ER

Powered By

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1.

Suppose that a database is needed to keep track of student enrollments in classes and students' final grades.
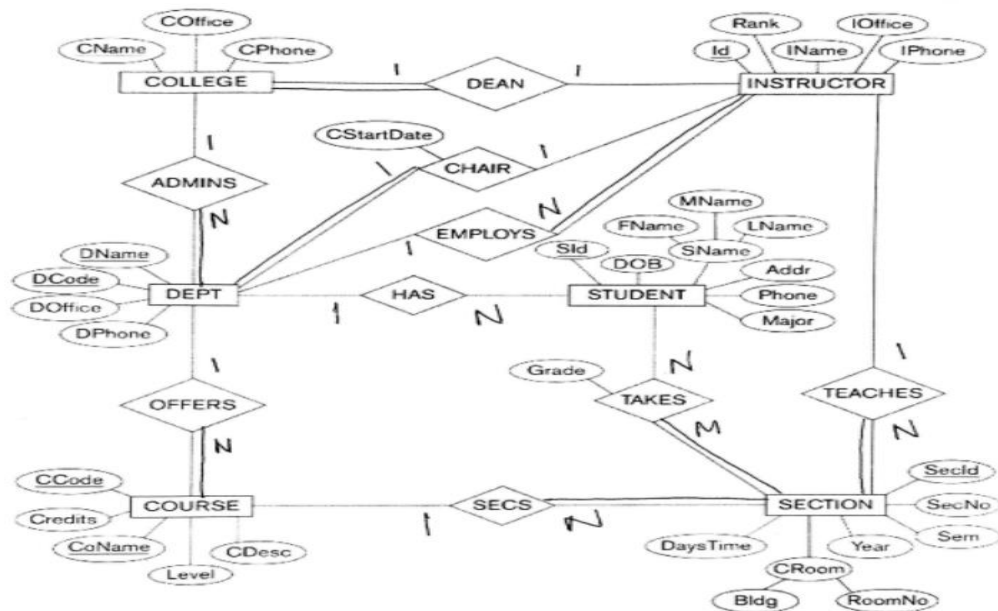
The university is organized into colleges (COLLEGE), and each college has a unique name (CName), a main office (COffice) and phone (CPhone), and a particular faculty member who is dean of the college. Each college administers a number of academic departments (DEPT). Each department has a unique name (DName), a unique code number (DCode), a main office (DOffice) and phone (DPhone), and a particular faculty member who chairs the department. We keep track of the start date (CStartDate) when that faculty member began chairing the department.

A department offers a number of courses (COURSE), each of which has a unique course name (CoName), a unique code number (CCode), a course level (Level: this can be coded as 1 for freshman level, 2 for sophomore, 3 for junior, 4 for senior, 5 for MS level, and 6 for PhD level), a course credit hours (Credits), and a course description (CDesc). The database also keeps track of instructors (INSTRUCTOR); and each instructor has a unique identifier (Id), name (IName), office (IOffice), phone (IPhone), and rank (Rank); In addition, each instructor works for one primary academic department.

The database will keep student data (STUDENT) and stores each student's name (SName, composed of first name (FName), middle name (MName), last name (LName)), student id (Sid, unique for every student), address (Addr), phone (Phone), major code (Major), and date of birth (DoB). A student is assigned to one primary academic department. It is required to keep track of the student's grades in each section the student has completed.

Courses are offered as sections (SECTION). Each section is related to a single course and a single instructor and has a unique section identifier (SecId). A section also has a section number (SecNo: this is coded as 1, 2, 3, . . . for multiple sections offered during the same semester/year), semester (Sem), year (Year), classroom (CRoom: this is coded as a combination of building code (Bldg) and room number (RoomNo) within the building), and days/times (DaysTime: for example, 'MWF 9am-9.50am' or 'TR 3.30pm-5.20pm'— restricted to only allowed days/time values). (Note: The database will keep track of all the sections offered for the past several years, in addition to the current offerings. The SecId is unique for all sections, not just the sections for a particular semester.) The database keeps track of the students in each section, and the grade is recorded when available (this is a many-to-many relationship between students and sections). A section must have at least five students.

Draw an ER Diagram which meets the above requirements. Use regular notation to denote relationship structural constraints (Cardinality Ratio and Existence Dependency Constraint). State clearly any assumptions you make.

An ER diagram for a UNIVERSITY database schema.

2.

Question 1:

You have been assigned by a startup to assist in designing and implementing a database system for an app named "Bookworms". Develop an Entity-Relationship (ER) diagram based on the data requirements below:

- The app involves readers, individuals having their unique readerID, name, multiple contact numbers, and email addresses stored within the database. Each email is composed of an initial and a domain.

- Additionally, the app includes authors. Authors have a unique authorID, name, a brief biography, and awards stored in the system.

- Readers can own multiple books, and each book, identified by ISBN_no and copy_no, has info like title, genre, price and publication year. Books can have contributions from multiple authors, and every author must have written at least one book.

- The app also incorporates information about book clubs. Book clubs have a unique clubID, a name, and details about the club's genre preference. A book club must have multiple members, and a reader must belong to at least one book club.

- A book club organizes multiple reading sessions, each with a unique serial number (such as 1, 2, 3,...) within the club. While sessions in different clubs can have the same serial number, within the same club, they are unique. Reading sessions also have a budget, multiple discussion points, themes and notes, and a designated chair of the reading session.

- Readers join different reading Sessions, and we keep track of when they join using a timestamp composed of the date and time. Also readers get points for joining a reading Session.

- Additionally, readers can be reading partners to each other.

- Readers can borrow books, and details like borrowDate, returnDate, and the specified timespan for borrowing are recorded. Each transaction involves a reader borrowing one or more books and the same book can be borrowed by multiple readers over a period of time. While borrowing books, readers have to pay a certain amount. The amount is calculated from the price of the book and the point stored for the reader.

Design an ER diagram for the Book Club Management app, adhering to the provided data requirements and incorporating appropriate symbols for relationships and entities.
Do not assume any attributes/entities/relationships/multivalued/composite other than the ones mentioned above. For participation constraints/cardinality ratios, if they are not hinted at in the question, you may assume according to your logical reasoning.
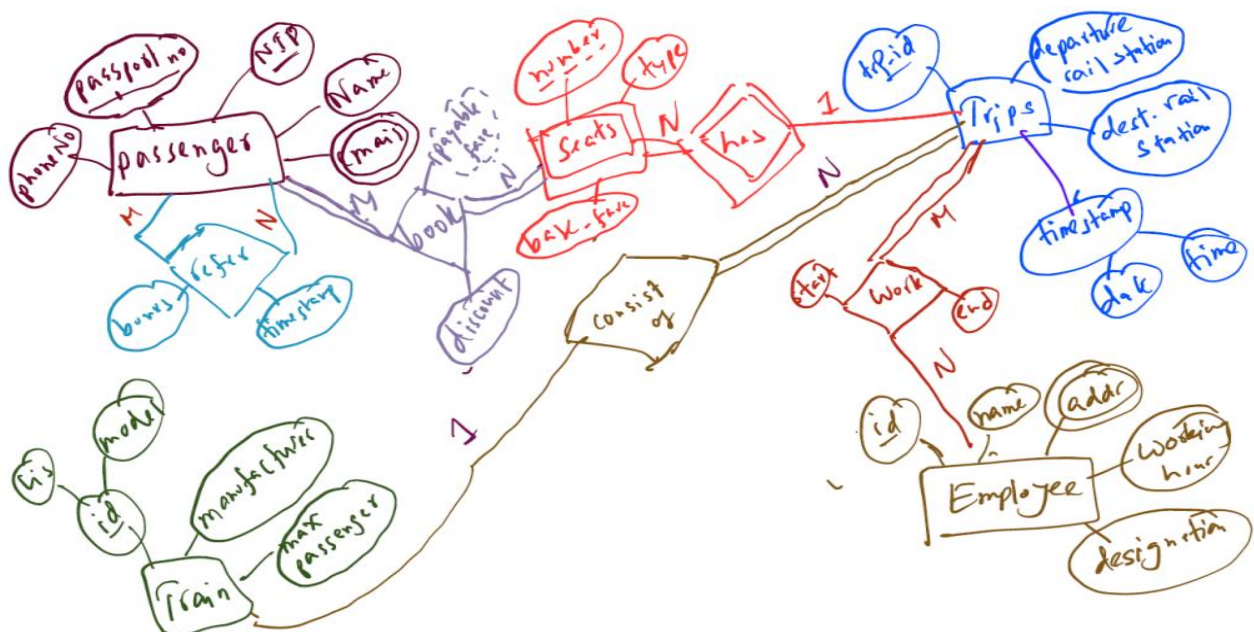
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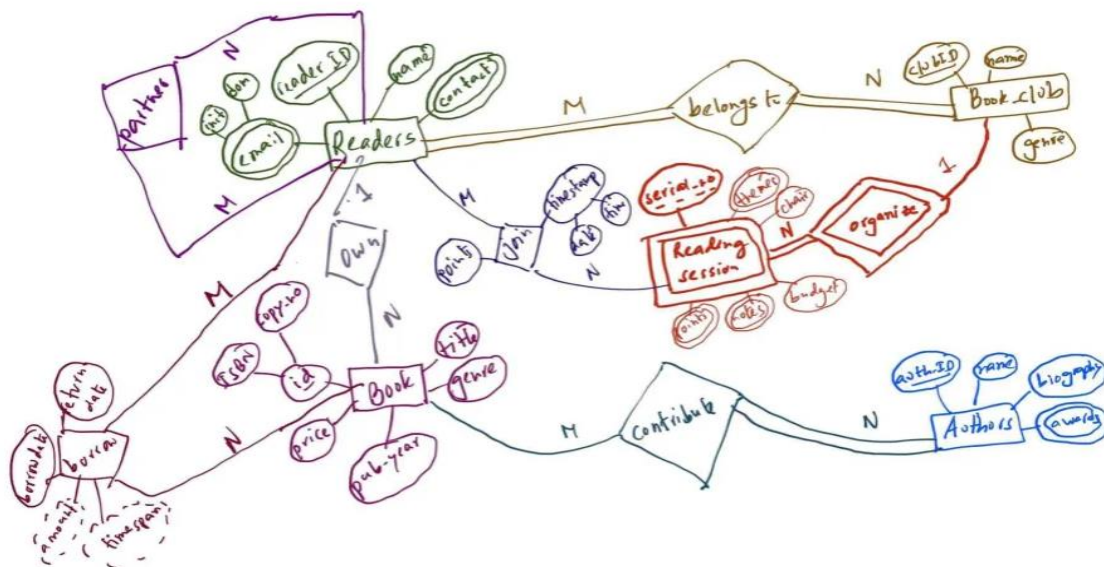
A startup has hired you to help design and set up a database system for an Bangladeshi Railway management system. Construct an ER diagram based on the following data requirements:

- There are several passengers in the system. Passengers have a unique Passport number, unique NID, Name, a phone number, and multiple email addresses, which can be stored in the database.

- Multiple trips are offered by the railway. Trips are characterized by their unique trip_id, a departure rail-station, a destination rail-station, and a departure timestamp (composed of date and time).

- The Railway system also owns multiple trains. A train is identified by a license number and a model number. Also, manufacturer and maximum passenger capacity for a train are stored.

- Many employees work for the railway system. An employee has a unique employee id, name, address, working hours, and designation.

- A trip must consist of exactly one train. One train may be used for several trips.

- Multiple employees work on the trip. Moreover, the timestamp is recorded when employees start and end their shifts for a particular trip. The same employee can be assigned to different trips at different times.

- A trip must have at least one seat. A seat has attributes such as a seat number, type, and a base fare. Note that different seats in different trips can have the same seat numbers, but in the same trip, the numbers will not be the same (such as 1, 2, 3, and so on).

- Passengers can book any number of seats. After booking a seat, any discount amount and payable fare are required. The payable fare of the seat can be calculated from the base fare and discount amount, so it does not need to be stored in the database. However, it is an important attribute and should be shown in the diagram using an appropriate symbol.

- Passengers can also refer to each other. For a particular referral, a bonus point and timestamp are stored.

Do not assume any attributes/entities/relationships/multivalued/composite other than the ones mentioned above. For participation constraints/cardinality ratios, if they are not hinted at in the question, you may assume according to your logical reasoning.

4.

Question 1 :   **[10 points]**

A startup has hired you to help design and set up a database system for a Bangladeshi airline company. **Construct** an ER diagram based on the following data requirements:

- There are several passengers in the airline. Passengers have a unique passport number, unique NID, Name, a phone number, and multiple email addresses which can be stored in the database.
- Flights are offered by the airline. Flights are characterized by their unique flight id, a departure airport, a destination airport and a departure timestamp (which is composed of date and time),
- An airline also owns multiple aircrafts. An aircraft is attributed by a unique license number, model number, manufacturer and maximum passenger capacity.
- Many employees work for the airline company. An employee has a unique employee id, name, address, flying hours and designation.
- A flight must use exactly one aircraft. One aircraft may be used for several flights.
- Several employees work on the flight. Moreover, the timestamp is recorded when employees start and end their shifts for a particular flight. The same employee can be assigned to different flights at different times.
- A flight must have at least one seat. A seat has attributes such as a seat number, type and a base fare. Note that different seats in different flights can have the same seat numbers, but in the same flight the numbers will not be the same (such as 1, 2, 3 and so on).
- Passengers can book any number of seats. After booking a seat any discount amount and the payable fare is required. The payable fare of the seat can be calculated from the base fare and discount amount, so it does not need to be stored in the database. However, it is an important attribute and should be shown in the diagram using an appropriate symbol.
- Passengers have the ability to refer other passengers to the airline company. When one passenger successfully refers to another passenger, both the referrer and the referred passenger earn points, which are recorded and stored in the database.

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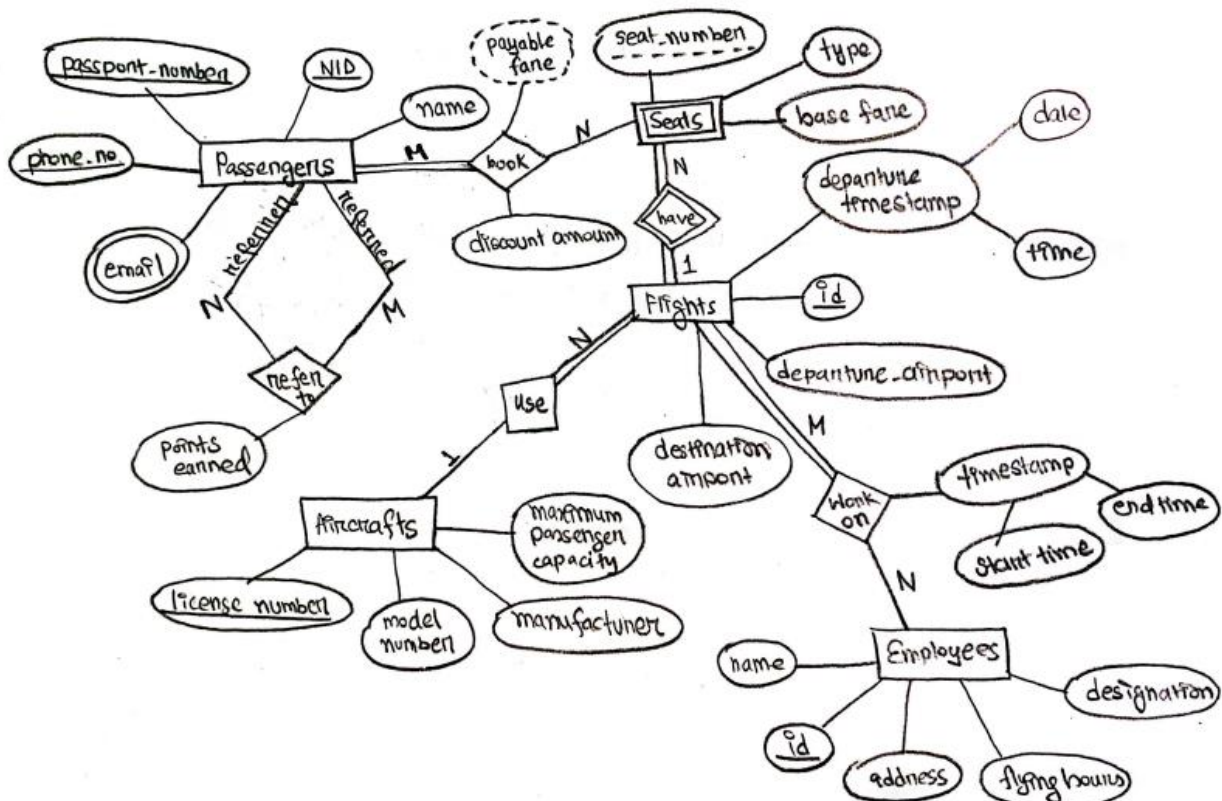
5.

Question 1: Design an Entity-Relationship (ER) diagram for a database that stores information about "Web Series." Create the ER diagram based on the following data requirements: [10 points]

- A web series is characterized by its title and year of release. It also has attributes for the budget and nominations received for various awards. A web series can have multiple directors.

- Web series consists of multiple episodes, each uniquely identified by an episode number. Note that the same episode number can exist in different web series. For each episode, we want to store the release date, viewer rating and duration.

- Actors are cast in several web series. Each actor is uniquely identified by their name and date of birth and has attributes including SSN, phone numbers, emails, and a set of addresses (comprising house number, road number, city, and country). When an actor is cast in a web series, a role and script are assigned to them. Each actor must be cast in at least one web series.

- Actors can appear in different episodes. For each appearance in an episode, actors have a payment per unit time, and we also store the total unit of time they have worked in each episode. This allows us to calculate the total payment for a particular episode for each actor.

- Actors can mentor or groom other actors. An actor can be mentored by multiple other actors.

- There are production companies, and each production company is responsible for producing at least one web series. A web series is produced by a single production company. Each production company is uniquely identified by its title and license number and may have a set of directors associated with it.

- Each web series may be adapted from one or more novels, while a novel can serve as the source material for multiple web series. For each novel, we store the unique title of the novel, its authors and publisher. For each adaptation, we need to record the adaptation type (e.g., faithful adaptation or creative interpretation).

