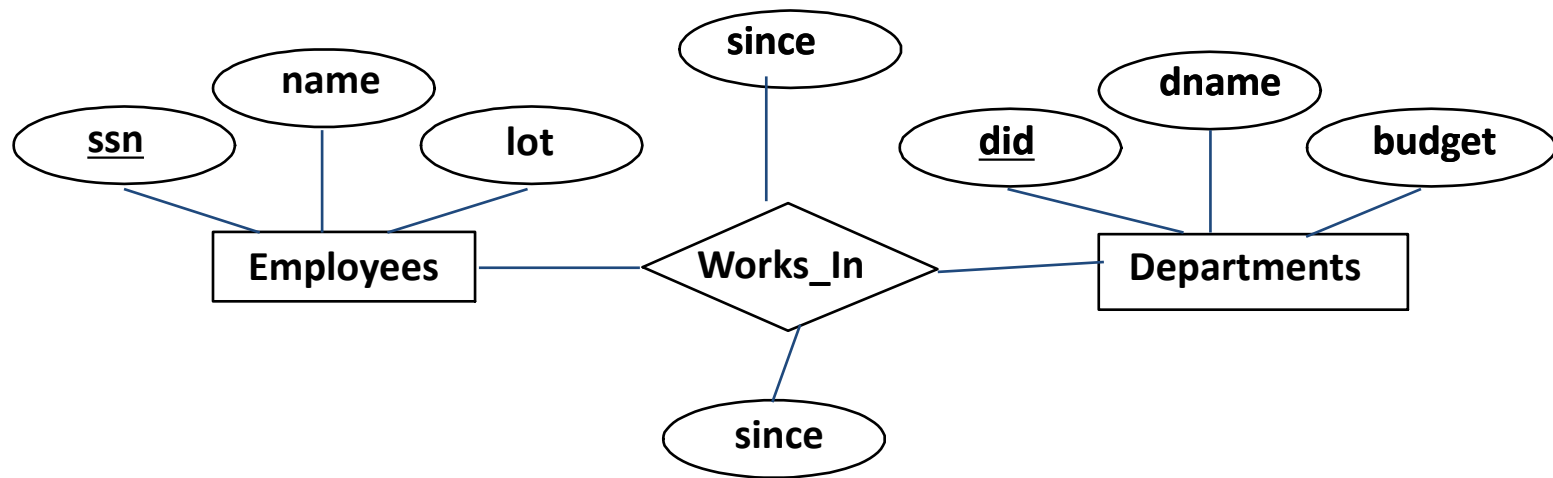# The Entity-Relationship Model (Part II)

R &G - Chapter 2

Last Lecture

- ER model: model data conceptually
  - Entities & entity set
  - Relationships & relationship set
 - Keys (superkey, candidate keys, primary keys)

E-R Diagrams

- **Rectangles** represent entity sets.

- **Diamonds** represent relationship sets.

- **Ellipses** represent attributes

- **Underline** indicates primary key attributes

- Degree of relationship set:
  - Binary, ternary, n-ary...

Unary Relationship Set

- Unary (degree 1) relationship:
  - A unary relationship exists when both participating entity sets are the same
    - Example: A group of employees is managed by another employee (i.e., manager)
    - Only one entity set: *Employees*
  - Also called as **recursive relationship**

- How can we draw the unary relationship set?

Employees

Reports_to
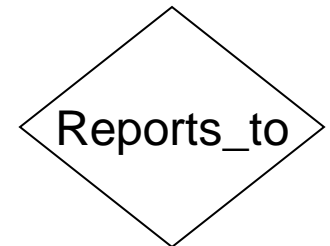
Case 1: Different Roles in Unary Relationships

Different entities are involved in the same relationship with different "roles".

