

3/3/2015 ER-MO05L

Entity-Relationship model - informal way to communicate/model information structure

- 1st step towards defining the database
- concepts are standard, but pictorial representations are not.
- We'll use Chen's notation

I. Basic concepts

- 1) Entity - an "object." Examples: Bob, Boston, the country whose capital is Paris
- 2) Relationship - entities participate in relationships Example Alice & Boston are in relationship "likes"
- 3) Attributes - a property Example age is an attribute of Person size is an attribute of city

An entity set is a collection of similar entities. Eg. Employees, Person

Can be tough to pick the right entity set.

Eg. - partition people by sex?
 yes, if we are talking about things that can give birth
 no, if we are modelling employment.

Eg. - concrete vs. abstract objects.
 All Ford cars = models of cars (abstract)?
 manufactured cars (concrete)?

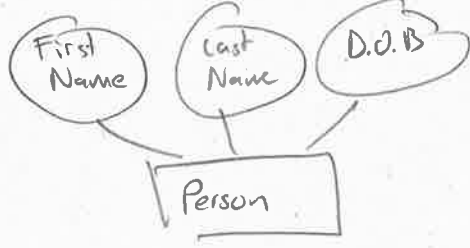
II Details and Pictorial Representations

II.1 Entity



- Rectangle
- Single noun
- Capitalized
- Has a key

II.2 Attribute



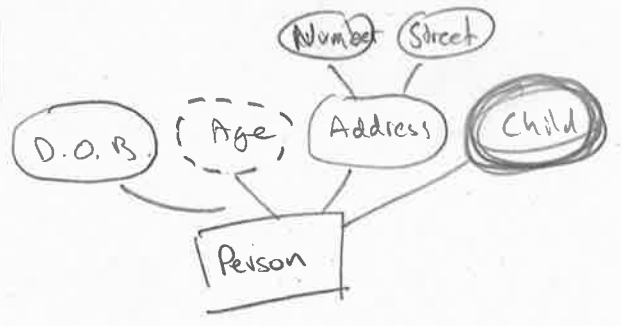
- Each entity has 0 or more attributes
- Each attribute has a domain (i.e. set of values it can take) which may include NULL.
- Written with ellipses
- All entities in the same entity set have same attributes.

Attributes can be:

- Base - Eg. D.O.B
- vs. - Derived - dashed ellipse Eg. age and DOB

- Simple - Eg. D.O.B
- vs. Composite - has component attributes Eg. Address / number and street.

- single valued - D.O.B
- vs. multi valued - unspecified number, thick line ellipse e.g. child



sets
 $A \subseteq B$ means A is a subset of B

- A = {2, 5, 6}
- B = {1, 2, 5, 6, 8}
- C = {2, 5, 6}

$A \subseteq B, A \subseteq C$
 $A \subseteq B, A = C$

Keys

A super key is a set of attributes that for any two entities, they must differ in the values of the attributes

A minimal super key is a key or candidate key

E.g. social and name is superkey, not key
 longitude and latitude for city is a key, but just longitude is not.

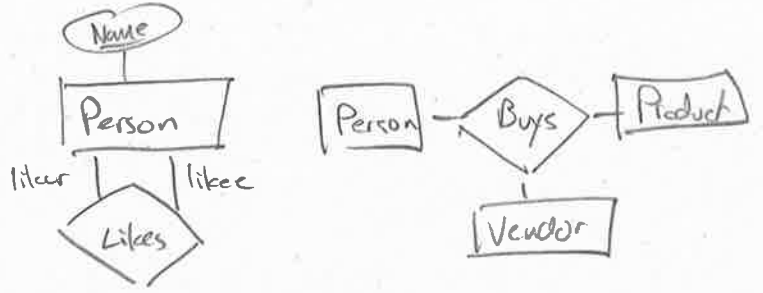
If there is more than one key, pick one to be primary (underline in E.R.)



II.3 Relationship



- Association between (one or more) entities
- Diamonds
- Capitalized verb, 3rd person singular



Binary Relationships



- Not every person has to like a product
- Not every product has to be liked by a person
- A person may like many products
- A product may be liked by many people

Formally

R is a relationship among entity sets $E_1, E_2, E_3, \dots, E_n$ iff $R \subseteq E_1 \times E_2 \times E_3 \times \dots \times E_n$

R is a set of ordered tuples.

- $E_1 = \{ \text{Bob, Alice} \}$ ↑ important see alice/bob
- $E_2 = \{ \text{Computer, Phone} \}$
- $R = \{ (\text{Bob, Phone}), (\text{Alice, Computer}) \}$
- $E_1 \times E_2 = \dots$

Ternary Relationships...

E.g. Alice buys computer from Apple

Non-distinct entity sets !