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6.
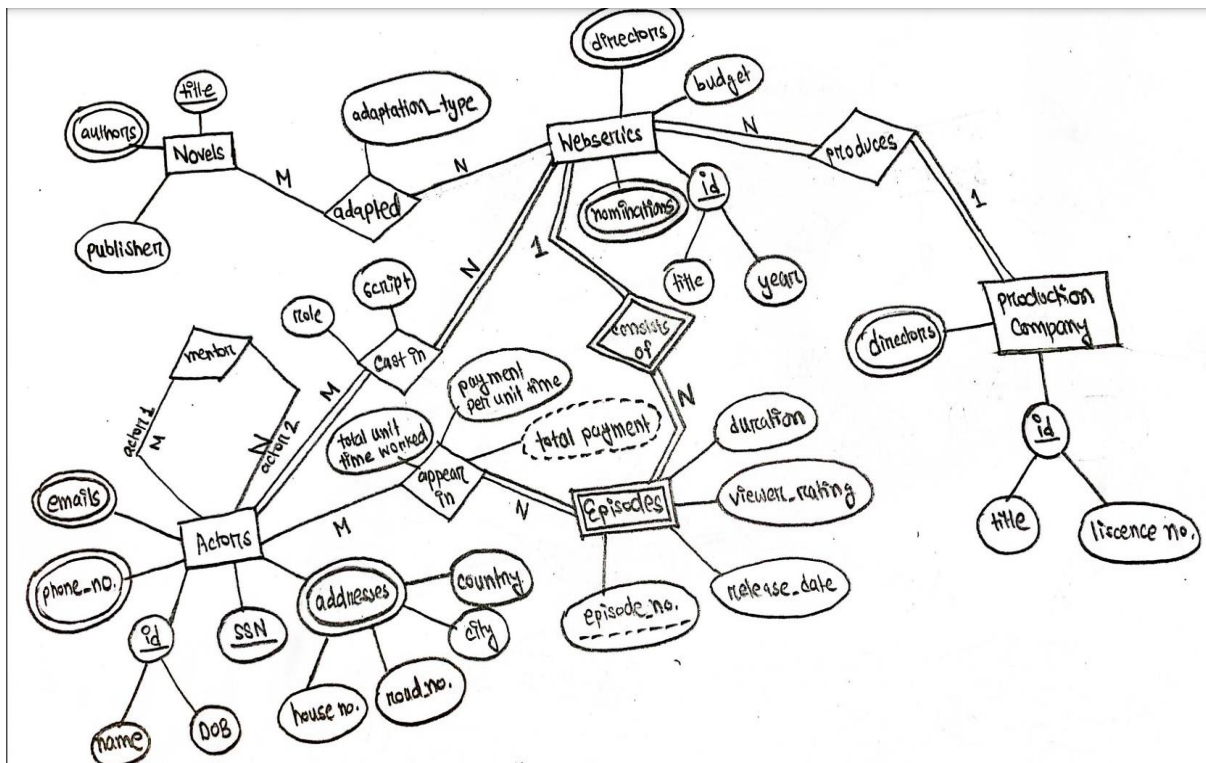
You are to design a Hospital database. So before creating the database, your task is to design the ER diagram based on the following data requirements:

  a. The hospital has departments. Each department has a name, department ID, location. Location consists of floor number and wing number (which will contain the values North, South, East or West).
  b. Doctors work for the department. Doctors have license number, name, title, multiple specializations. Some doctors supervise other doctors.
  c. A patient will have a name, unique ID, may have more than one phone number, age, height, weight and symptoms.
  d. Patients take appointments from doctors. Appointment date and time is recorded.
  e. A patient may have an attendant. An attendant will have his/her name and relationship with the patient as a record in the database. The hospital allows 1 attendant with each patient.

Write down any assumptions you may have made.

3.
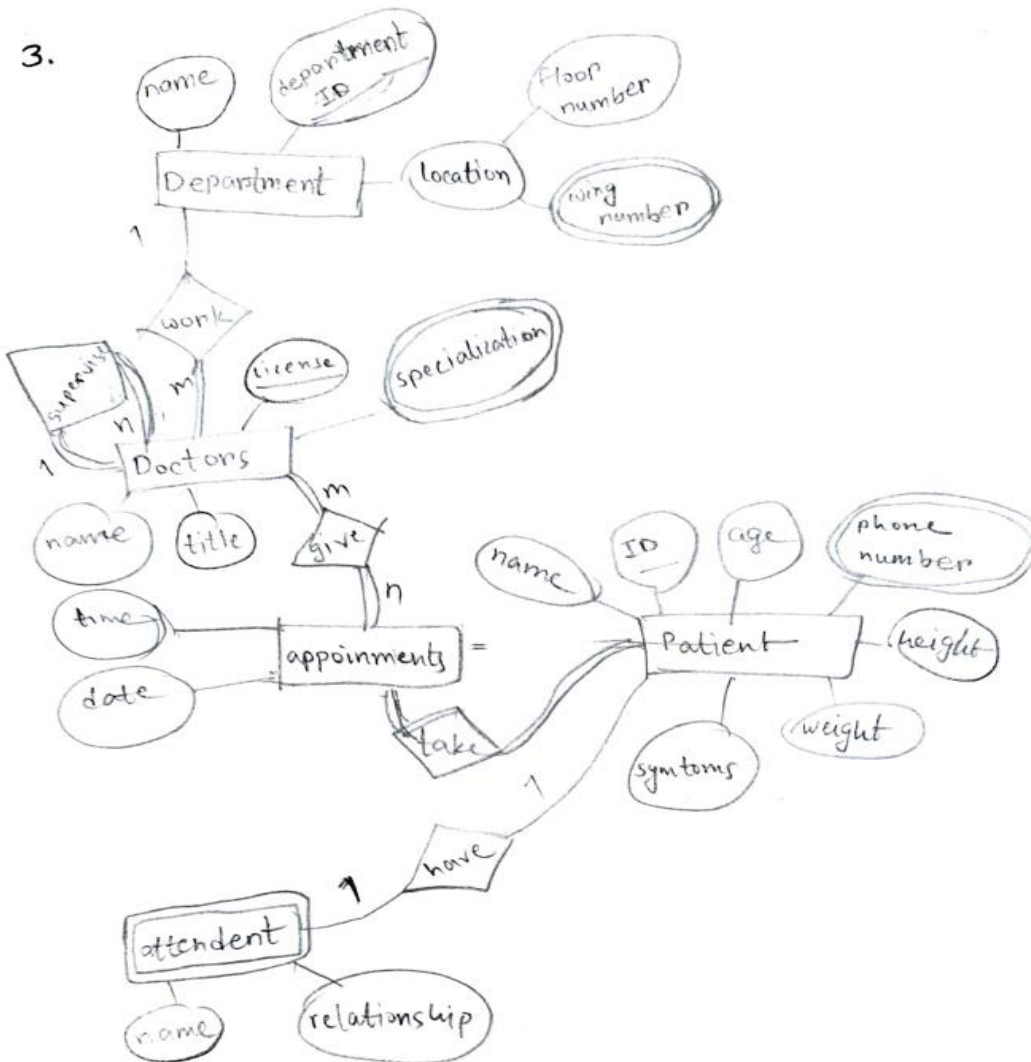
7.

