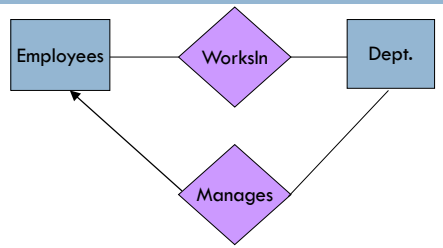
Key Constraints

37



- Many-many: "An employee can work in many depts, and a dept. can have many employees
- One-many: A dept has at most one manager, and employees can manage many departments

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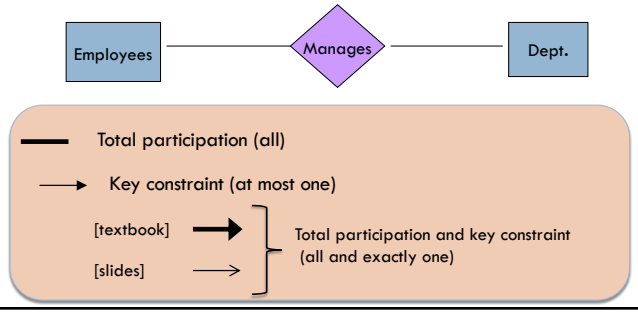
Participation Constraints

38

- Does every dept. have to have a manager?
  - If yes, then every dept. must appear in the manages relation: total participation (vs. partial)



38

Attributes on Relationships

39

- Sometimes it is useful to attach an attribute to a relationship.
- Think of this attribute as a property of tuples in the relationship set.

39

Example: Attribute on Relationship

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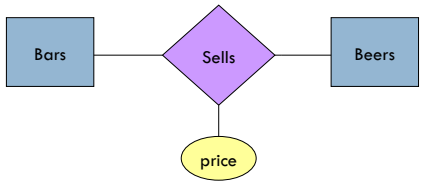

Price is a function of both the bar and the beer, not of one alone.
E.g., "The price of Miller beer at Joe's bar"

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Equivalent Diagrams Without Attributes on Relationships

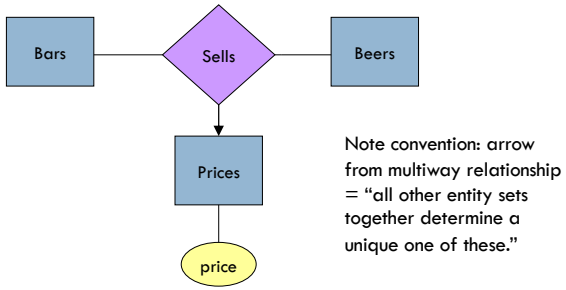
41

- Create an entity set representing values of the attribute.
- Make that entity set participate in the relationship.

41

Example: Removing an Attribute from a Relationship

42



42

Roles

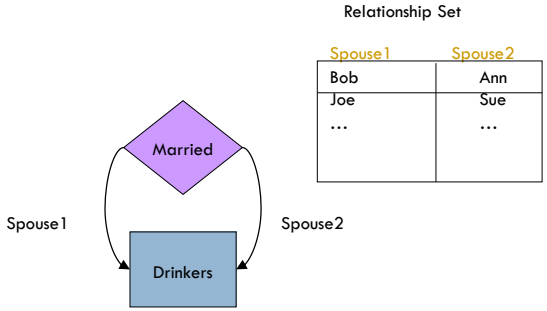
43

- Sometimes an entity set appears more than once in a relationship.
- Label the edges between the relationship and the entity set with names called *roles*.

43

Example: Roles

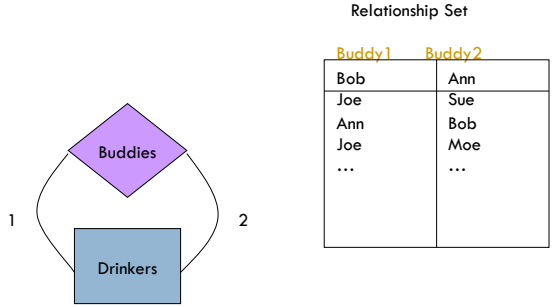
44



44

Example: Roles

45



Relationship Set

Buddy1	Buddy2
Bob	Ann
Joe	Sue
Ann	Bob
Joe	Moe
…	…

45

Subclasses

46

- *Subclass* = special case = more properties.
- Example: Ales are a kind of beer.
  - Not every beer is an ale, but some are.
  - Let us suppose that in addition to all the *properties* (attributes and relationships) of beers, ales also have the attribute color.

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Subclasses in E/R Diagrams

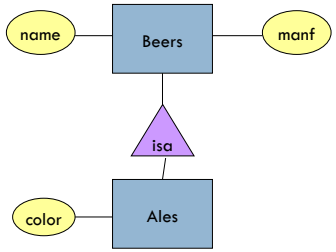
47

- isa triangles indicate the subclass relationship.
  - Point to the superclass.
- Reasons for using isa:
  - To add descriptive attributes specific to a subclass.
  - To identify entities that participate in a relationship.

