Lab 3 Guidelines

Database Design Using *pgModeler*

Phases of database design *cont.*

Conceptual design

- ✓ Determine the characteristics of real world features that should be included in the db
- ❖ Build a conceptual model, e.g. E-R model

Conceptual Schema: E-R diagram

Logical design

- ✓ Describes how data are organized and stored in the db, constraints, and the relationships among the data.
- ❖ Translate the conceptual model to a logical (conceptual) schema, e.g., relational model

Relational Logical Schema: Tables with Constraints

Physical design

- ✓ How the database is actually stored in a particular machine
- ✓ Issues related to storage, indexing and memory management.
- ❖ Physical schema and actual database files (e.g., tables)

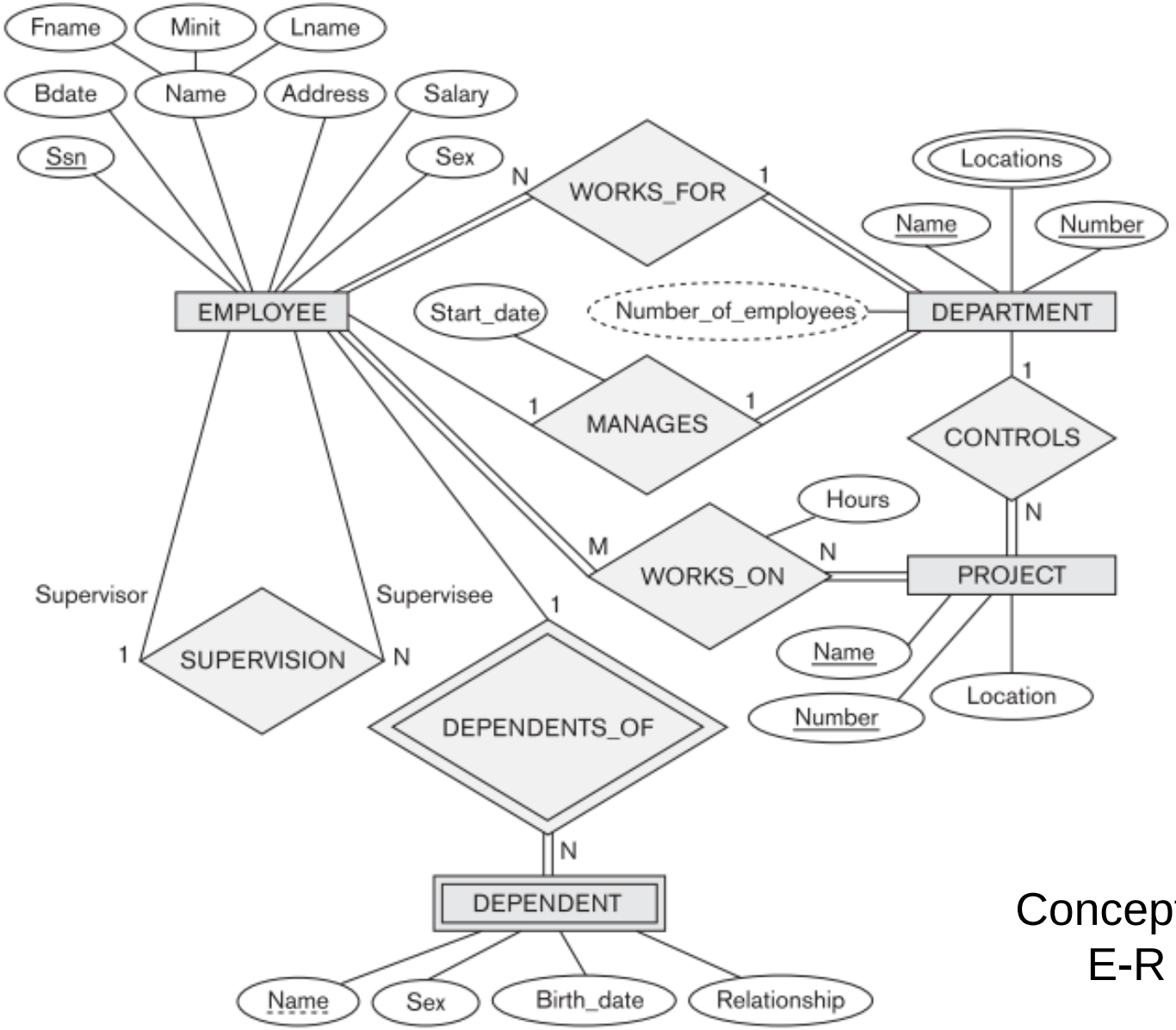
Example: COMPANY Database

Data requirements:

- The company is organized into departments. Each department has a unique name, a unique number, and a particular employee who manages the department. We keep track of the start date when that employee began managing the department. A department may have several locations.
- A department controls a number of projects, each of which has a unique name, a unique number, and a single location.
- We store each employee's name, social security number, address, salary, sex (gender), and birth date. An employee is assigned to one department, but may work on several projects, which are not necessarily controlled by the same department. We keep track of the current number of hours per week that an employee works on each project. We also keep track of the direct supervisor of each employee (who is another employee).
- We want to keep track of the dependents of each employee for insurance purposes. We keep each dependent's first name, sex, birth date, and relationship to the employee.

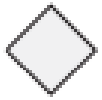
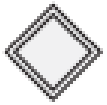
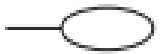
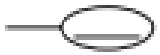
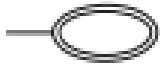
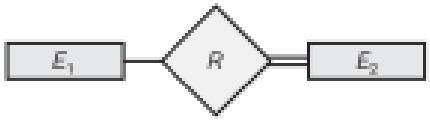
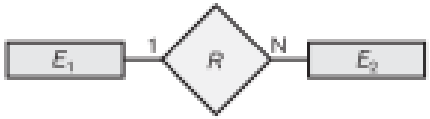
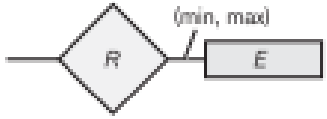
Identify *Entity Types* and *Relationships* among them.

Example: COMPANY Database



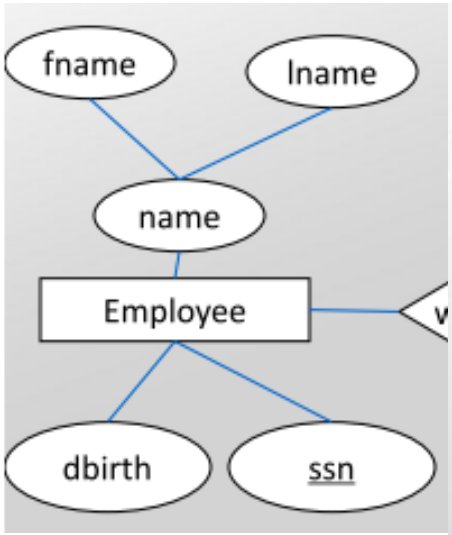
Conceptual Design:
E-R diagram

E-R diagram notations

Symbol	Meaning
	Entity
	Weak Entity
	Relationship
	Indentifying Relationship
	Attribute
	Key Attribute
	Multivalued Attribute
	Composite Attribute
	Derived Attribute
	Total Participation of E_2 in R
	Cardinality Ratio 1: N for E_1:E_2 in R
	Structural Constraint (min, max) on Participation of E in R

Example: COMPANY Database

Logical Design: How to map a E-R diagram into a relational logical schema (a set of tables)?



