ER to Relational Mapping (Part II)

Announcement

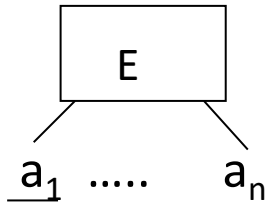
- Assignment 2 is available in Canvas
  - Design ER diagram, and convert the ER diagram into relational tables
  - Due time: 11:59pm, Friday, Oct 7

What We have Learned?

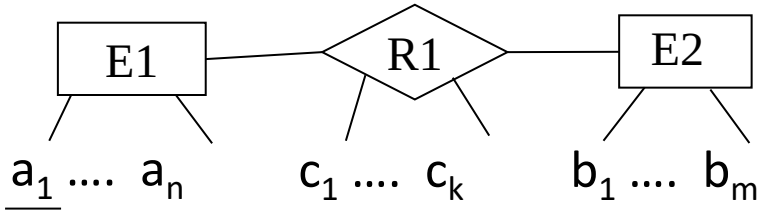
E/R diagram

Relational schema, e.g.

account=(bname, acct_no, bal)



E = (a_1, …, a_n)



Many-to-many relationship:

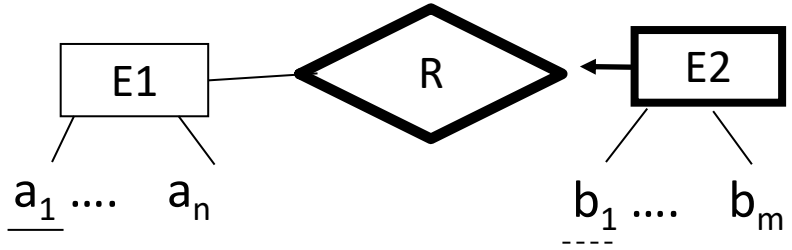
R1= (a_1, b_1, c_1, …, c_k)

Fk1: a1 references E1(a1)

Fk2: b1 references E2(b1)

E/R to Relational

- Weak entity set



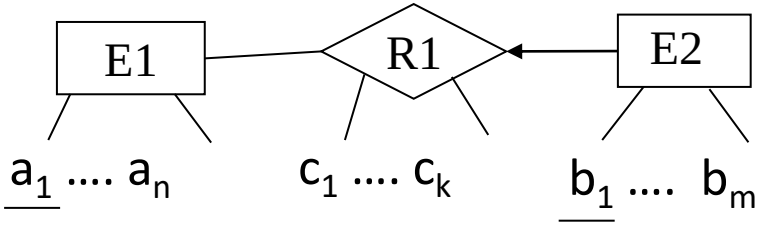
E1 = ($\underline{a_1}$, …, a_n)

E2 = ($\underline{a_1, b_1}$, …, b_m)
Foreign key: a1 references E1(a1)

No table for R

More on relationships

- 1-many relationship:



- Solution 1:

  R1= (a_1, $\underline{b_1}$, c_1, …, c_k)
  Foreign key1: a1 references E1(a1)
  Foreign key2: b1 references E2(b1)

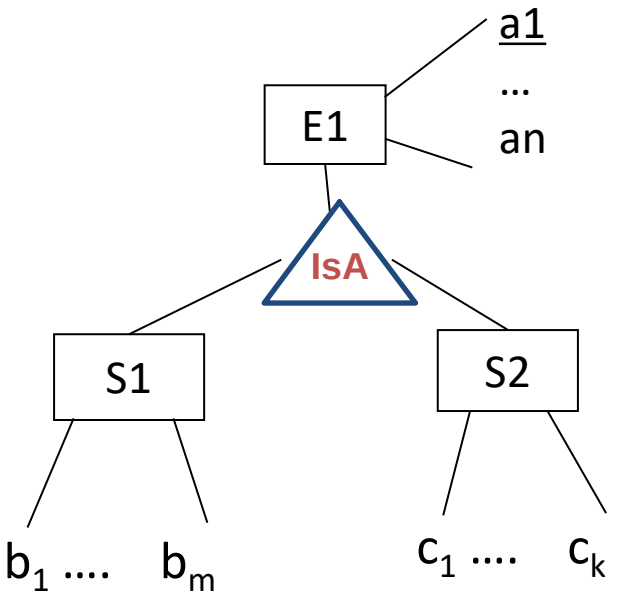
- Solution 2:
  - Don't construct a table for R1
  - Add a1, c1, …., ck to E2 instead
    - E2= ($\underline{b_1}$, …., b_m, a_1, c_1, …, c_k)

