CSE 370 – Database Systems

a. **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.

b. Consider a POKEMON database. The data requirements are summarized as follows:

1. There are pokemon trainers who are mainly characterized by attributes such as,name consisting of first and last name, SSN, DOB, Addresses. Each address is composed of city, zip, village, region and house_no.

2. Pokemon trainers own pokemons. For a pokemon, we only store its name. Note that there may be multiple pokemon having the same name (for example there can be multiple pikachus) each having different owners. For simplicity we assume that each pokemon owned by a pokemon trainer. Each pokemon has HP, type, evolve_stage, last_evolution_date, and a set of attacks. Also, we want to store the number of days passed since its last evolution.

3. Pokemon trainers battle with each other. A pokemon trainer invites another trainer for a battle. Battle duration, prize_money and winner are stored.

4. There are Pokemon Leagues where pokemon trainers can join. A league is uniquely identified by start_date and league_name. We also want to store the end_date, region_name and duration of each league (!). Each pokemon trainer who participates in the league gets a standing.

5. Pokemons are kept in the Pokemon Nursery when they are not with their trainers. A pokemon may be placed into multiple Pokemon Nurseries over time. For each nursery, we want to store its name, location, director, one or more nurses and set of facilities provided. A fee has to be paid for each pokemon when kept in the nursery.
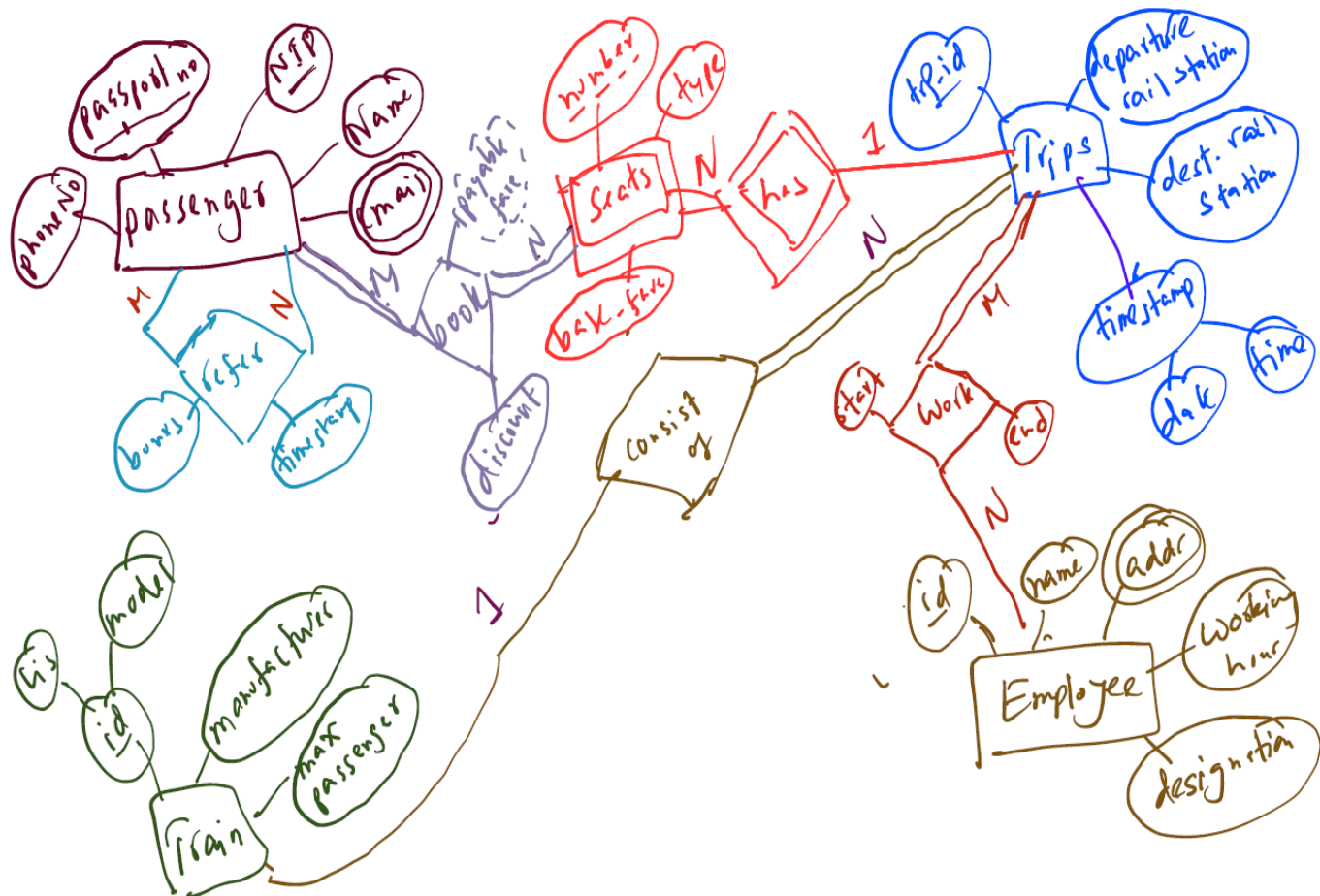
Design an entity–relationship diagram for the pokemon database. Discuss any assumptions you make, and then justify your ER design choices. DO NOT make extra entities or relationships if not specified by the requirements.