Primary key and foreign key

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

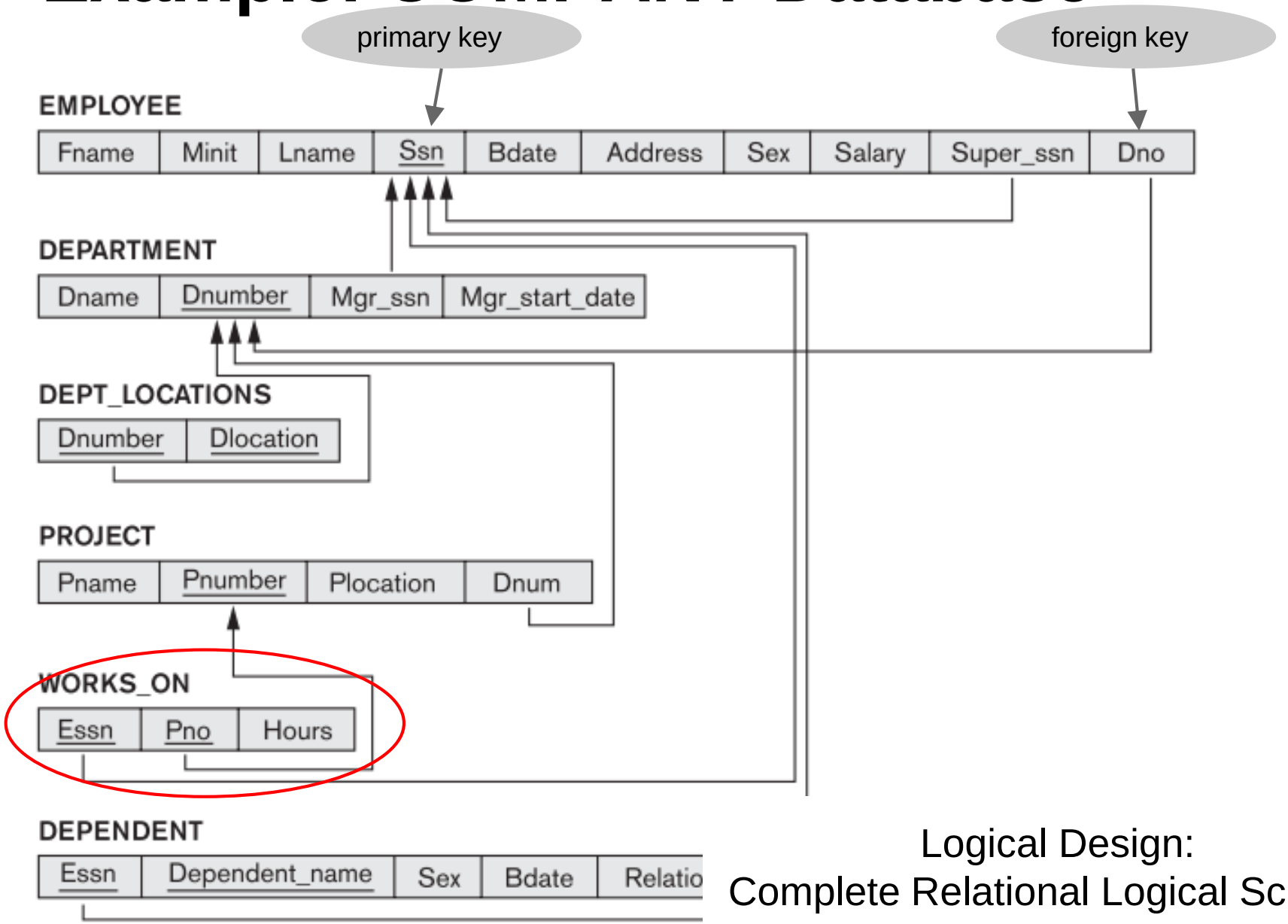
EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	NULL	1

The “Dnumber” column in the “department" table is the PRIMARY KEY in the "department" table

The “dno” column in the “employee" table is a FOREIGN KEY in the " employee " table

Example: COMPANY Database



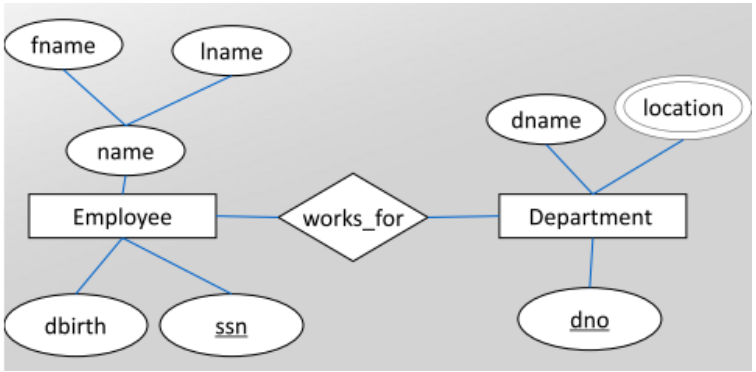
Logical Design:
Complete Relational Logical Schema

