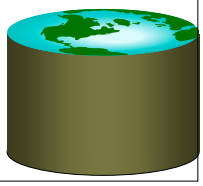
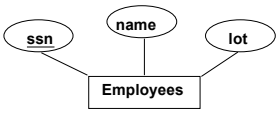
ER to Relational Mapping



Logical DB Design: ER to Relational

- **Entity sets to tables.**



ssn	name	lot
123-22-3666	Attishoo	48
231-31-5368	Smiley	22
131-24-3650	Smethurst	35

```
CREATE TABLE Employees
    (ssn CHAR(11),
     name CHAR(20),
     lot INTEGER,
     PRIMARY KEY (ssn))
```

Relationship Sets to Tables

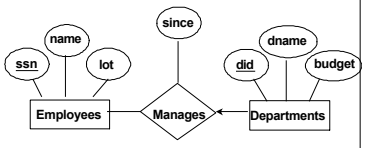
- **In translating a many-to-many relationship set to a relation, attributes of the relation must include:**
  - Keys for each participating entity set (as foreign keys).
    - This set of attributes forms a *superkey* for the relation.
  - All descriptive attributes.

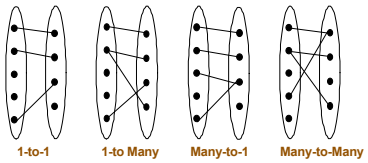
```
CREATE TABLE Works_In(
    ssn CHAR(1),
    did INTEGER,
    since DATE,
    PRIMARY KEY (ssn, did),
    FOREIGN KEY (ssn)
        REFERENCES Employees,
    FOREIGN KEY (did)
        REFERENCES Departments)
```

ssn	did	since
123-22-3666	51	1/1/91
123-22-3666	56	3/3/93
231-31-5368	51	2/2/92

Review: Key Constraints

- **Each dept has *at most one* manager, according to the *key constraint* on Manages.**





Translation to relational model?

Translating ER Diagrams with Key Constraints

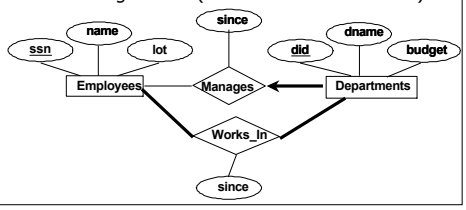
- **Map relationship set to a table:**
  - Note that did is the key now!
  - Separate tables for Employees and Departments.
- **Since each department has a unique manager, we could instead combine Manages and Departments.**

```
CREATE TABLE Manages(
    ssn CHAR(11),
    did INTEGER,
    since DATE,
    PRIMARY KEY (did),
    FOREIGN KEY (ssn) REFERENCES Employees,
    FOREIGN KEY (did) REFERENCES Departments)
```

```
CREATE TABLE Dept_Mgr(
    did INTEGER,
    dname CHAR(20),
    budget REAL,
    ssn CHAR(11),
    since DATE,
    PRIMARY KEY (did),
    FOREIGN KEY (ssn) REFERENCES Employees)
```

Review: Participation Constraints

- **Does every department have a manager?**
  - If so, this is a *participation constraint*: the participation of Departments in Manages is said to be *total* (vs. *partial*).
    - Every *did* value in Departments table must appear in a row of the Manages table (with a non-null *ssn* value!)



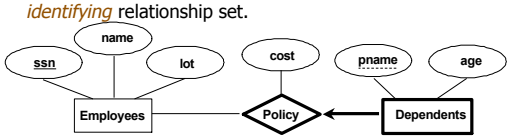
Participation Constraints in SQL

- **We can capture participation constraints involving one entity set in a binary relationship, but little else (without resorting to CHECK constraints).**

```
CREATE TABLE Dept_Mgr(
  did INTEGER,
  dname CHAR(20),
  budget REAL,
  ssn CHAR(11) NOT NULL,
  since DATE,
  PRIMARY KEY (did),
  FOREIGN KEY (ssn) REFERENCES Employees,
    ON DELETE NO ACTION)
```

Review: Weak Entities

- **A *weak entity* can be identified uniquely only by considering the primary key of another (*owner*) entity.**
  - Owner entity set and weak entity set must participate in a one-to-many relationship set (1 owner, many weak entities).
  - Weak entity set must have total participation in this *identifying* relationship set.

