of professors jointly, but it is possible that no one professor in a team can teach the course.

Case Study 9:

Consider the following information about the university data base

- Professors have an SSN, a name, an age, a rank and a research specialty.
- Projects have a project number, a sponsor name, a starting date and ending date and the budget.
- Graduate students have an SSN, a name, an age and a degree program (MS or PhD).
- Each project is managed by one professor (known as the project's principal investigator).
- Each project is work on by one or more professors (known as the project's coinvestigators).
- Professors can manage and /or work on multiple projects.
- Each project is work on by one or more graduate students (known as the project's research assistants)
- When graduate student work on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have supervisor for each one (potentially different).
- Departments have a department no., a department name and main office.
- Departments have a professor known as a (chairman) who runs the department.
- Professor's work in one or more departments, and for each department that they work in, a time percentage is associated with their job.
- Graduate students have one major department in which they are working on their degree.
- Each graduate student has another, more senior graduate student (known as a student advisor) who advises him or her on what courses to take.

Design and draw an ER diagram for the following collection of data. Use only the basic ER model here, i.e., entities relationships and attributes. Be sure to indicate any key and participation constraints.

Case Study 10:

A Company has several business units. Each business unit has multiple projects. Employees must be assigned to one business unit. One or more employees are assigned to a project, but an employee may be on vacation and not assigned to any projects. One of the assigned employees will be project manager for that project.

Case Study 11:

In a hospital there are different departments. Patients are treated in these departments by the doctors assigned to patients. Usually each patient is treated by a single doctor, but in rare cases they will have two or three. Healthcare assistants will also attend to patients; every department has many healthcare assistants. Each patient is required to take a variety of drugs during different parts of the day such as morning, afternoon and night.

Case Study 12:

A toy manufacturing company manufactures different types of toys. The company has several manufacturing plants. Each plant manufactures different types of toys. A customer can place the order for these toys. Each order may contain one or more toys. Each customer has multiple ship-to addresses. To promote the business, the company offers different schemes based on the order value.Survey and extend the business rules for your company to design a perfect ER model.

Case Study 13:

Draw an ER Diagram for the following scenario:

- There are several companies which provide DMAT Account for trading of shares
- Each company has different branches in different cities
- Each branch has many customers
- One customer should take only one account in a company
- One customer can take multiple accounts with different companies

Case Study 14:

Create an ERD for a car dealership. The dealership sells both new and used cars, and it operates a service facility. Base your design on the following business rules:

- A salesperson may sell many cars, but each car is sold by only one salesperson.
- A customer may buy many cars, but each car is bought by only one customer.
- A salesperson writes a single invoice for each car he or she sells.
- A customer gets an invoice for each car he or she buys.
- A customer may come in just to have his or her car serviced; that is, a customer need not buy a car to be classified as a customer.
- When a customer takes one or more cars in for repair or service, one service ticket is written for each car.
- The car dealership maintains a service history for each of the cars serviced. The service records are referenced by the car's serial number.
- A car brought in for service can be worked on by many mechanics, and each mechanic may work on many cars.
- A car that is serviced may or may not need parts (e.g., adjusting a carburetor or cleaning a fuel injector nozzle does not require providing new parts).

Case Study 15:

The following is a description of some data requirements for a chain of pharmacies. Draw the appropriate entity-relationship (E-R) diagram. Clearly show all cardinality constraints, cardinality limits, and existence dependencies.

(a) A pharmaceutical company manufactures one or more drugs, and each drug is manufactured and marketed by exactly one pharmaceutical company.

(b) Drugs are sold in pharmacies. Each pharmacy has a unique identification. Every pharmacy sells one or more drugs, but some pharmacies do not sell every drug.

(c) Drug sales must be recorded by prescription, which are kept as a record by the pharmacy. A prescription clearly identifies the drug, physician, and patient, as well as the date it is filled.

(d) Doctors prescribe drugs for patients. A doctor can prescribe one or more drugs for a patient and a patient can get one or more prescriptions, but a prescription is written by only one doctor.

(e) Pharmaceutical companies may have long-term contracts with pharmacies and a pharmacy can contract with zero, one, or more pharmaceutical companies. Each contract is uniquely identified by a contract number.

Case Study 16:

Suppose that you are designing a schema to record information about reality shows on TV. Your database needs to record the following information:

- For each reality show, its name, genre, basic_info and participants name. Any reality show has at least two or more participants.
- For each producer, the company name, company country. A show is produced by exactly one producer. And one producer produces exactly one show.
- For each television, its name, start year, head office. A television may broadcasts multiple shows. Each show is broadcasted by exactly one television.
- For each user, his/her username, password, and age. A user may rate multiple shows, and a show may be rated by multiple users. Each rating has a score of 0 to 10.

Draw an entity relationship diagram for this database.

Case Study 17:

Construct an ER Diagram for Company having following details:

• Company organized into DEPARTMENT. Each department has unique name and a particular employee who manages the department. Start date for the manager is recorded. Department may have several locations.

• A department controls a number of PROJECT. Projects have a unique name, number and a single location.

• Company's EMPLOYEE name, ssno, address, salary, sex and birth date are recorded. An employee is assigned to one department, but may work for several projects (not necessarily controlled by her dept). Number of hours/week an employee works on each project is recorded; the immediate supervisor for the employee.

• Employee's DEPENDENT are tracked for health insurance purposes (dependent name, birthdate, relationship to employee).

Case Study 18:

The following are the requirements for the Gym Fitness Database

• For each MEMBER we keep track of the unique MemdID, a well as Name, Zip, and the Date the membership was paid
• For each MEMBERSHIP type we keep track of the unique Mid, as well as MName and Price
• For each PASS CATEGORY we keep track of the unique PassCatID, as well as PCName and Price
• For each ONE DAY PASS we keep track of the unique PassID and Date
• For each MERCHANDISE item we keep track of the unique MrchID, as well as Name and Price
• For each sale TRANSACTION we keep track of the unique Tid and Date
• Each member pays for exactly one membership type; each membership type has at least one member but can have many members
• Each member can buy many day passes but does not have to buy any, each day pass was bought by exactly one member
• Each day pass belongs to exactly one pass category; a pass category can have many individual day passes issued for it but does not have to have any
• Each sale transaction involves exactly one member; each member can be involved in many sale transactions but does not have to be involved in any
• Each merchandise item is sold via at least one sale transaction but it can be sold via many sale transactions; each sale transaction involves at least one merchandise item but can involve many merchandise items
• Every time a merchandise item is sold via a sale transaction, we keep track of the quantity (how many instances of that particular merchandise item were sold via that particular sale transaction)
Your task is to create and ER Diagram based on these requirements.

Bonus Case Study:

You have been asked to develop a new Course Registration System for a college. The college wants a web-based system to replace its manual system. The college provides education in the various streams. In any stream, the entire graduation is divided into semesters.

The new system should allow the aspirants to submit their applications online. Once their applications have been approved and they have been admitted into the college in a Branch, the system should send an automatic welcome email along with the login id and the password

to the email addresses of the students. The email address is specified as part of the application. For students without any email address, the system shall print the welcome letters to be posted. Each Branch will have a set of courses, which are mandatory, and a certain number of elective courses.

At the beginning of the semester, the Head of the Department will create the necessary classes and do the allocation of lecturers to the classes for his department. The HOD may make changes in the allocation during the progress of the course. The system maintains a history of all the instructors who have conducted the classes throughout the semester.

The instructor will use the system to update the marks of the student (project, assignment, internal test marks and the semester end examination marks). The instructor will also mark the attendance of the students through the system.

The student can view his / her marks and attendance through the system.

In addition to the above, the system also keeps track of the residential status of the student. The student may be a hostelite or a day scholar. If he is a hostelite, the system will maintain his / her hostels name, room number and the fees pertaining to the same.