

CSCC43 Tutorial #7

ER Diagrams to Database Schemas

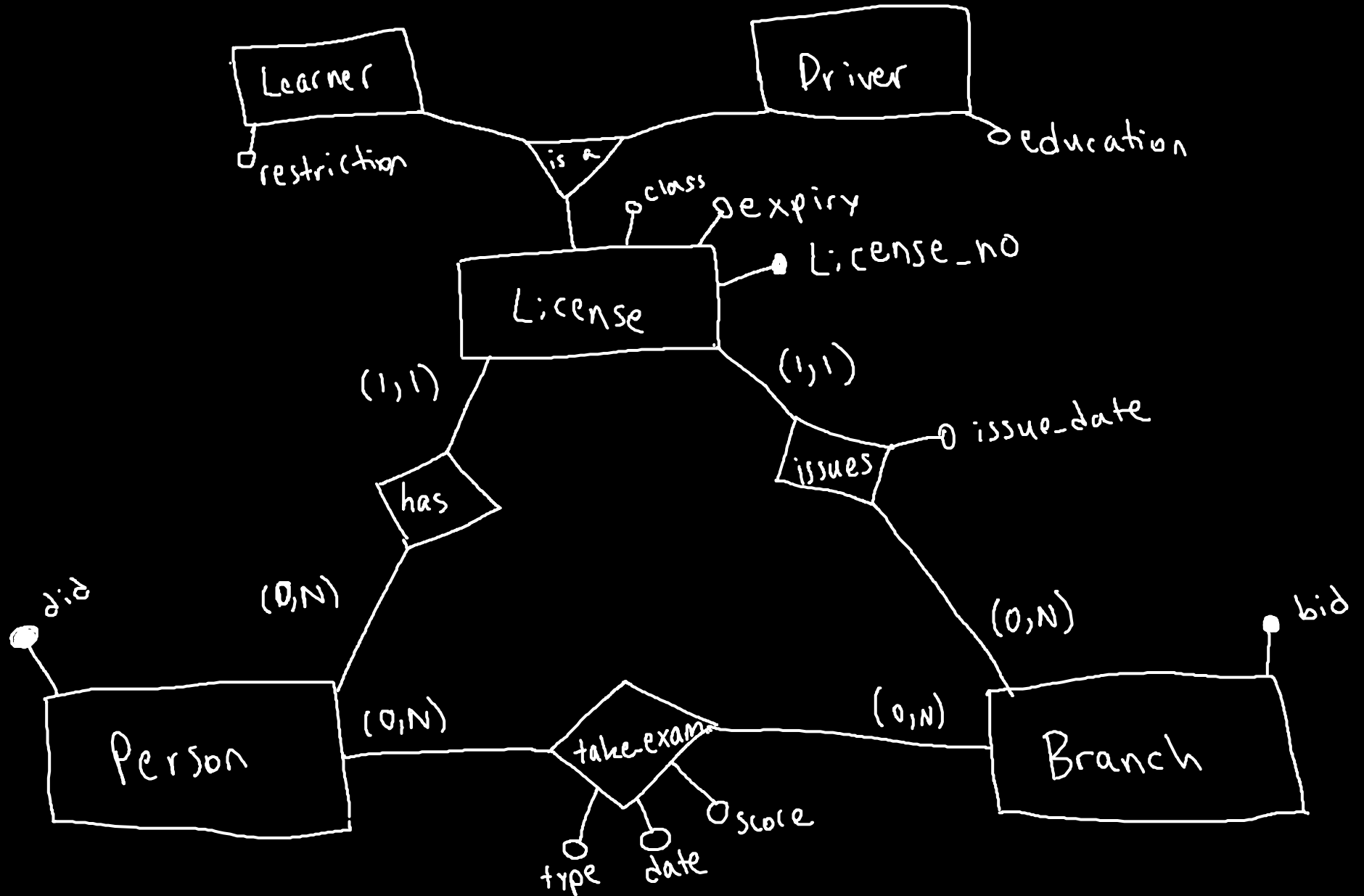
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Part 1