E.g. Bob likes Alice
 Alice does not like Bob
 order matters

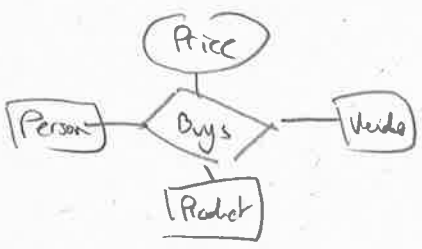
May give Roles e.g. Liker, Likee

- written in diagram

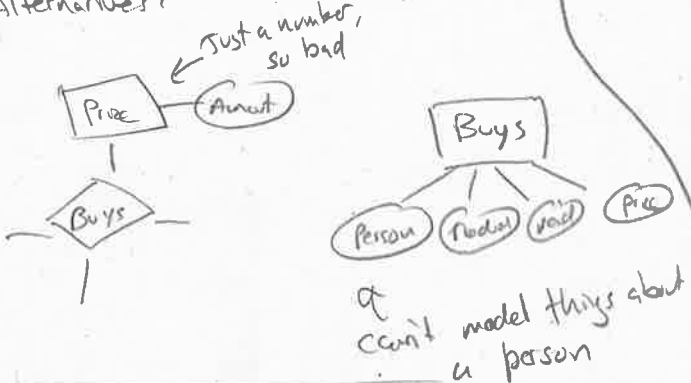
- Relationship with attributes

Consider Buys(Person, Vendor, Product)
What about Price?

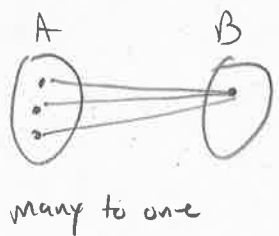
- not a property of vendor, product, or person



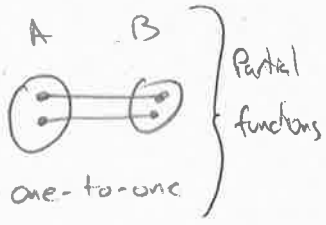
Alternatives:



Can't model things about a person

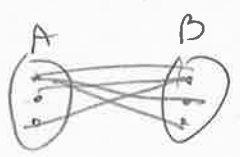


many to one



one-to-one

Partial functions



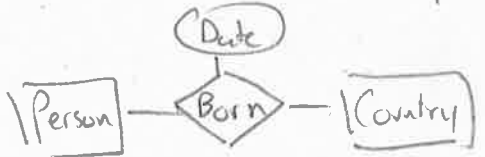
many-to-many

Not a function

Property on relationship



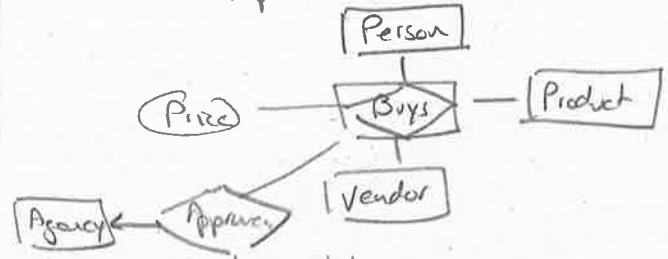
Can "slide" to person, not to country



if one-to-one, can slide either way,
if many-to-one, can move to the many

Aggregation = relationship as entity

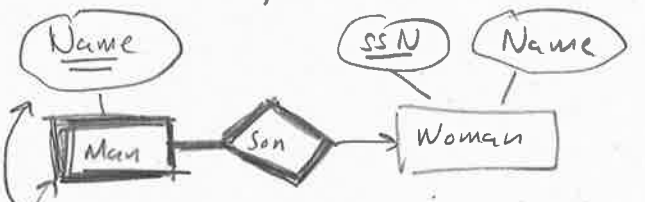
Allows the relationship to participate in relationships.



Strong vs Weak Entities

A strong entity (set): elements can be identified by value of attributes (i.e., has a primary key)

A weak entity set: elements are identified by combination of attributes and relationship with other entity

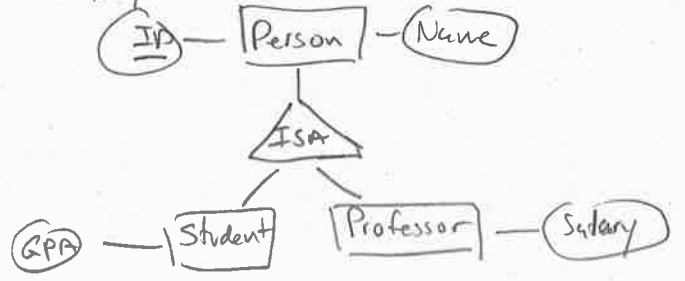


discriminant - double lines, the attributes that distinguish entities in the weak entity set

thick line for weak entity

ISA Relationship

- ISA is a subset relation
- subset entities have all attributes of the superset
- may participate in relationships that superset cannot
- may have additional attributes

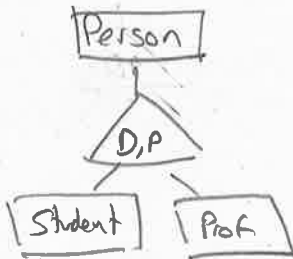


- Note, student and professor are weak entity sets with no discriminants.

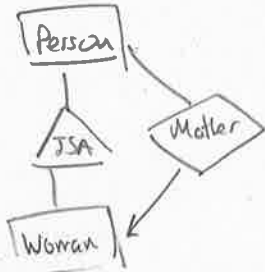
An ISA can be:

- Disjoint - no entity can be in more than one subclass
- Overlapping - can be in more than one subclass
- Total - every entity is in at least one subclass
- Partial - an entity need not be in a subclass

example:



- Some people are professors
- Some people are students
- Some people are neither
- No one is both



every person has a mother.

Cardinality Constraints

- Specify how many times an entity participates in a relationship

$i..j$ means $0 \leq i \leq j$

$i..*$ means $[i, \infty)$

$0..*$ means no constraint or don't write it



- Every person likes exactly 1 country
- Every country is liked by 2 or 3 people

2 Notations:

