Q1: Design and draw an EER diagram that best captures the information of each of the following three cases. Your EERD may or may not include features such as weak entity sets, aggregation and inheritance. You should only use these features if you believe that they are necessary to best capture the given information.

1. Real Estate Firm Database

A real estate firm lists property for sale and wishes to establish a database system for its operation. The firm has a number of sales offices in several states. Each sales office has office_number and address, city, state and zip. Each sales office is assigned one or more employees. Every employee has an employee_id and employee_name. An employee must be assigned to only one sales office. If an employee is married to another employee of the firm, the date of the marriage and who is married to whom must be stored; however, no record of marriage is required if an employee’s spouse is not also an employee. For each sales office, there is always one employee assigned to manage that office. An employee may manage only the sales office to which he or she is assigned. In other words, an employee cannot be assigned to one office, yet manage another office.

The firm lists property for sale; which has property_id, and address, city, state and zip. Each property must be listed with one and only one of the sales offices. A sales office may have any number of properties listed or may have no properties listed.

Each property has one or more owners. Every owner has an owner_id and owner name. An owner may own one or more property. The firm wants to keep track of the percentage that a given owner owns a given piece of property. For example, imagine that Smith and Jones both own property A. Smith owns 35% of property A and Jones owns 65% of property A. The firm wants to retain this information and they want to call it percent_owned.
2. Construction Company Database

A construction company wishes to establish a database system to record information about employees. The employee data to be recorded in the database are consists of employee SINs (which are unique), first names, last names and home phone numbers. The company has three types of special employees; as well as many regular employees who do not fit into one of these categories, which are:

- **For insured employees**: the insurance policy number, the insured amount, and the annual premium are to be recorded.
- **For qualified**: the professional qualification and the annual institute fees are to be recorded.
- **For managers**: the number of profit shares, and the parking stall number are to be recorded.

In addition, they need to record data about departments; each (unique) department name, budget, and location should be recorded. Employees must work for one, and only one department, departments must have at least one employee, and may (of course) have more than one.

Each manager normally manages one department, but on occasion a manager may be responsible for more than one department, but never less than one. A department can have only one manager, but occasionally will not have a manager.

It is necessary to record the dependents of insured employees; the first name, age and relationship (e.g. child, spouse, etc.) of each dependent must be recorded. It is assumed that no two dependents of the same employee will have the same name. An insured employee must have at least one dependent, the dependents must have one and only one insured employee.

3. National Football League Database

The NFL (National Football League) database store information about single NFL season, which will record data about teams, players and games. For each team they record their name (which are unique), the last name of the team coach and the last name of the owner, the home city and their total player salary.
For players they record the player's first and last name, their number (that is, their uniform or jersey number), their salary, and a list of their criminal convictions (a player can have had more than one criminal conviction). A player can only play for one team, and no one team has two uniform numbers that are the same (e.g. the Colts can't have two number 18s) although two or more teams may well have the same uniform number (so other teams will have players who are number 18). Players must play for one (and only one) team and teams must have players.

In addition to all of the information about players noted above they also record additional information about quarterbacks and field goal kickers (these are specific player positions if you are not familiar with American or Canadian football). The database is to record the pass completion percentage, number of touchdowns and number of interceptions of quarterbacks and the field goal percentage of kickers.

Information is also to be recorded about players' agents. The first name and last name of agents, their legally registered and unique company names, and phone numbers are to be recorded. A player can have only one agent (but does not have to have an agent). Many players are represented by the same agent. An agent has to represent at least one player.

Finally they record information about games. A game is played between two teams. In each game there is one home team and one visiting team. For each game the date and the time is also to be recorded. Each team will play exactly eight games as the home team and exactly eight games as the visiting team.

**Q2: Review the ERD below for a company database. What design rules are violated? Why? What modifications would you suggest?**

![ERD Diagram](image-url)