The Motor Vehicle Branch administers driving tests and issues driver's licenses. Any person who wants a driver's license must first take a learner's exam at any Motor Vehicle Branch in the province. If he/she fails the exam, he can take the exam again any time after a week of the failed exam date, at any branch. If he passes the exam, he is issued a license (type = learner's) with a unique license number. A learner's license may contain a single restriction on it. The person may take his driver's exam at any branch any time before the learner's license expiry date (which is usually set at six months after the license issue date). If he passes the exam, the branch issues him a driver's license. A driver's license must also record if the driver has completed driver's education, for insurance purposes.

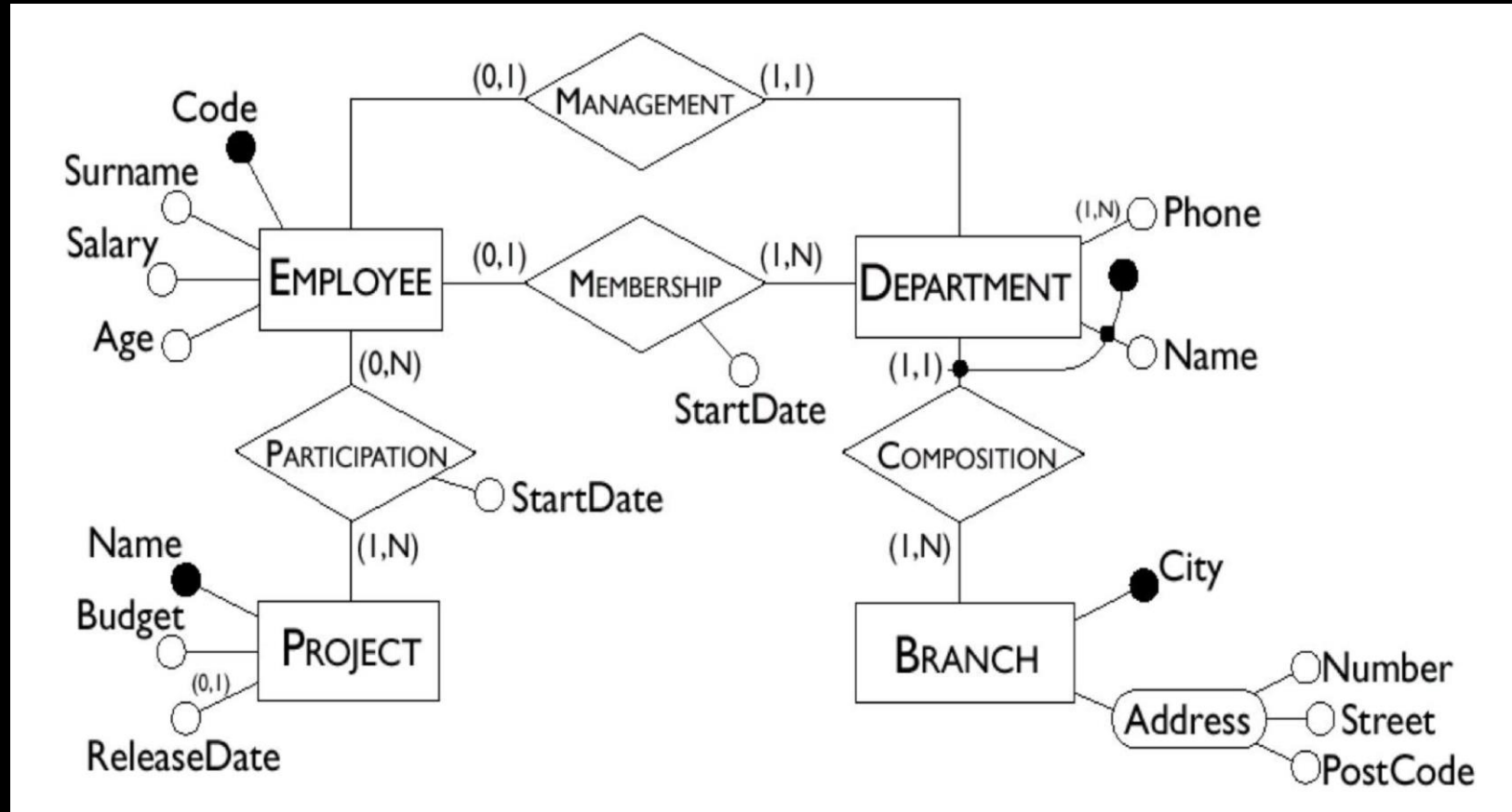
Draw an ER diagram that captures this information (Show major attributes).