•Examples:

– Employee A is the supervisor of Employee B (i.e., Employee B is the subordinate of Employee A)

  • I.e., same entity pair (A, B) is involved in the *Reports_To* relationship with different roles

•How to draw the ER diagram:

– Add two connections (links) between the entity set and the relationship set

– Write down the role beside each link

name

Employees

supervisor   **subordinate**

Reports_To

Different Roles in Unary Relationships (Cont.)

name
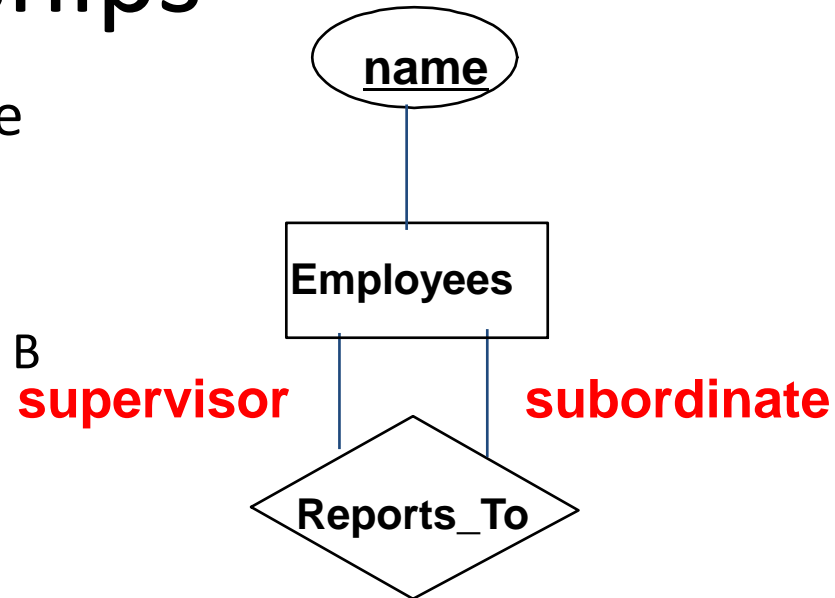
Employees

supervisor   **subordinate**
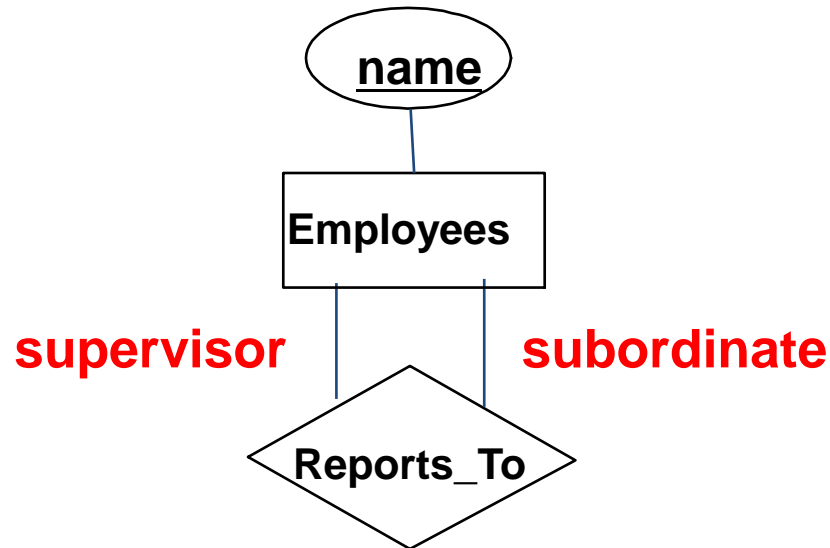
Reports_To

The corresponding *Reports_To* table will look like this:

Employee_supervisor	Employee_subordinate
Alice	Bob
Bob	Carol

Reports_To table

Example 2: Different Roles in Unary Relationships

People

Husband | Wife
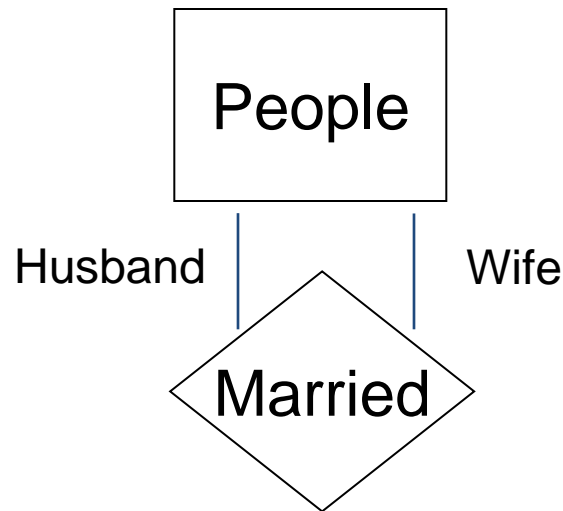
Married

| Husband	Wife
Bob	Alice
Joe	Betty

Married table

Case 2: Same Role in Unary Relationships

- The participant entities are involved in the relationship with the same role

- Can we have the ER diagram shown at the right side?
  - One entity set, one relationship, one link

- NO
  - There should be (again) two connections (links) between entity set and relationship set, even though they are of the same roles
  - Write down the role names. Make the role names distinct (such as Role 1 and Role 2), even Role 1 and Role 2 refer to the same role.

Drinkers

Buddy

8
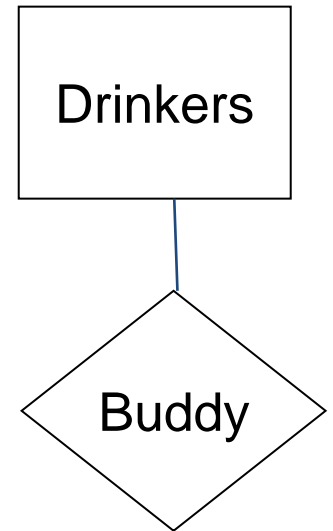
More Example: Same Roles in Relationship

Drinkers

1 | 2
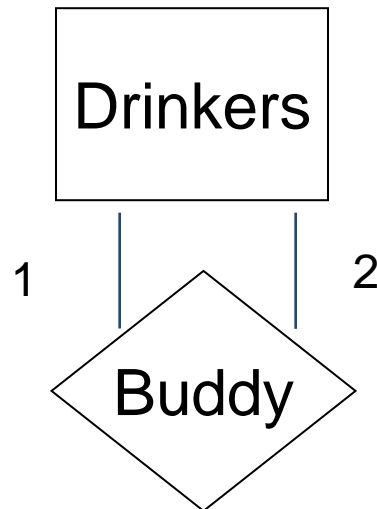
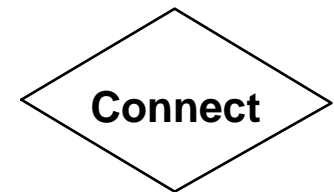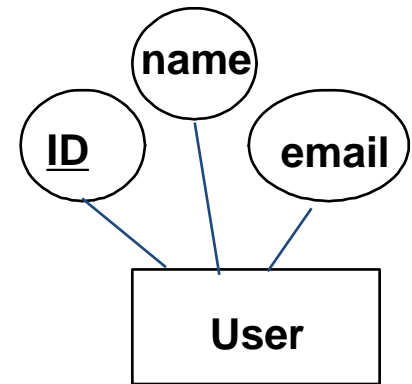Buddy

Buddy 1	Buddy 2
Bob	Alan
Bob	Joe
Alan	Joe

Buddy table

Exercise: Relationships in Twitter

- In Twitter, there are two types of relationships between users
  - *Following others:* you are subscribing to their Tweets as a follower
  - *Being followed*: You have followers

- Question:
  - Draw the ER diagram of the relationship *Connect*

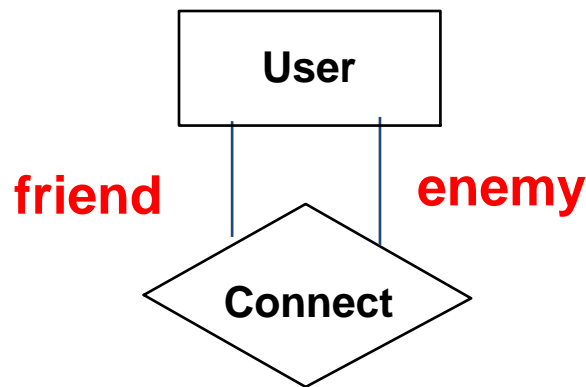# Exercise: Facebook II (cont.)

- Assume you want to design an annual student directory (a prototype of Facebook II)

- The main concepts you need to describe include

  - Users (ID, age, gender, school)

  - Friend & enemy relations among users

Questions

  - Draw the ER diagram with the relationships.

Exercise: Facebook II (cont.)

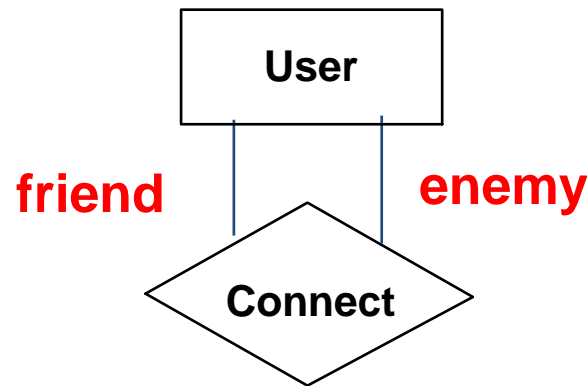- Can we draw the ER diagram as following?

- Hint: what will the table look like for this ER diagram? Is this correct?

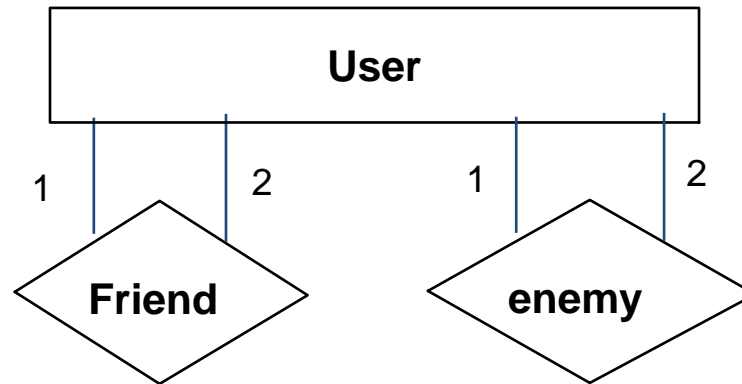| Friend	Enemy
Bob	Alan
Bob	Joe
Alan	Joe

Connect table

Exercise: Facebook II (cont.)

- Can we draw the ER diagram as the following?

- Answer: NO

  - *Friend* and *enem*y are two different types of relationships, NOT the different roles in the same relationship!

    - The same pair of users (A, B) cannot be involved in the same Connect relationship with A as friend of B but B is enemy of A!

Exercise: Facebook II (cont.)

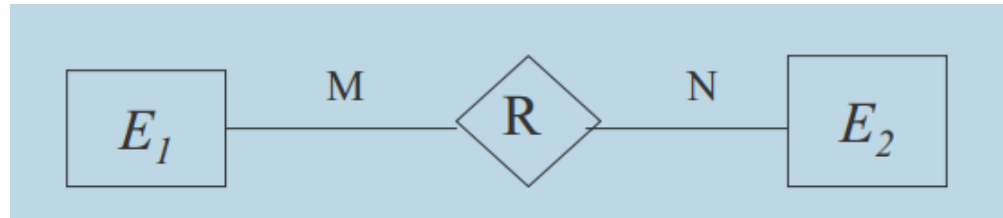- Correct solution:

- The corresponding tables

Friend 1	Friend 2
Alice	Bob
Bob	Carol

Enemy 1	Enemy 2
Alice	Carol
Daisy	Alice

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Today's Lecture

- Unary relationships

- **Constraints** on ER diagram
  - Cardinality constraints in ER diagram
 - Participation constraint
  - Weak entities

Cardinality Constraints in E-R Diagram

- *Cardinality ratio* of R: the number of entities of E2 that an entity of E1 can possibly be associated thru R

- Four possibilities are usually specified:
  - one-to-one (1-1)
  - one-to-many (1-N)
  - many-to-one (N-1)
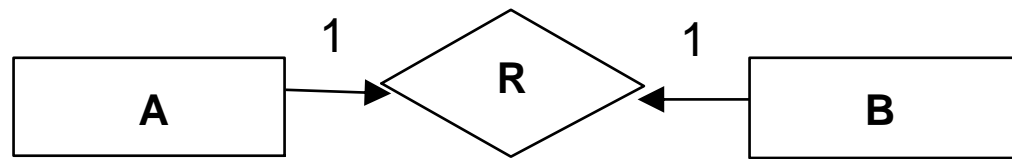 - many-to-many (M-N)

One-to-One (1-1) Relationship

- An entity in A is associated with at most one entity in B and vice versa

- e.g. A: driver, B: driver's license

- More examples of 1-1 relationship?

1-to-1
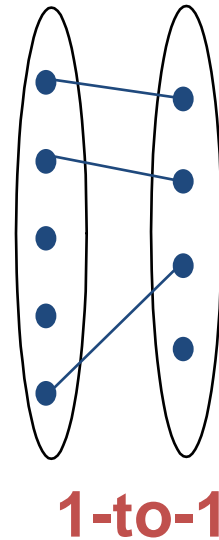
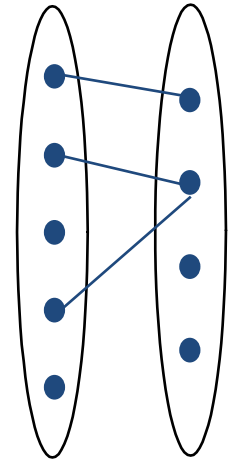# Draw 1-1 Relationship in ER Diagram

- **Both lines (R, A) and (R, B) must be arrowed**: each arrow pointing to R

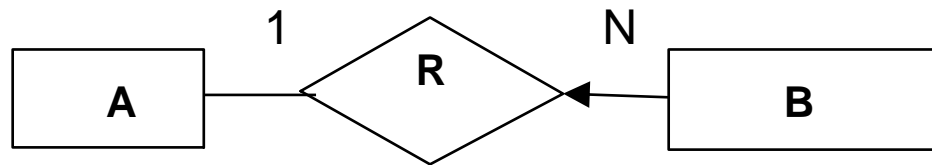**ER diagram**

One-to-Many (1-N) Relationship

- One-to-many from A to B

  - An entity in A is associated with any number of entities in B

  - An entity in B is associated with at most one entity in A

    - e.g. A: biological-mother, B: children

 - More examples of 1-N relationships?

Many-to-1

Draw 1-N Relationship in ER Diagram

- Assume:
  - R is a 1-N relationship between entity sets A and B
  - A is the entity set at 1-side
  - B is the entity set at many-side
- **The line between R & B must be arrowed**:
  - The arrow leaves entity set at many-side and points to entity set at 1-side
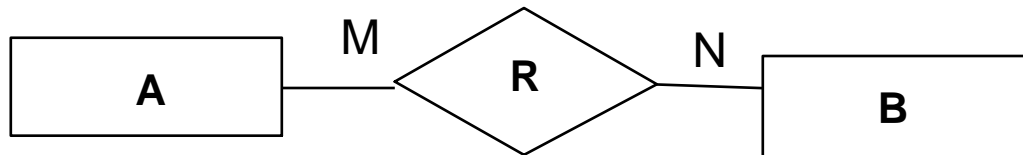
Many-to-Many (M-N) Relationship

- many-to-many from A to B:
  - An entity in A is associated with any number of entities in B and vice versa

- e.g. A: student, B: course

- More examples of M-N relationship?
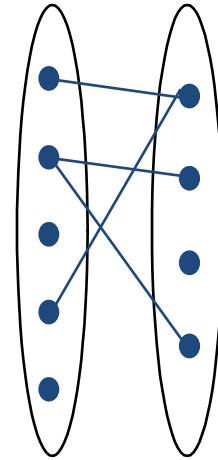
Many-to-Many

Draw M-N Relationship in ER Diagram

- NO special treatment: no arrow.

Exercise: Cardinality constraints

- What are the cardinality constraints of following relationships?
  - A: Country; B: Capital; R: has
  - A: Movie; B: Director; R: has
  - A: Movie; B: actor; R: play
  - A: Person; B: email address; R: has
  - A: book; B: author; R: write
  - A: doctor; B: patient; R: treat