2. **[CO2]** Complete the following ER diagram with the proper scenario. Do not modify the given structure [Entity, attribute, relationship etc.]. Moreover, you must impose the constraints according to your scenario and modify the given ER diagram accordingly. You need to write down the scenario based on your ER diagram. **[7 marks]**
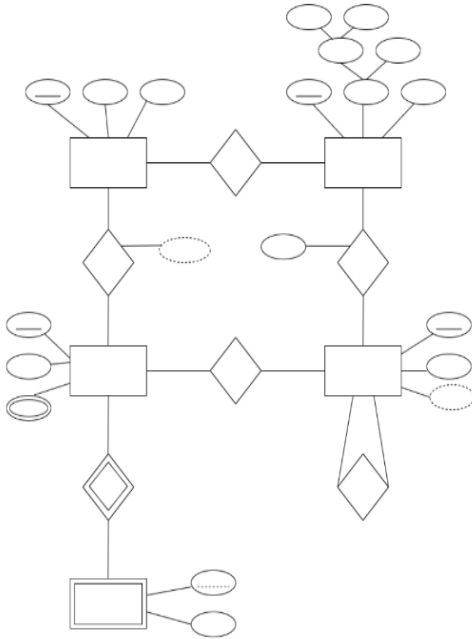
2. A Library Management System database keeps track of readers with the following considerations —

• A publisher has unique publisher ID, name, year of publish. Publisher published books. Book has it's ISBN, author details (name, nationality) and title. Author name has also two attribute — first name and last name.

On a fixed date books are reserved for Readers. Each reader has unique ID, name and age but age is not stored in database. Sometime reader suggest books to each other. There are staff who keep track of all reader. Each staff has an unique ID, name and multiple phone number. Staff rate publisher and give some point which is not store in database. Staff can login to an application system which has password and name.
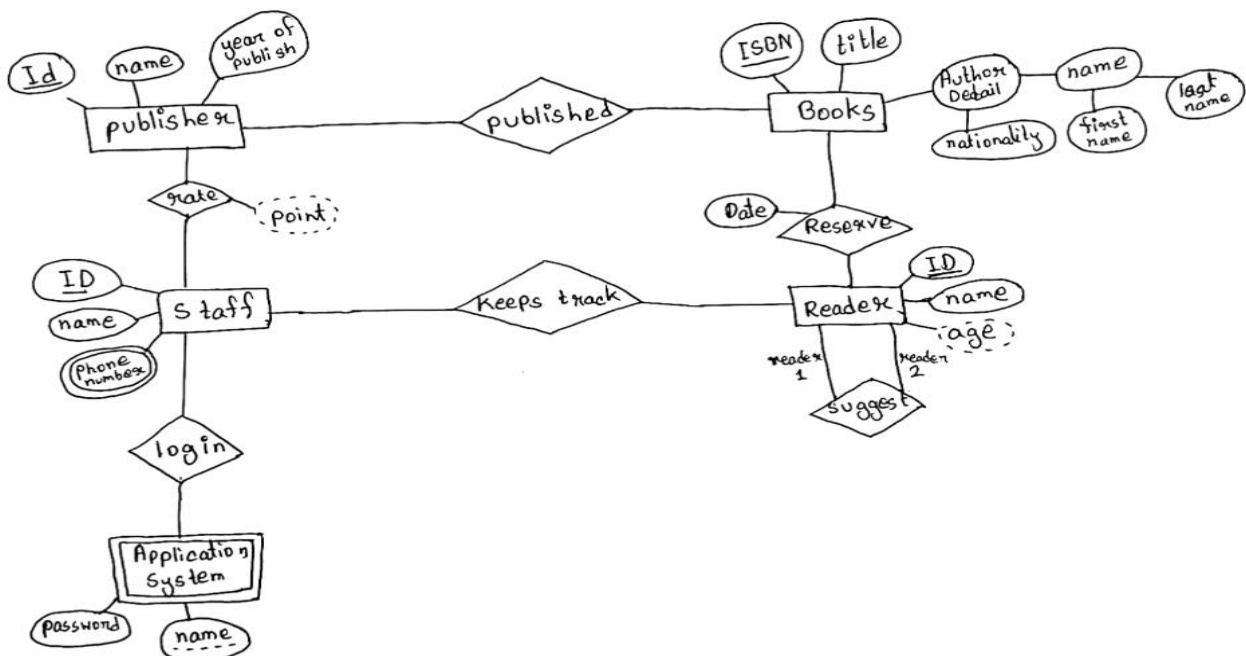
8.