      Foreign key: a1 references E1(a1)

Today's lecture

- Translate IsA relationship to relation
- Translate aggregation relationship to relation
- In-class exercise

Translating IsA to Relations



Method 1:

- E1 = ($\underline{a_1}$, …, a_n)
- S1 = ($\underline{a_1}$, b_1, …, b_m)

Foreign key: a1 reference E1(a1)

- S2 = ($\underline{a_1}$, c_1 …, c_k)

Foreign key: a1 reference E1(a1)

Method 2:

- S1 = ($\underline{a_1}$,…, a_n, b_1, …, b_m)
- S2 = ($\underline{a_1}$, …, a_n, c_1 …, c_k)

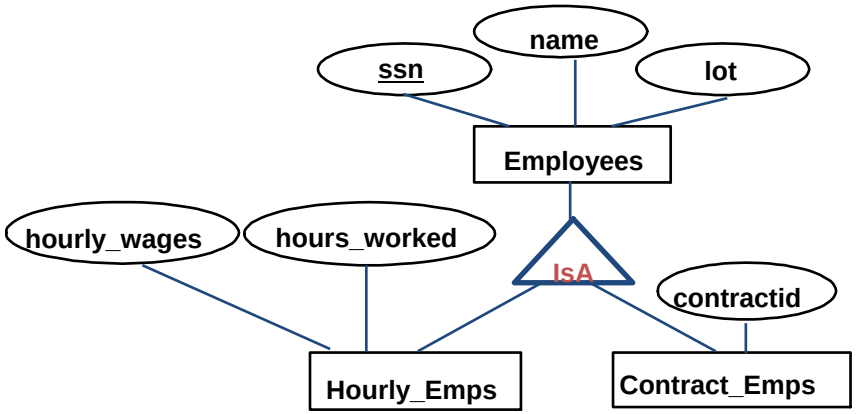
No foreign key for S1 & S2

No table for E1

Q: When will Method 2 be wrong?

A: Method 2 is wrong if IsA relationship does not have the ***covering constraint***

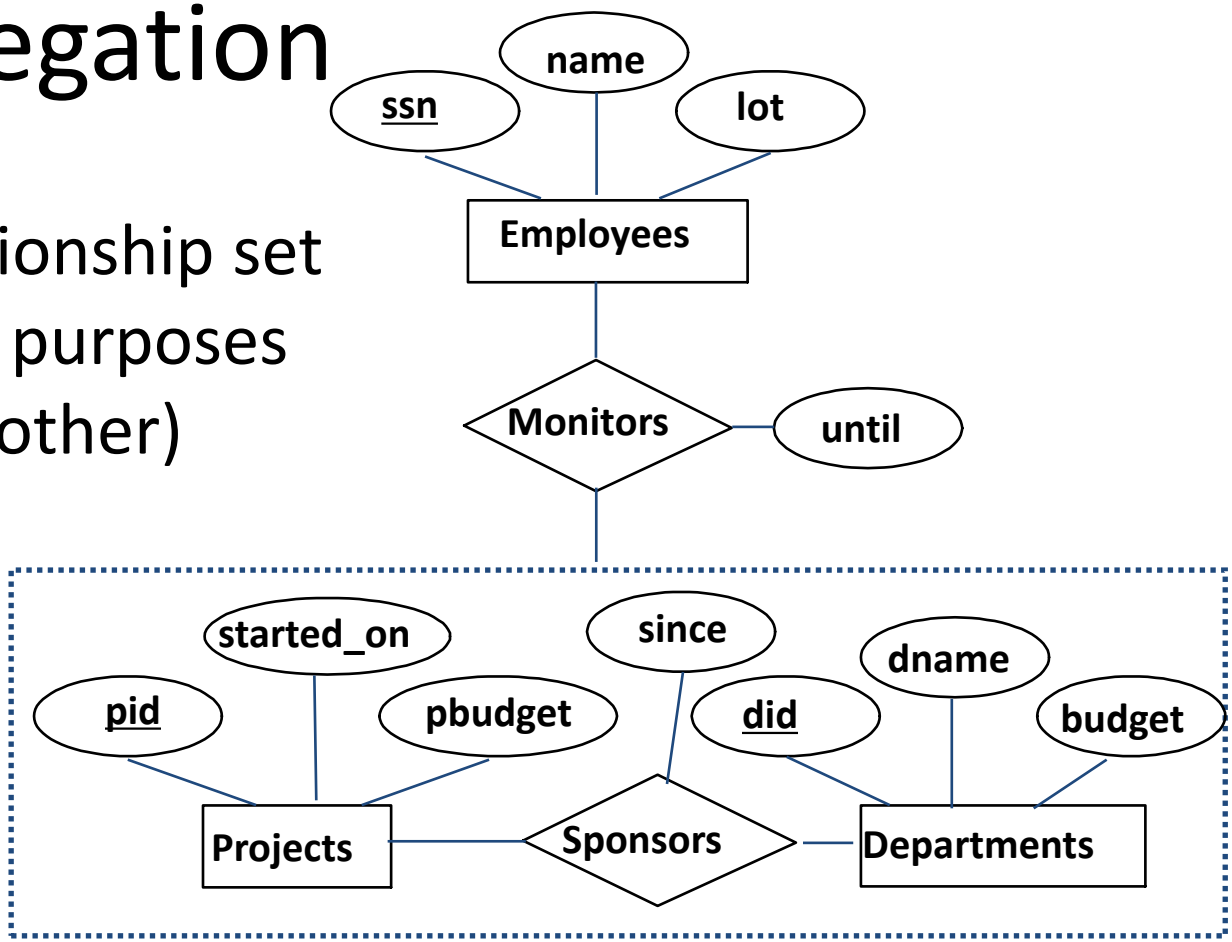
Example: Translating IsA Hierarchies to Relations