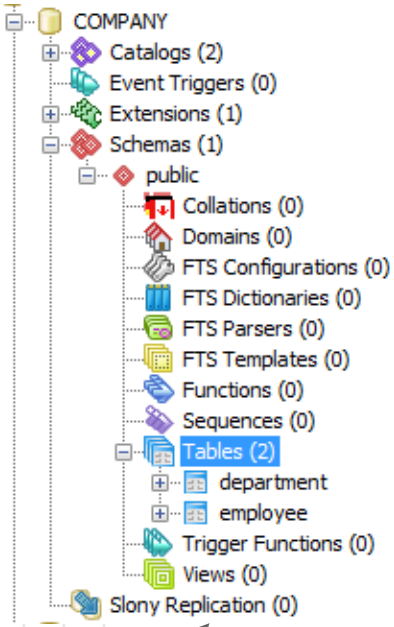
Example: COMPANY Database

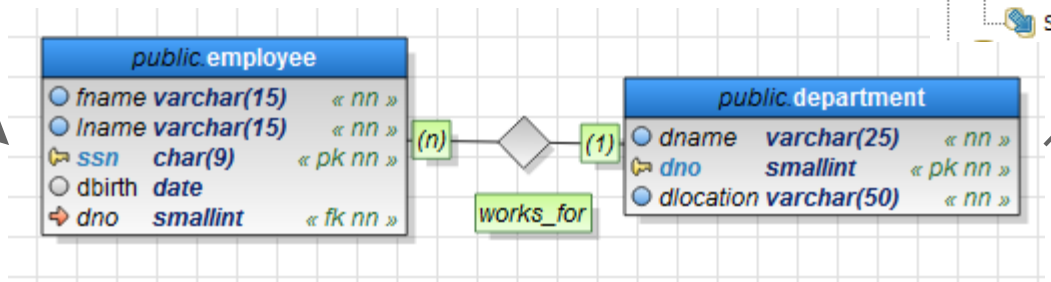
Question:

How to implement *relational logical schema* in a relational DBMS (e.g., PostgreSQL)?

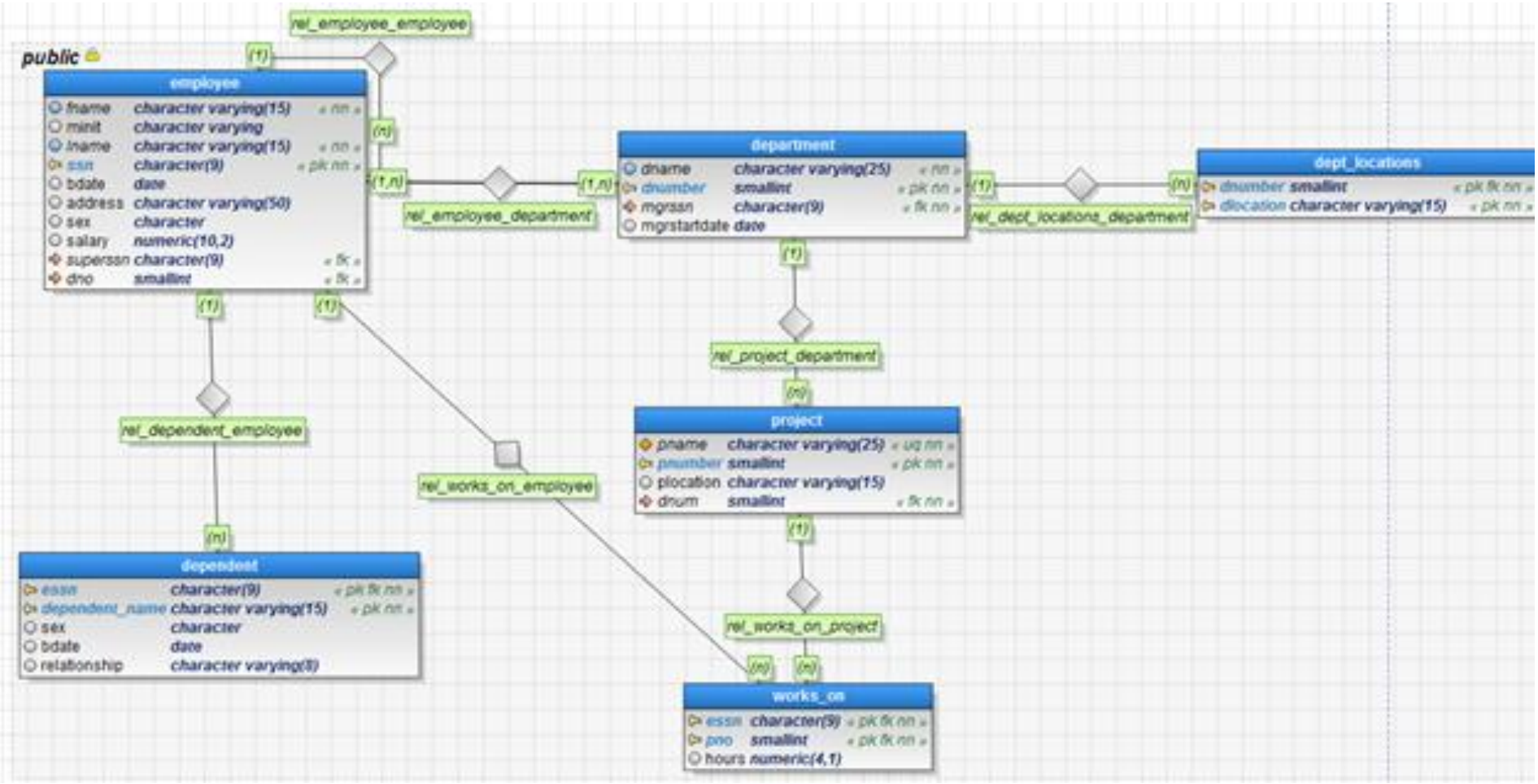
pgModeler Demo:





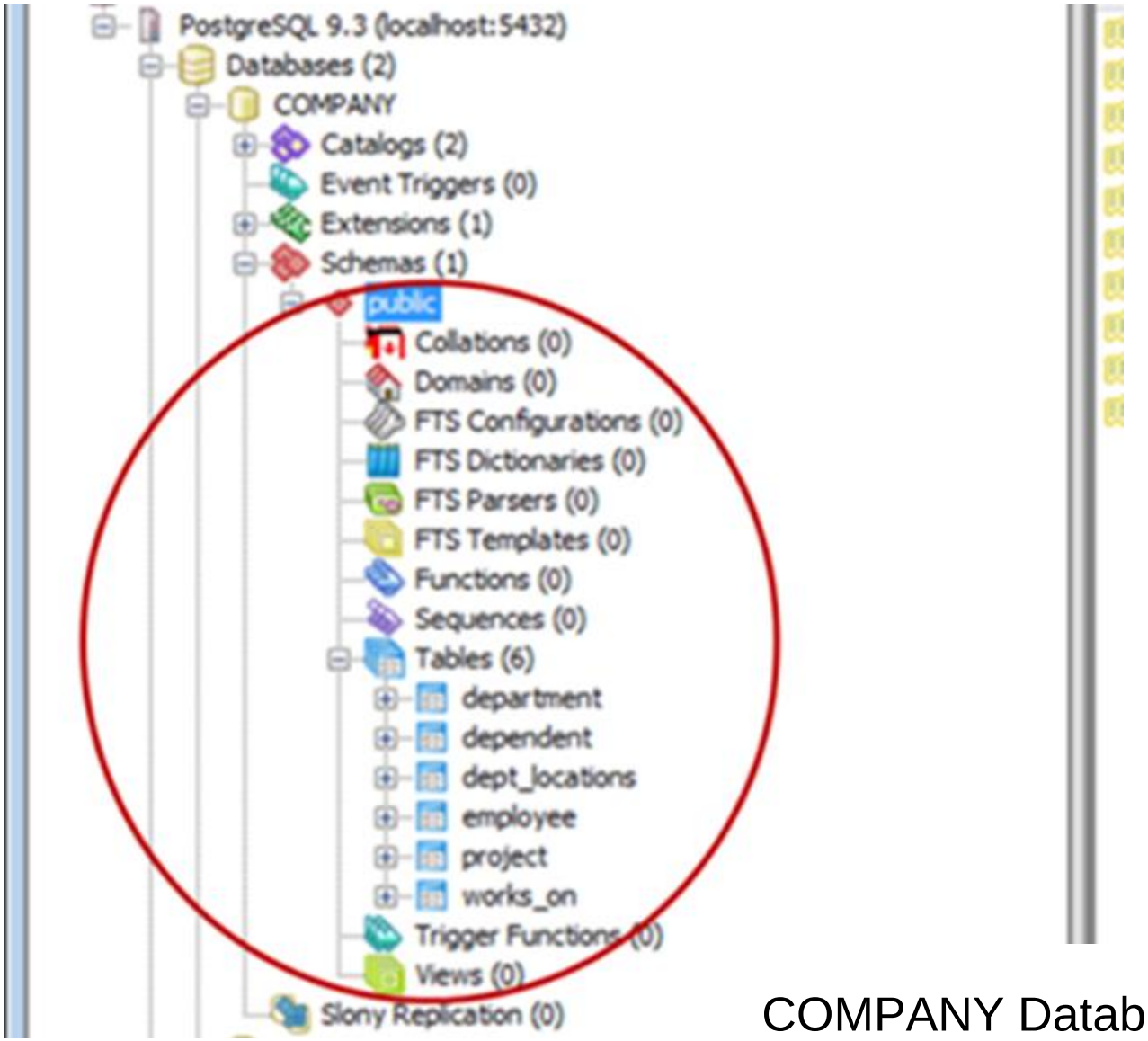


Example: COMPANY Database



Complete E-R model in *pgModeler*

Example: COMPANY Database



COMPANY Database in *PostgreSQL*