   c. Suppose you are given the following requirements for a simple database for the National Hockey League (NHL):
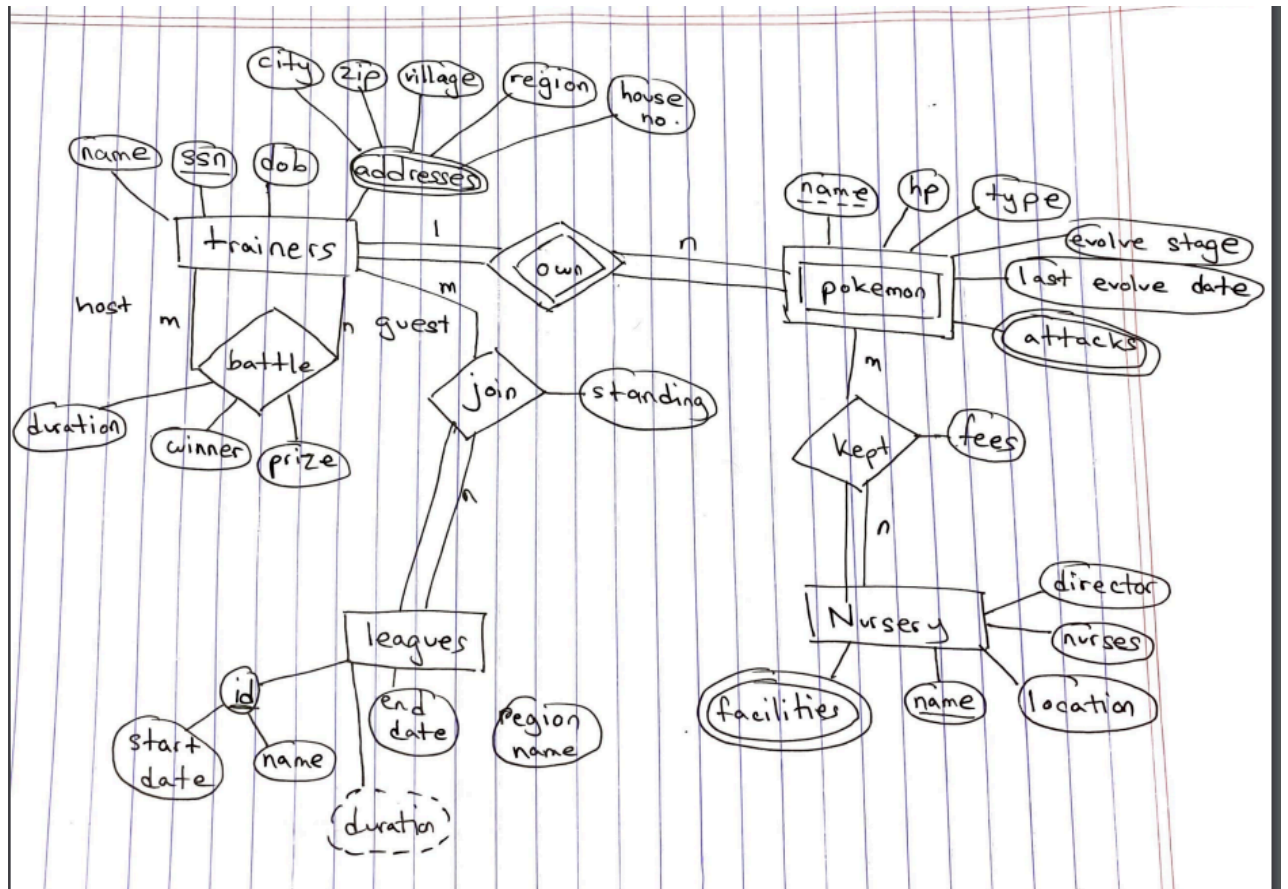
- The NHL has many teams,
- Each team has a unique name, a city and a coach
- Each player belongs to only one team.
- Each player has a unique phone number, name, a position (such as left wing or goalie), a skill level, and a set of injury records.
- Each team has exactly 1 captain who is a player.
- 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).

Solutions:

1.

2.

An entity-relationship diagram containing:

- **trainers** entity with attributes: name, ssn, dob, addresses (city, zip, village, region, house no.)
- **own** relationship (1:n) between trainers and pokemon
- **pokemon** entity with attributes: name, hp, type, evolve stage, last evolve date, attacks
- **battle** relationship (host m, guest n) with attributes: duration, winner, prize
- **join** relationship (m, n) with attribute: standing
- **leagues** entity with attributes: id, start date, name, end date, region name, duration
- **kept** relationship (m:n) with attribute: fees
- **Nursery** entity with attributes: director, nurses, location, name, facilities

3.