- *Approach 1:*
  - 3 relations: Employees, Hourly_Emps and Contract_Emps.
    - Employees (ssn, name, lot)
    - Hourly_emps (ssn, hourly_wages, hours_worked)
      - FK: ssn references Employees (ssn)
    - Contract_emps (ssn, contractid)
      - FK: ssn references Employees (ssn)
- Approach 2: Just Hourly_Emps and Contract_Emps (if there is a covering constraint on ISA relationship).
    - Hourly_emps (ssn, name, lot, hourly_wages, hours_worked)
    - Contract_emps (ssn, name, lot, contractid)

Review: Aggregation

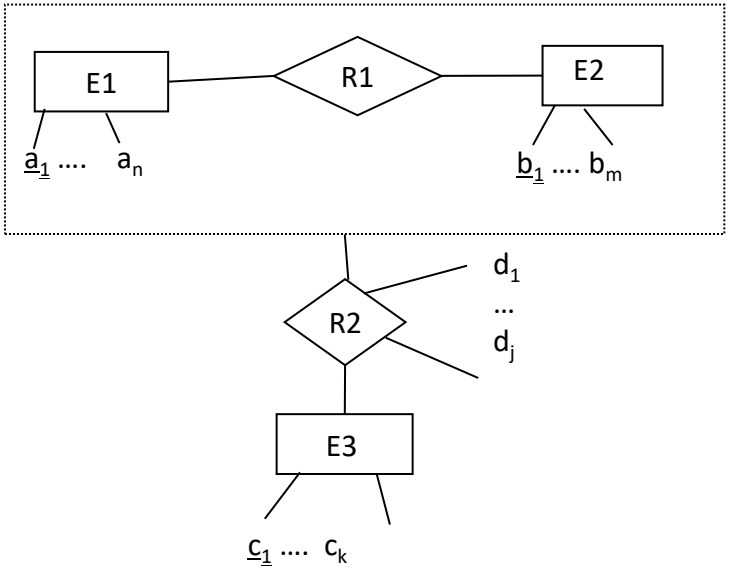
Allows to treat a relationship set as an entity set for purposes of participation in (other) relationships.