In Pokemon World, Trainers collect magical creatures called pokemons and use them to fight battles against other Trainers to become Pokemon Masters. **Construct** an ER diagram for the Pokemon World according to the data requirements given below:

  a. A pokemon has a unique pokemon id, a name, a type, one or more powers and the next evolution stage.

  b. A pokemon trainer has a unique id, name, address which consists of house no., street no. and city., date of birth and rank. The age of a trainer is determined by the given date of birth and the current date, so it is not stored, but should be shown using the appropriate symbol.

  c. Pokemon trainers collect pokemons throughout their journey. Every Pokemon trainer may have many pokemons but a pokemon will have only one trainer. Some pokemons may not have been collected yet.
  d. Trainers participate in Leagues. Each league has a unique Id, start date, end date and league name.

  e. A league has several battles on the same date. A battle has a battle number, location and date. The battle number is a serial number(1, 2, 3...) within the league and the other attributes also will not be unique.

  f. Trainers fight in battles. The score of each trainer in that battle is recorded.

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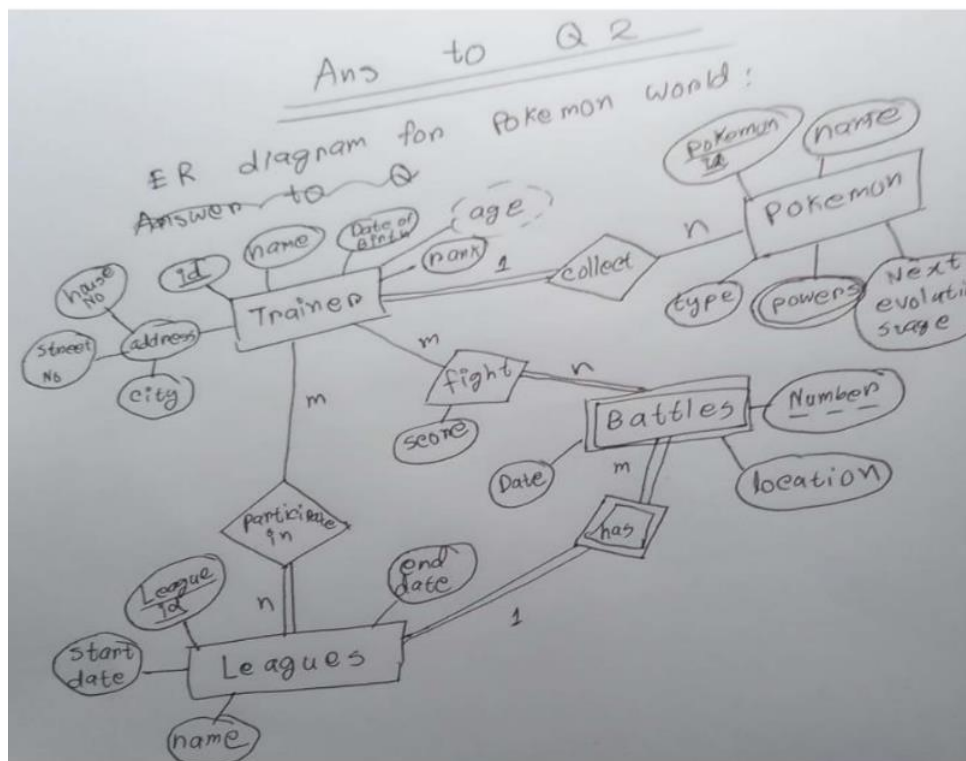
9.

Scenario: University Course Management System

In a University Course Management System, various entities and their attributes are managed to facilitate efficient course scheduling, student registration, and academic record keeping.

- Each student has a "Student ID" to uniquely identify them in the system.

- The "Contact Information" of a student may include multiple values such as phone numbers and email addresses.

- The "Address" of a student entity can be composed of street, city, state, and zip code.

- The "Educational Background" of a student may include all the "Institution Name," "Degree," and "Year of Graduation."

- The "Age" of a student can be calculated from the "Date of Birth".

- The "Course" has "Course Code," "Course Title," and "Credit Hours."

- The "Course Offering" entity has "Semester" and "Section"

- Each faculty member has a unique initial, Name, Email.

- "Student" enrolls in offered sections.

- Once the student is enrolled in a course section, his/her/their/zir grades and enrollment date will be recorded.

- Course is offered every semester and section is assigned.

- There is a faculty for each section.

- A chairperson will manage faculty.
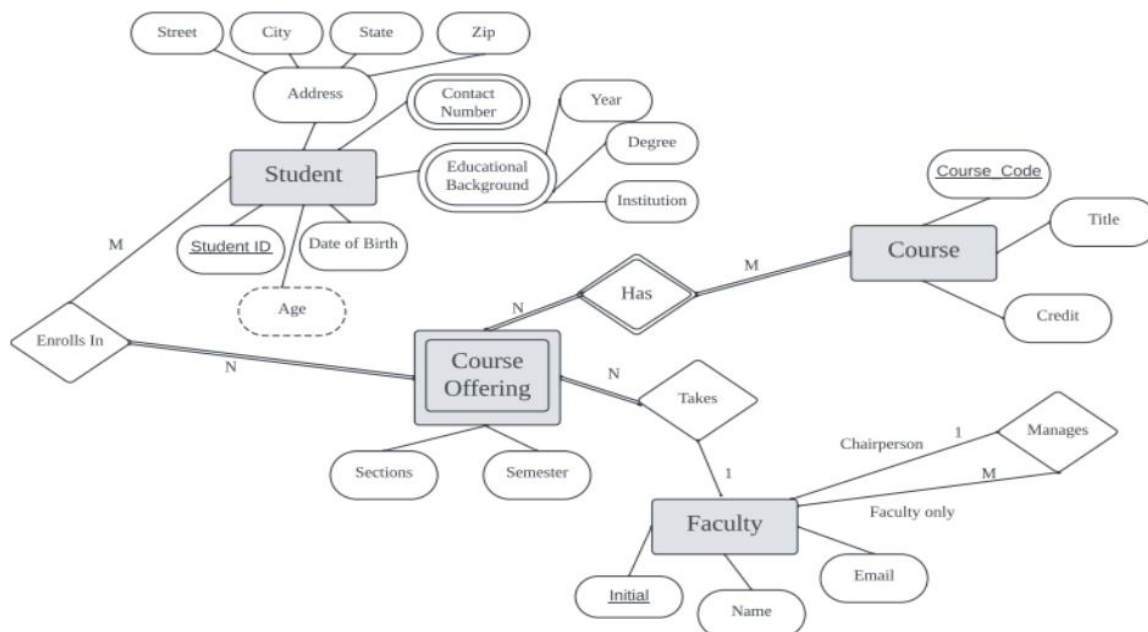
10.

Draw an ER diagram for the BRACU Computer Club according to the data requirements given below:

a. There are members in the club. The members have unique student id, name, phone, address, program, semester. Address is composed of street, city, zip [2 points]

b. The club has departments. Each department has a unique id, name and description. All members must be assigned to exactly one department. [2 points]

c. The members may participate in different Programming Contests. Contests have unique id, title, date and time. The score each member gets in each contest is recorded. [2 points].

d. Each contest contains many questions and each question belongs to a single contest. The questions only have question number, problem description, input format and output format. The question number is a partial key. [2 points]

e. Each question is submitted by a faculty, a single faculty may submit many questions, all faculties need to submit at least one question. Faculty has unique initial, name, email, phone and designation. [2 points]

DO NOT add any additional attributes/entities/relationships unless mentioned above. **DO NOT** assume any multivalued/composite attribute unless mentioned/hinted above.

11.

The Triwizard Tournament is held every three years between three highest ranked wizarding schools around the world. The organizers want to maintain a database for tracking the tournaments. **Construct** an ER diagram for the Tournament database according to the data requirement given below:

    a. Each tournament has a unique tournament id, unique year, duration (which is composed of start date and end date).

    b. Different schools participate in each tournament. A school may participate in several tournaments and some schools may never be able to participate. Schools have a unique name, secret location, a rank, multiple houses and headmaster name.

    c. Schools must select Champions, who have a unique student_ID, a house, name, date of birth, school year and wand specification. A school will select different champions at different times, a champion can be selected only once from the school.

    d. Each tournament holds several games. The games have a game number, description, points. Game number is a serial number (1, 2, 3....) of the game within any tournament and other attributes also cannot be unique.

    e. Champions compete in games and their score for each game is recorded.

    f. Each champion will also have a final score attribute. This attribute can be calculated from the scores in each game for each champion, thus the final score attribute will not be stored, but must be shown in ER using appropriate symbols.

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12.

Question 1 [CO2] : 10 Points

Suppose that a database is needed to keep track of student enrollments in classes and students' final grades.

The university is organized into colleges (COLLEGE), and each college has a unique name (CName), a main office (COffice) and phone (CPhone), and a particular faculty member who is dean of the college. Each college administers a number of academic departments (DEPT). Each department has a unique name (DName), a unique code number (DCode), a main office (DOffice) and phone (DPhone), and a particular faculty member who chairs the department. We keep track of the start date (CStartDate) when that faculty member began chairing the department.

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