Part 1



Part 2

1. Consider the following ER Diagram:



Part 2

- a) Name a weak entity set in this diagram. **Department**
- b) What attributes form a key for this entity set? **Name and City**
- c) Can a department exist without a manager? **No**
- d) How many departments can an employee belong to? **At most one**
- e) Find an example of each of these kinds of relationship if there is one.
 - A one-to-one relationship: **Management**
 - A one-to-many relationship: **Membership**
 - A many-to-many relationship: **Participation**
- f) Find an example of each of these if there is one.
 - A ternary relationship: **None**
 - A recursive relationship: **None**

Part 2

2. Translate the ER diagram into a relational schema without making any simplifications. That is, create one relation for every entity set and one relation for every relationship set. Underline the key of each relation, and explain foreign keys in the relations.

Part 2

Here, we assume the cardinality of all attributes is (1,1) unless otherwise specified.

- Employee(Code, Surname, Salary, Age)

All attributes of Employee are not null.

- Project(Name, Budget, ReleaseDate)

Name and Budget are not null. ReleaseDate, however, could be null.

- Participation(Emp, Proj, StartDate)

Emp foreign key of Employee, Proj foreign key of Project. All attributes of Participation are not null.

- Branch(City, Number, Street, PostCode)

All attributes of Branch are not null.

Part 2

- Department(Name, City)

City is foreign key of Branch (note that this foreign key represents the relationship Composition). All attributes of Department are not null.

- DeptPhone(Name, City, Phone)

(Name, City) foreign key of Department. All attributes of DeptPhone are not null.

- Management(Emp, Dept, City)

Emp foreign key of Employee. (Dept, City) is unique and a foreign key of Department. All attributes of Management are not null.

- Membership(Emp, Dept, City, StartDate)

Emp is a foreign key of Employee. (Dept, City) is unique and a foreign key of Department. All attributes of Membership are not null.

Part 2

- There are several relationships with a “minimum 1” constraint. These can be expressed in the relational model as follows:

- o $\text{Project}[\text{Name}] \subseteq \text{Participation}[\text{Proj}]$

(This enforces the minimum 1 constraint on Project's involvement in the Participation relationship.)

- o $\text{Branch}[\text{City}] \subseteq \text{Department}[\text{City}]$

(This enforces the minimum 1 constraint on Branch's involvement in the Composition relationship.)

- o $\text{Department}[\text{Name}, \text{City}] \subseteq \text{Membership}[\text{Dept}, \text{City}]$

(This enforces the minimum 1 constraint on Department's involvement in the Membership relationship.)

- o $\text{Department}[\text{Name}, \text{City}] \subseteq \text{Management}[\text{Dept}, \text{City}]$

(This enforces the minimum 1 constraint on Department's involvement in the Management relationship.)

None of these can be expressed as FOREIGN KEY constraints in SQL, since they do not refer to attributes that are either PRIMARY KEY or UNIQUE in their home table.

- We have not enforced the “minimum 1” constraint on the phone attribute of Department

Part 2

3. Which relationship sets represent information that can be collapsed onto an entity set? Revise the schema accordingly.

- Management and Composition (Composition is already collapsed above)
- Management can be collapsed into Department. In that case, the minimum 1 constraint cannot be expressed as a constraint between Department and Management as shown above. However, we can still enforce it using a not-null constraint.