Describes relationship among relationships

Translate Aggregation Relationship to Relation

- Aggregation



Step 1: Generate tables for E1, R1, E2, E3 as discussed before

- E1($\underline{a_1}$, … a_n)
- E2($\underline{b_1}$, … b_m)
- E3($\underline{c_1}$, … c_k)
- R1($\underline{a_1}$, $\underline{b_1}$)

  Foreign keys of R1:
  - $\underline{a_1}$ reference table E1(a1)
  - $\underline{b_1}$ reference table E2(b1)

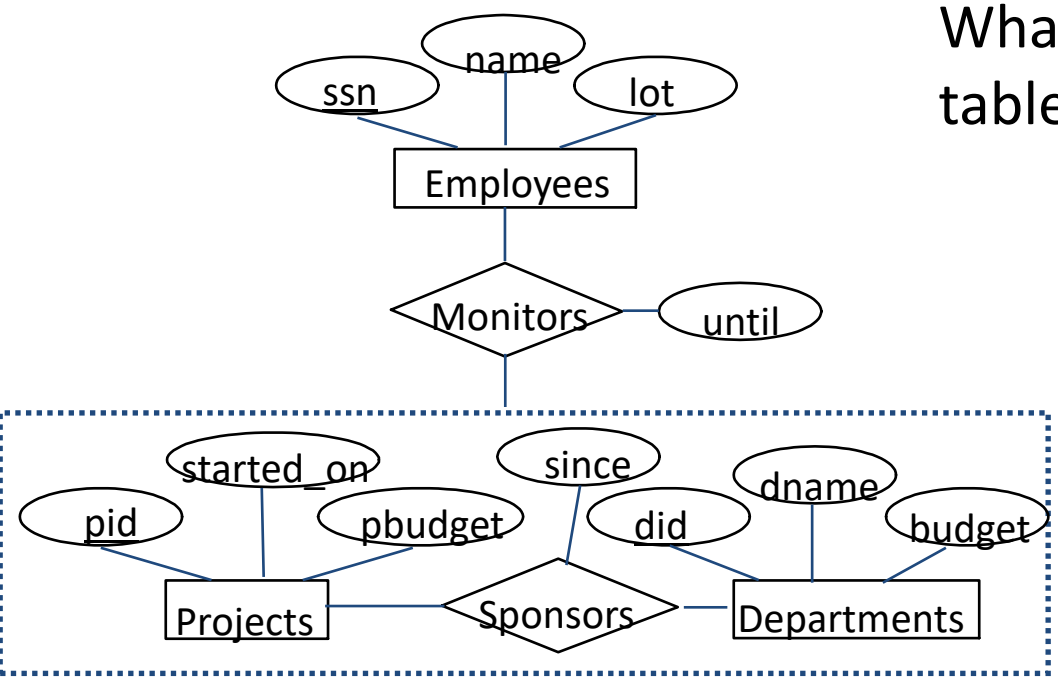
Step 2: Generate a table for the aggregation relationship R2

R2 = ($\underline{c_1}$, $\underline{a_1}$, $\underline{b_1}$, d_1, …, d_j)

Foreign keys of R2:

- $\underline{a_1}$ reference table E1(a1),
- $\underline{b_1}$ reference table E2(b1),
- $\underline{c_1}$ reference table E3(c1)
- (a1, b1) reference table R1

Example: Translating Aggregation to Relation



What's the schema of the *Monitors* table?

Monitors (pid, did, ssn, until)

Foreign keys:

- ssn references Employees,
- pid references Projects,
- did references Departments
- (pid, did) references Sponsors

ER to Relational
In-class Exercise

A university registrar's office maintains data about the following entities:

- **Courses:** include number, title, credits, syllabus, and prerequisites;
- **Course offerings:** include course number, year, semester, section number, instructor(s), time, and classroom;
- **Students:** include student ID, name, and program;
- **Instructors:** include identification number, name, department, and title.

Further, the following information must be appropriately modeled:

(1) The offering courses entirely depend on the courses.
(2) For each semester, the students enrolled in the offered courses.
(3) Each student gets a grade for each course he/she enrolled.
(4) Each offered course can have more than one instructor.
(5) Each course can be offered in more than one semester, and in multiple years. Each offered course may have multiple sections.

Q1: Construct an E-R diagram for the registrar's office. Specify the key and participation constraints for each relationship set. Specify the weak entity set if there is any.

Q2: Convert the constructed ER diagram into relations