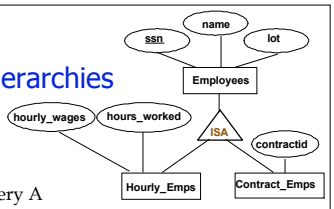


Translating Weak Entity Sets

- **Weak entity set and identifying relationship set are translated into a single table.**
  - When the owner entity is deleted, all owned weak entities must also be deleted.

```
CREATE TABLE Dep_Policy (
  pname CHAR(20),
  age INTEGER,
  cost REAL,
  ssn CHAR(11) NOT NULL,
  PRIMARY KEY (pname, ssn),
  FOREIGN KEY (ssn) REFERENCES Employees,
    ON DELETE CASCADE)
```

Review: ISA Hierarchies



❖As in C++, or other PLs, attributes are inherited.

❖If we declare A ISA B, every A entity is also considered to be a B entity.

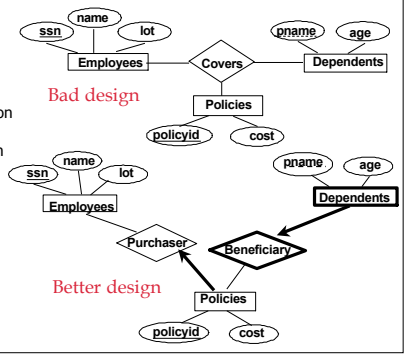
- ***Overlap constraints*: Can Joe be an Hourly_Emps as well as a Contract_Emps entity? (*Allowed/disallowed*)**
- ***Covering constraints*: Does every Employees entity also have to be an Hourly_Emps or a Contract_Emps entity? (*Yes/no*)**

Translating ISA Hierarchies to Relations

- *General approach:*
  - 3 relations: Employees, Hourly_Emps and Contract_Emps.
    - *Hourly_Emps*: Every employee is recorded in Employees. For hourly emps, extra info recorded in Hourly_Emps (*hourly_wages*, *hours_worked*, *ssn*); must delete Hourly_Emps tuple if referenced Employees tuple is deleted).
    - Queries involving all employees easy, those involving just Hourly_Emps require a join to get some attributes.
- **Alternative: Just Hourly_Emps and Contract_Emps.**
  - *Hourly_Emps*: *ssn*, *name*, *lot*, *hourly_wages*, *hours_worked*.
  - Each employee must be in one of these two subclasses.

Review: Binary vs. Ternary Rel'nships

- **If each policy is owned by just 1 employee:**
  - Key constraint on Policies would mean policy can only cover 1 dependent!



Binary vs. Ternary Relationships (Contd.)

- **The key constraints allow us to combine Purchaser with Policies and Beneficiary with Dependents.**
- **Participation constraints lead to NOT NULL constraints.**

```
CREATE TABLE Policies (
    policyid INTEGER,
    cost REAL,
    ssn CHAR(11) NOT NULL,
    PRIMARY KEY (policyid).
    FOREIGN KEY (ssn) REFERENCES Employees,
      ON DELETE CASCADE)
CREATE TABLE Dependents (
    pname CHAR(20),
    age INTEGER,
    policyid INTEGER,
    PRIMARY KEY (pname, policyid).
    FOREIGN KEY (policyid) REFERENCES Policies,
      ON DELETE CASCADE)
```

ER Model Summary

- **Usually easier to understand than Relational**
- **Expresses relationships clearly**
- **Rules to convert ER-diagrams to Relational Schema**
- **Some systems use ER-model for schema design**
- **Some people use ER-model as step before creating relational tables**