47

Example: Subclasses

48



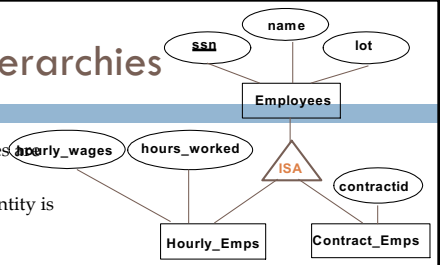
Assume subclasses form a tree.

48

ISA (`is a') Hierarchies

49

- 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 two sub-classes contain the same entity? E.g., Can Joe be an Hourly_Emps as well as a Contract_Emps entity?
- *Covering constraints*: Does every Employees entity have to be an Hourly_Emps or a Contract_Emps entity?

R. Ramakrishnan & J. Gehrke

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Keys

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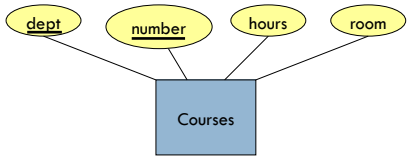
- A *key* is a set of attributes for one entity set such that no two entities in this set agree on all the attributes of the key.
  - It is allowed for two entities to agree on some, but not all, of the key attributes.
- We must designate a key for every entity set.
- Underline the key attribute(s).

50

Example: a Multi-attribute Key

51



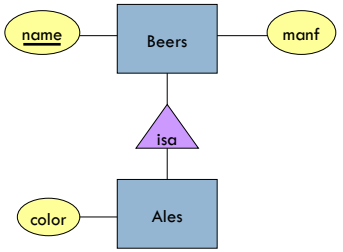
- Note that hours and room could also serve as a key, but we must select only one primary key.

51

Keys

52

In an Isa hierarchy, only the root entity set has a key, and it must serve as the key for all entities in the hierarchy.



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Weak Entity Sets

53

- Occasionally, entities of an entity set need "help" to identify them uniquely.
- Entity set *E* is said to be *weak* if in order to identify entities of *E* uniquely, we need to follow one or more many-one relationships from *E* and include the key of the related entities from the connected entity sets.

53

Example: Weak Entity Set

54

- name is almost a key for football players, but there might be two with the same name.
- number is certainly not a key, since players on two teams could have the same number.
- But number, together with the team name related to the player by Plays-on should be unique.

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In E/R Diagrams

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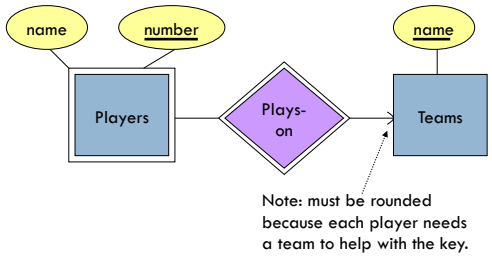

- Double diamond for *supporting* many-one relationship.
- Double rectangle for the weak entity set.

55

Weak Entity-Set Rules

56

- A weak entity set has one or more many-one relationships to other (supporting) entity sets.
  - Not every many-one relationship from a weak entity set need be supporting.
  - But supporting relationships must have a rounded arrow (entity at the "one" end is guaranteed).

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Weak Entity-Set Rules – (2)

57

- The key for a weak entity set is its own underlined attributes and the keys from the supporting entity sets.
  - E.g., (player) number and (team) name is a key for Players in the previous example.

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Design Techniques

58

1. Avoid redundancy.
2. Limit the use of weak entity sets.
3. Don't use an entity set when an attribute will do.

58

Avoiding Redundancy

59

- *Redundancy* = saying the same thing in two (or more) different ways.
- Wastes space and (more importantly) encourages inconsistency.
  - Two representations of the same fact become inconsistent if we change one and forget to change the other.

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Example: Good

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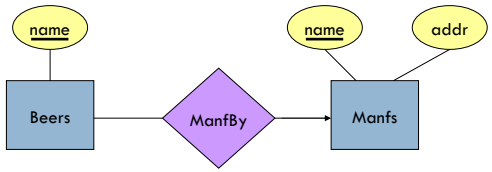
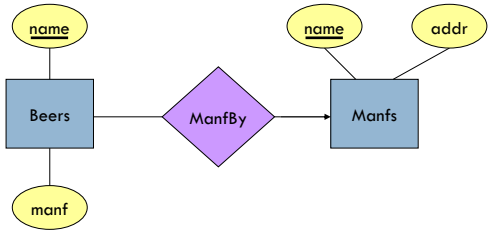


This design gives the address of each manufacturer exactly once.

60

Example: Bad

61

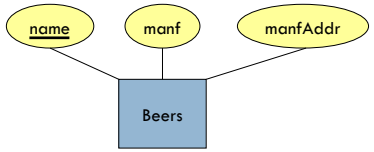


This design states the manufacturer of a beer twice: as an attribute and as a related entity.

61

Example: Bad

62



This design repeats the manufacturer's address once for each beer and loses the address if there are temporarily no beers for a manufacturer.

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