

Lecture 7: The E/R Model

جلسه هفتم: مدل موجودیت-رابطه

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Today's Lecture

1. E/R Design considerations (ملاحظات طراحی موجودیت-رابطه)
 - ACTIVITY: Crayon time pt. II

1. E/R Design Considerations

ملاحظات طراحی موجودیت-رابطه

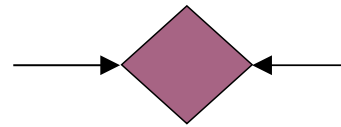
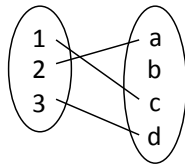
چه چیزهایی را در این بخش خواهید آموخت

1. Relationships cont'd: multiplicity, multi-way (ادامه‌ی موضوع روابط: تعدد، چند طرفی)
2. Design considerations (ملاحظات طراحی)
3. Conversion to SQL (تبدیل به اس-کیو-ال)

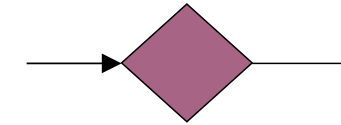
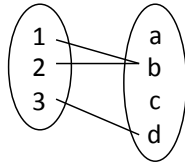
4. فعالیت: ترسیم نمودارهای موجودیت-رابطه (بر روی کاغذ) - بخش دوم

Multiplicity of E/R Relationships

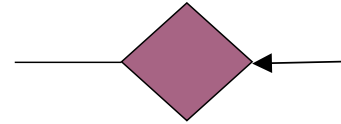
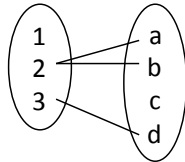
One-to-one:
(یک به یک)



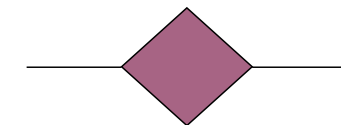
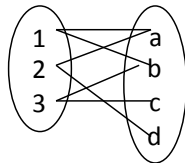
Many-to-one:
(چند به یک)



One-to-many:
(یک به چند)



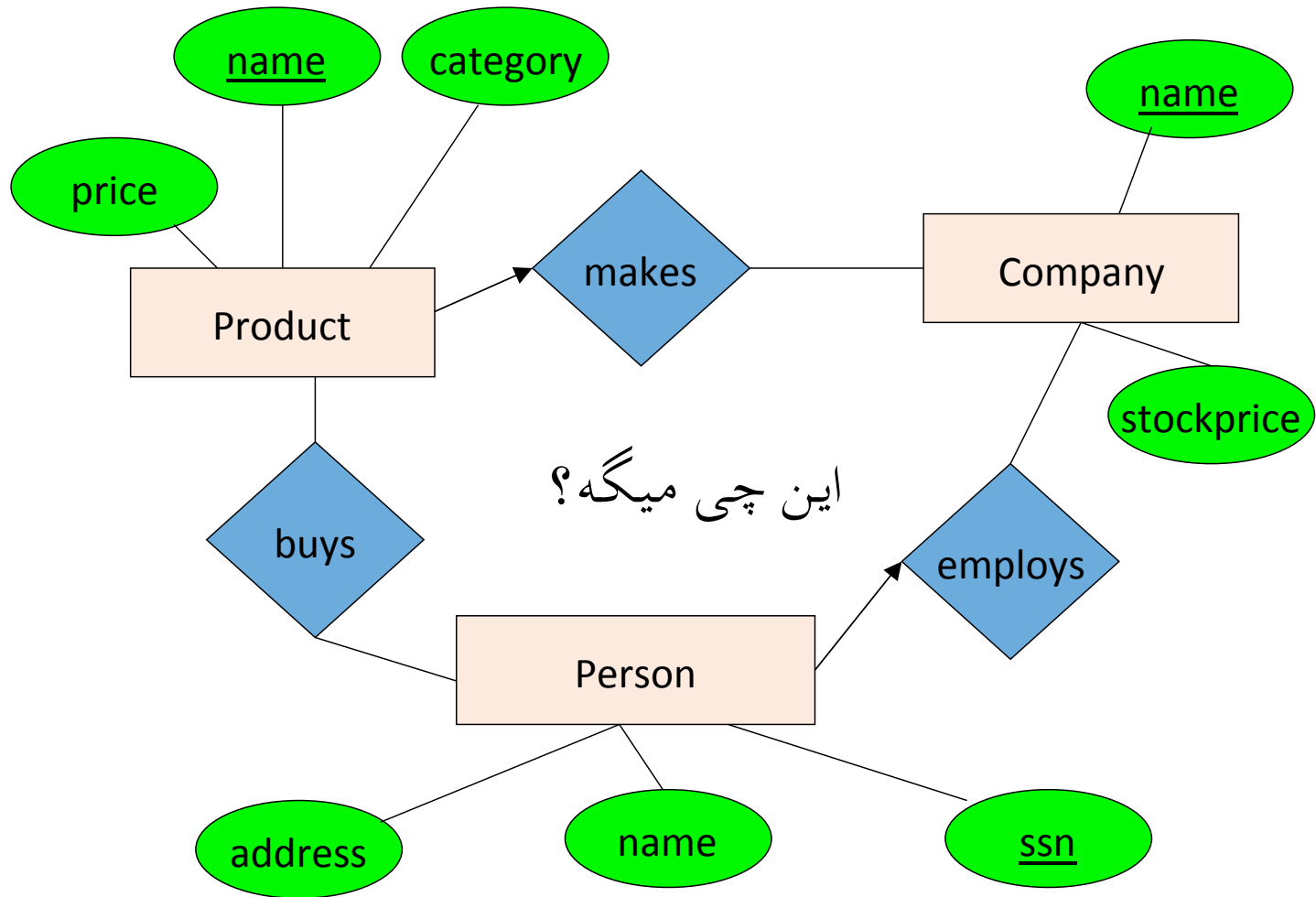
Many-to-many:
(چند به چند)



Indicated using
arrows

(با استفاده از فلش
مشخص می شود)

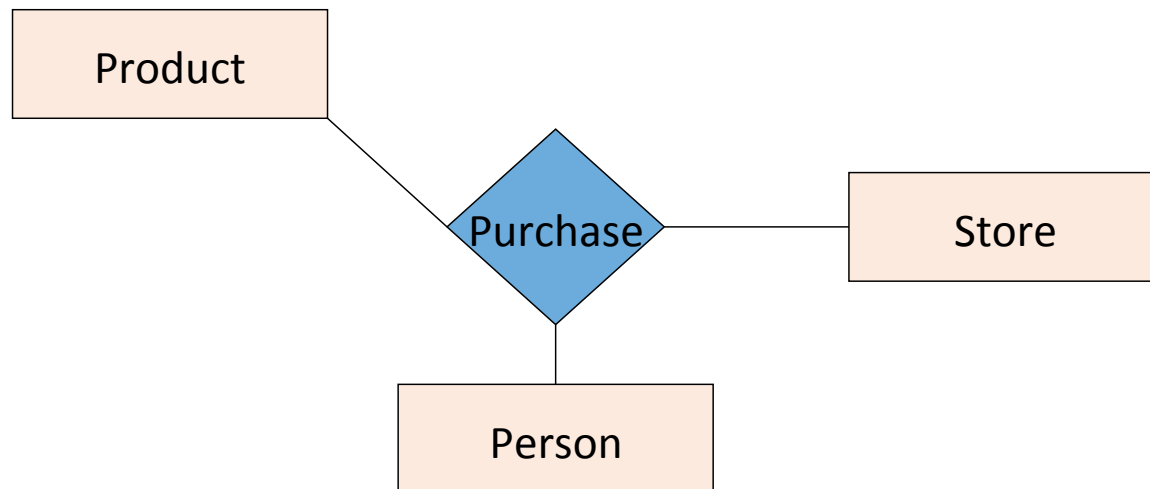
$X \rightarrow Y$ means
there exists a
function mapping
from X to Y (recall
the definition of a
function)



Multi-way Relationships (روابط چند طرفه)

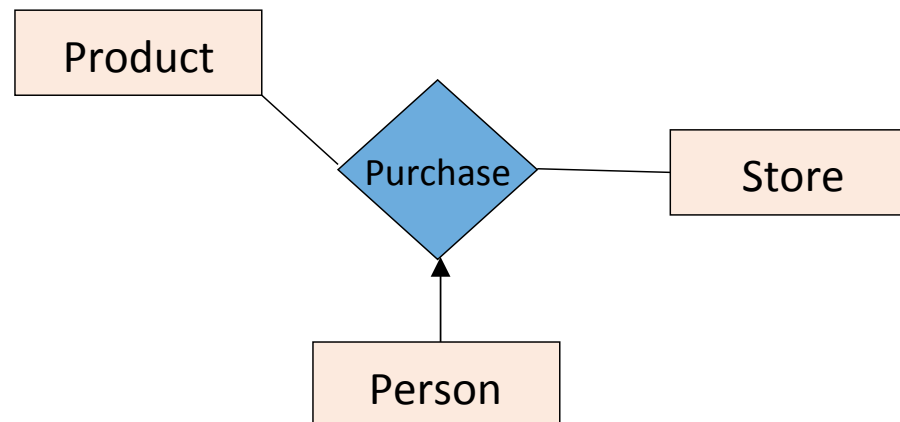
How do we model a purchase relationship between buyers, products and stores?

چطور یک رابطه‌ی خرید را بین خریداران، محصولات و مغازه‌ها مدل کنیم؟



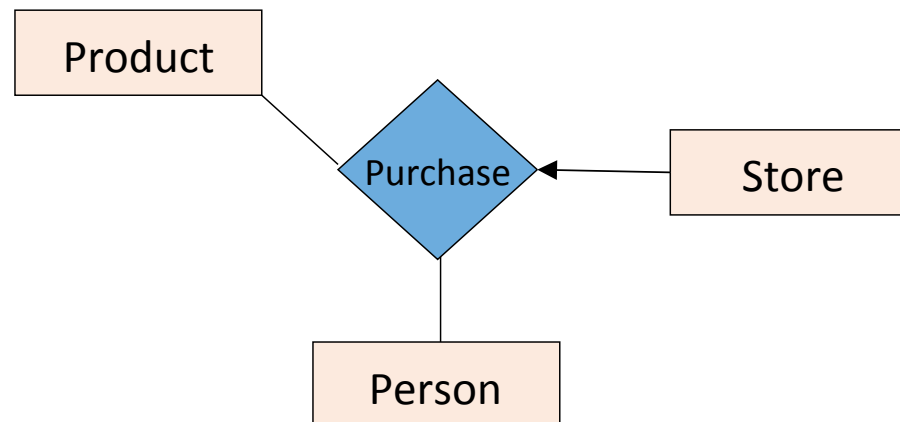
Arrows in Multiway Relationships

Q: What does the arrow mean ? (این فلش یعنی چه ؟)



Arrows in Multiway Relationships

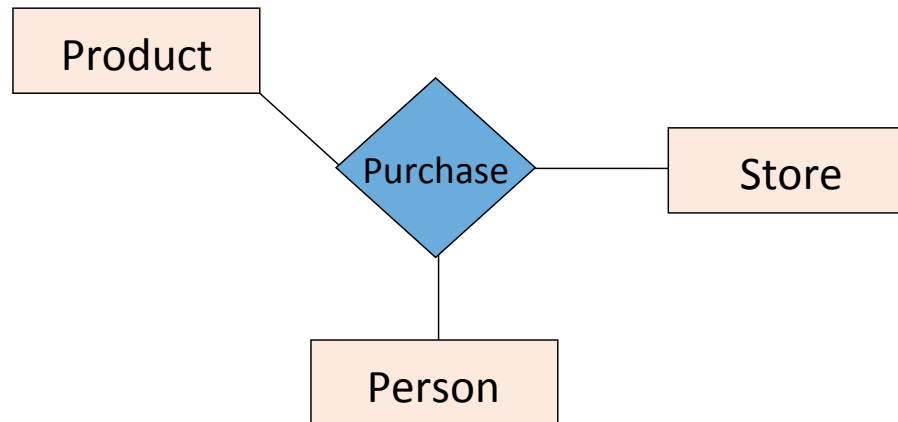
Q: What does the arrow mean ? (این فلش یعنی چه ؟)



Arrows in Multiway Relationships

Q: How do we say that every person shops in **at most** one store ?

سوال: چطوری میتونیم بگیم که هر فردی حداکثر در یک مغازه خرید می کنه؟

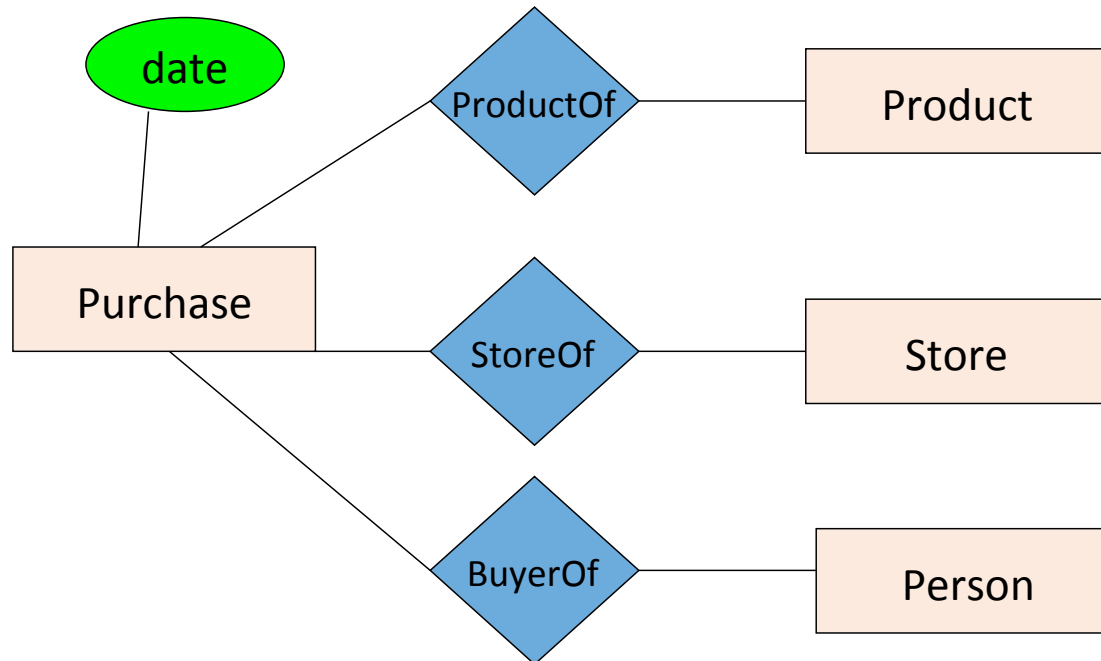


A: Cannot. This is the best approximation.
(Why only approximation ?)

جواب: نمیتونیم. همین نمودار بهترین تقریب هست. (چرا فقط تقریب؟)

Converting Multi-way Relationships to Binary

تبدیل روابط چند طرفه به دو طرفه

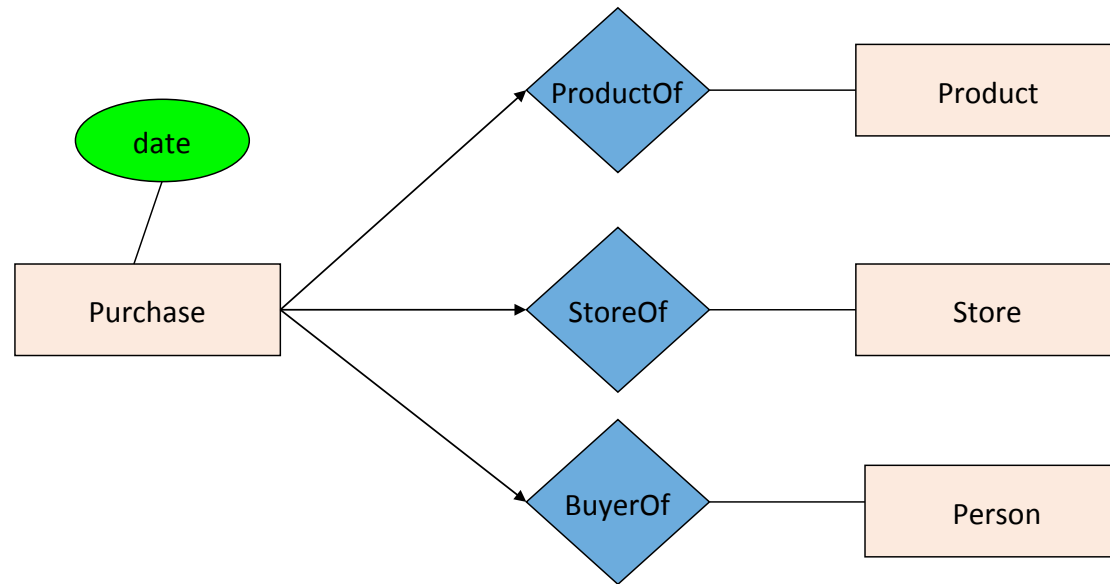


From what we had on previous slide to this - what did we do?

چه فرقی بین این و اسلاید قبلی وجود داره؟

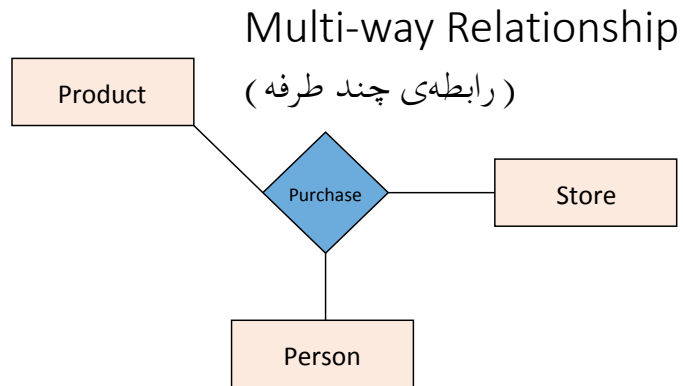
Converting Multi-way Relationships to New Entity + Binary Relationships

Side note:
What arrows
should be
added here?
Are these
correct?



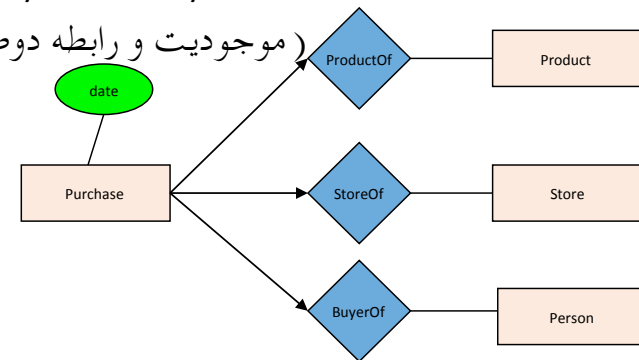
Decision: Multi-way or New Entity + Binary?

تصمیم: چند طرفه یا موجودیت جدید و دو طرفه؟



Entity + Binary

(موجودیت و رابطه دو طرفه)

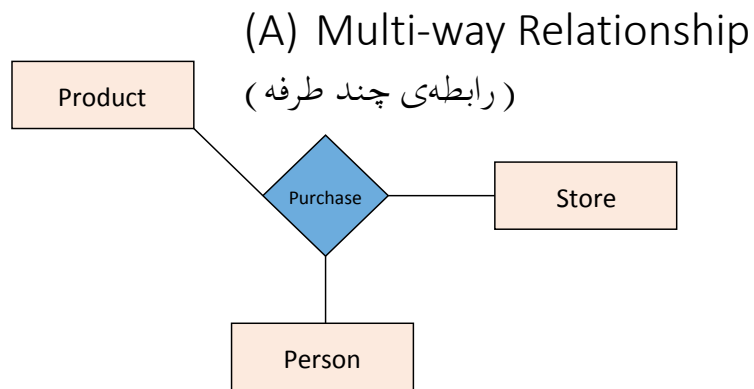


Should we use a single multi-way relationship or a *new entity with binary relations*?

آیا باید از یک رابطه‌ی چند طرفه استفاده کنیم یا یک موجودیت جدید و روابط دو طرفه؟

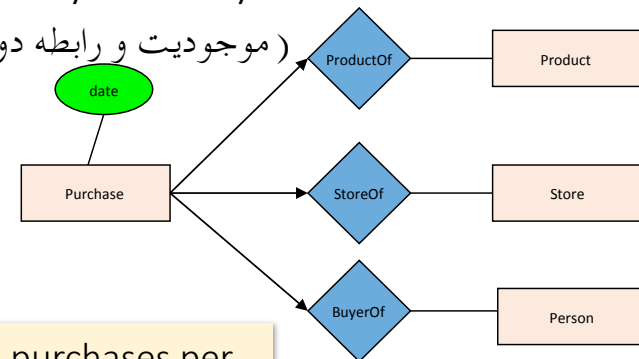
Decision: Multi-way or New Entity + Binary?

تصمیم: چند طرفه یا موجودیت جدید و دو طرفه؟



(B) Entity + Binary

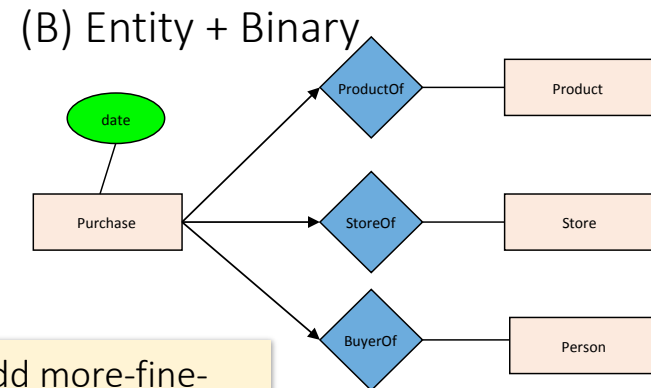
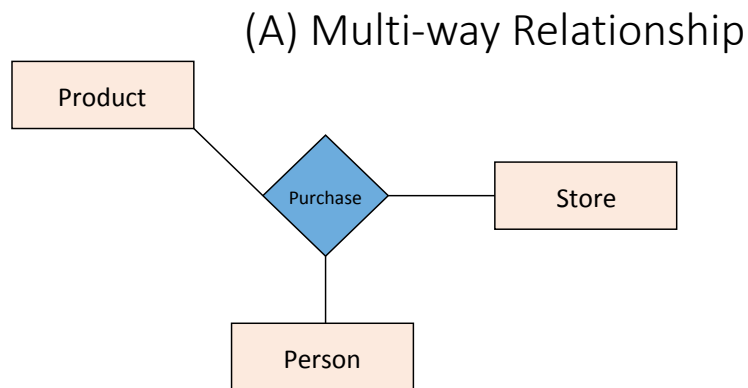
(موجودیت و رابطه دو طرفه)



Multiple purchases per
(product, store, person)
combo possible here!

- *Covered earlier:* (B) is useful if we want to have multiple instances of the “relationship” per entity combination

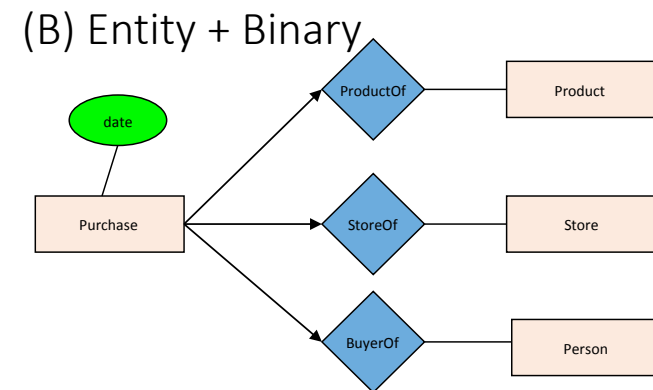
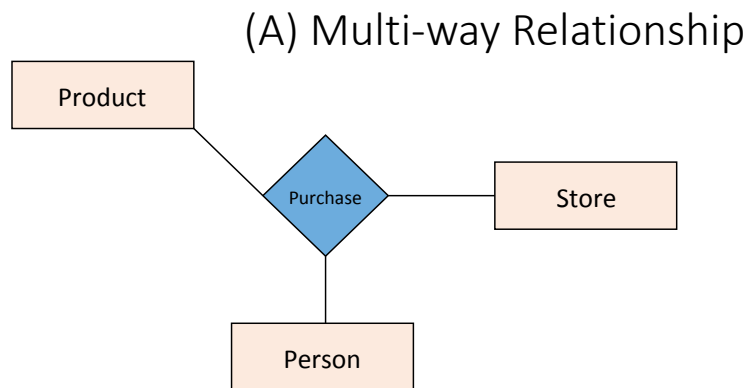
Decision: Multi-way or New Entity + Binary?



We can add more-fine-grained constraints here!

- (B) is also useful when we want to add details (constraints or attributes) to the relationship
 - “A person who shops in only one store”
 - “How long a person has been shopping at a store”

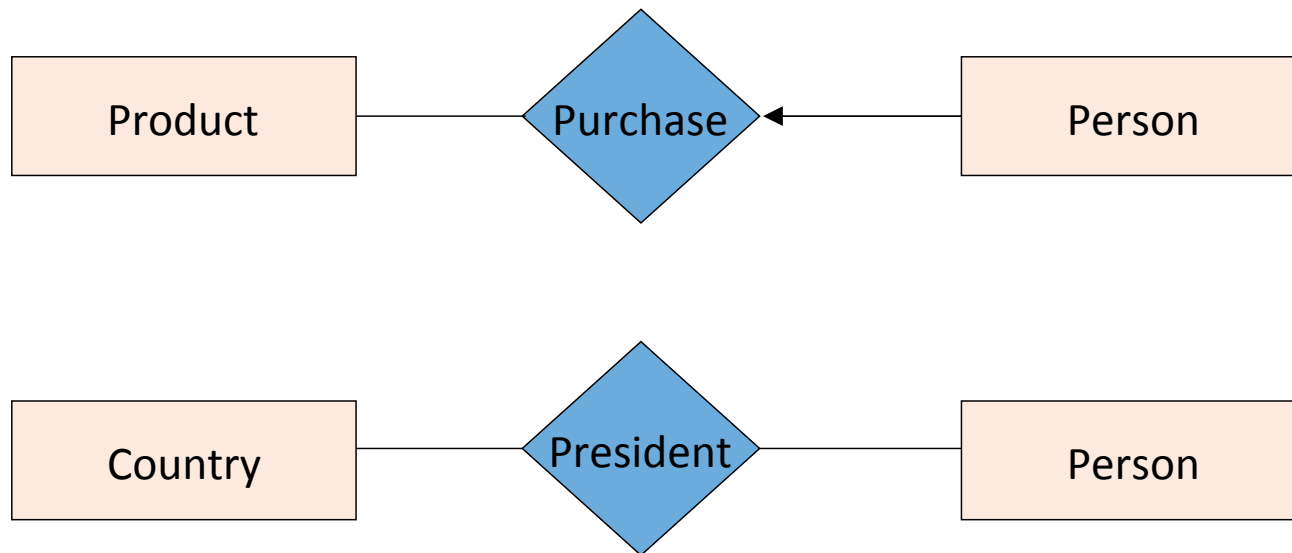
Decision: Multi-way or New Entity + Binary?



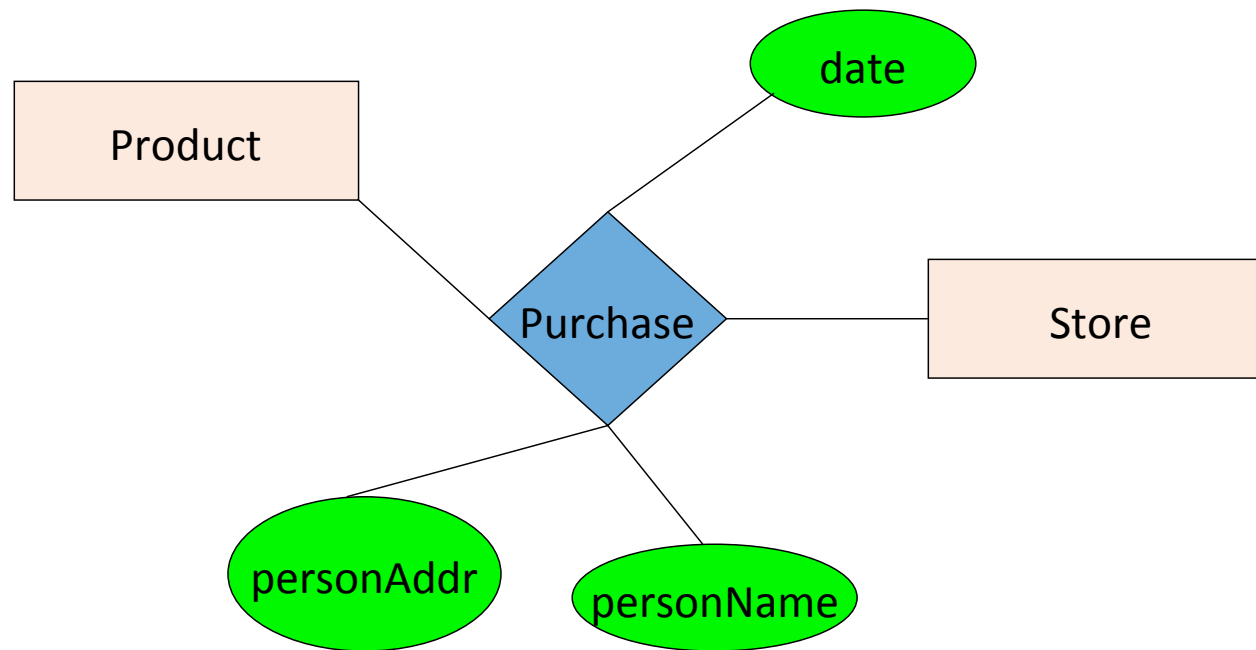
- (A) is useful when a relationship really is between multiple entities
 - *Ex: A three-party legal contract*

3. Design Principles

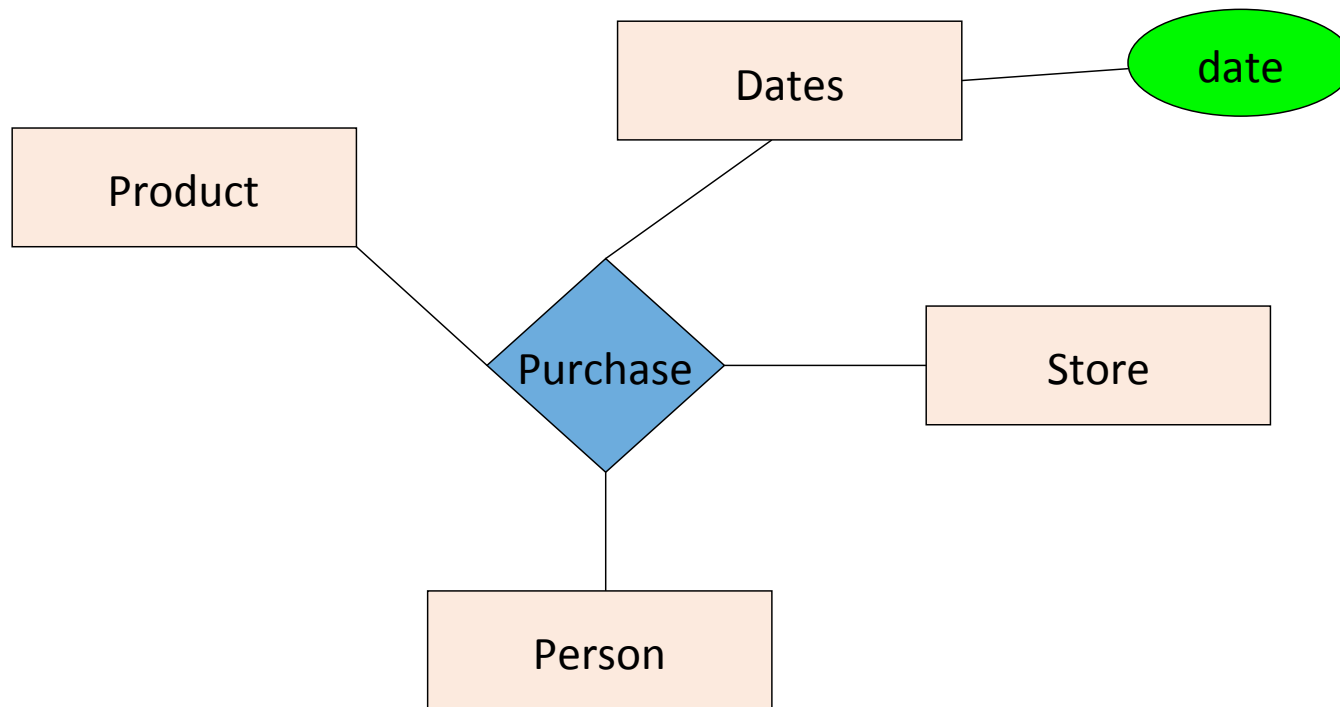
What's wrong with these examples?



Design Principles: What's Wrong?

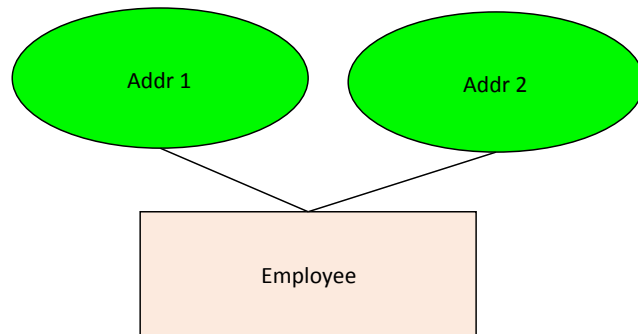


Design Principles: What's Wrong?

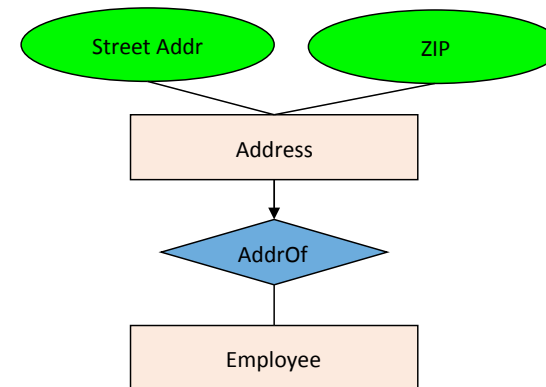


Examples: Entity vs. Attribute

Should address (A)
be an attribute?

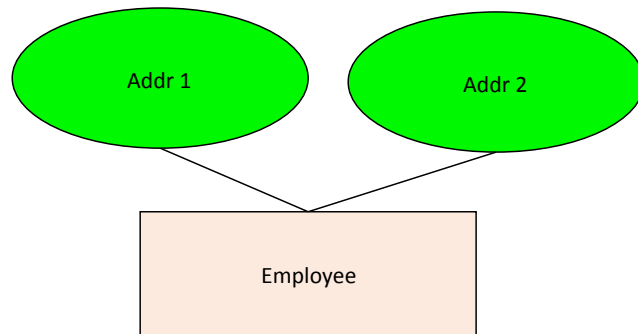


Or (B) be an entity?



Examples: Entity vs. Attribute

Should address (A)
be an attribute?

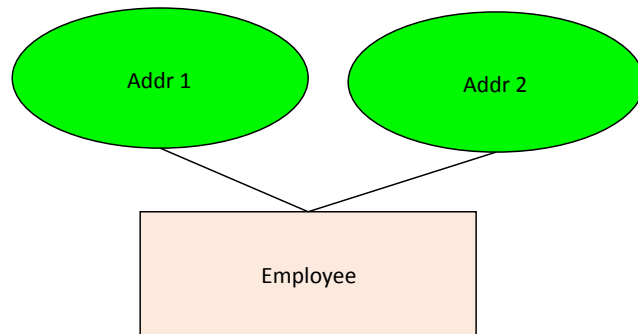


How do we handle employees
with multiple addresses here?

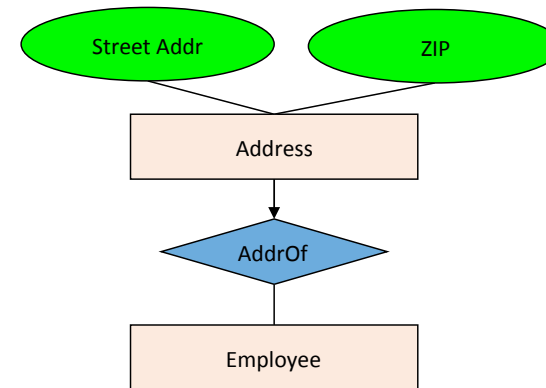
How do we handle addresses
where internal structure of the
address (e.g. zip code, state) is
useful?

Examples: Entity vs. Attribute

Should address (A)
be an attribute?



Or (B) be an entity?



In general, when we want to record several values,
we choose new entity

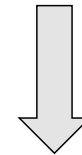
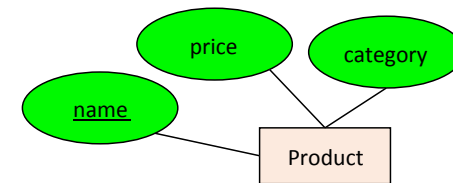
From E/R Diagrams to Relational Schema

- Key concept:

Both ***Entity sets*** and ***Relationships*** become relations (tables in RDBMS)

From E/R Diagrams to Relational Schema

- An entity set becomes a relation (multiset of tuples / table)
 - Each tuple is one entity
 - Each tuple is composed of the entity's attributes, and has the same primary key

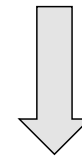
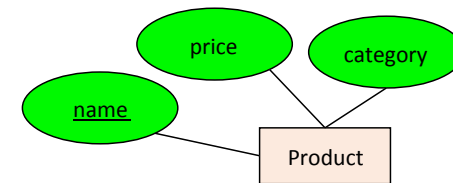


Product

<u>name</u>	price	category
Gizmo1	99.99	Camera
Gizmo2	19.99	Edible

From E/R Diagrams to Relational Schema

```
CREATE TABLE Product(  
  name      CHAR(50) PRIMARY KEY,  
  price     DOUBLE,  
  category  VARCHAR(30)  
)
```

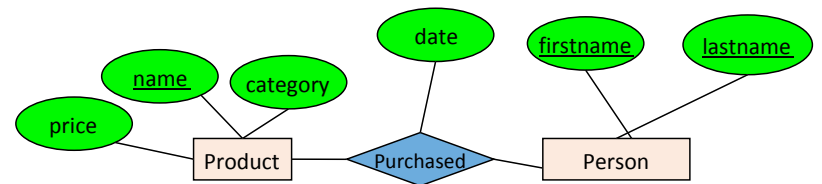


Product

<u>name</u>	price	category
Gizmo1	99.99	Camera
Gizmo2	19.99	Edible

From E/R Diagrams to Relational Schema

- A relation between entity sets A_1, \dots, A_N *also* becomes a multiset of tuples / a table
 - Each row/tuple is one relation, i.e. one unique combination of entities (a_1, \dots, a_N)
 - Each row/tuple is
 - composed of the **union of the entity sets' keys**
 - has the entities' primary keys as foreign keys
 - has the union of the entity sets' keys as primary key



Purchased

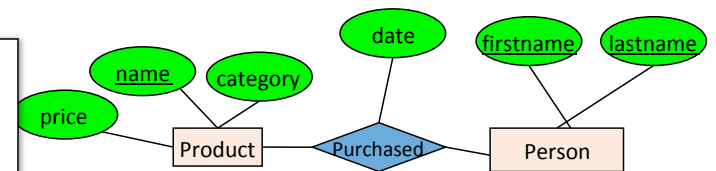
<u>name</u>	<u>firstname</u>	<u>lastname</u>	<u>date</u>
Gizmo1	Bob	Joe	01/01/15
Gizmo2	Joe	Bob	01/03/15
Gizmo1	JoeBob	Smith	01/05/15

From E/R Diagrams to Relational Schema

```

CREATE TABLE Purchased(
  name      CHAR(50),
  firstname CHAR(50),
  lastname  CHAR(50),
  date      DATE,
  PRIMARY KEY (name, firstname, lastname),
  FOREIGN KEY (name)
    REFERENCES Product (name),
  FOREIGN KEY (firstname, lastname)
    REFERENCES Person (firstname, lastname)
)

```

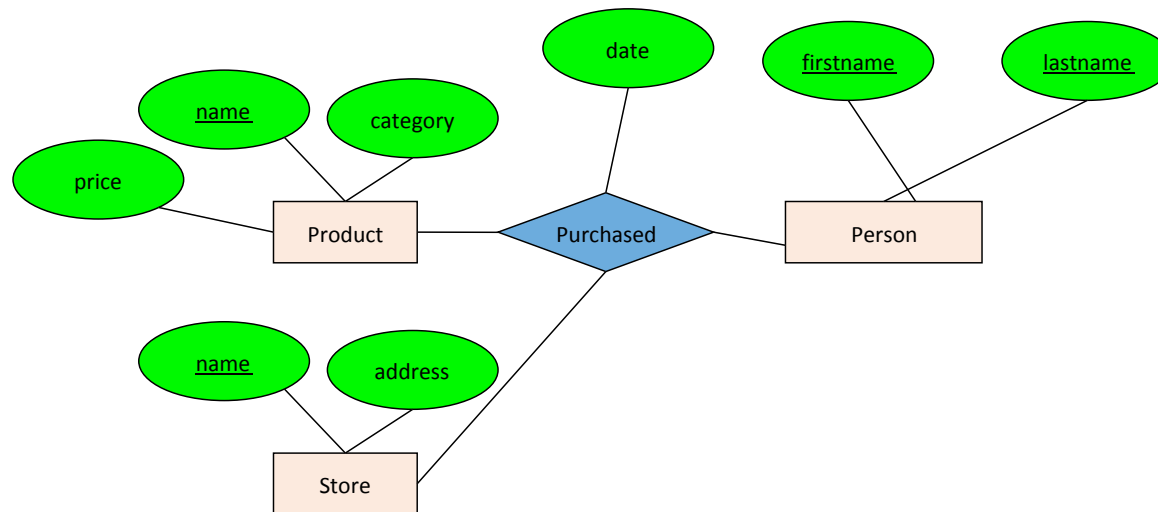


Purchased

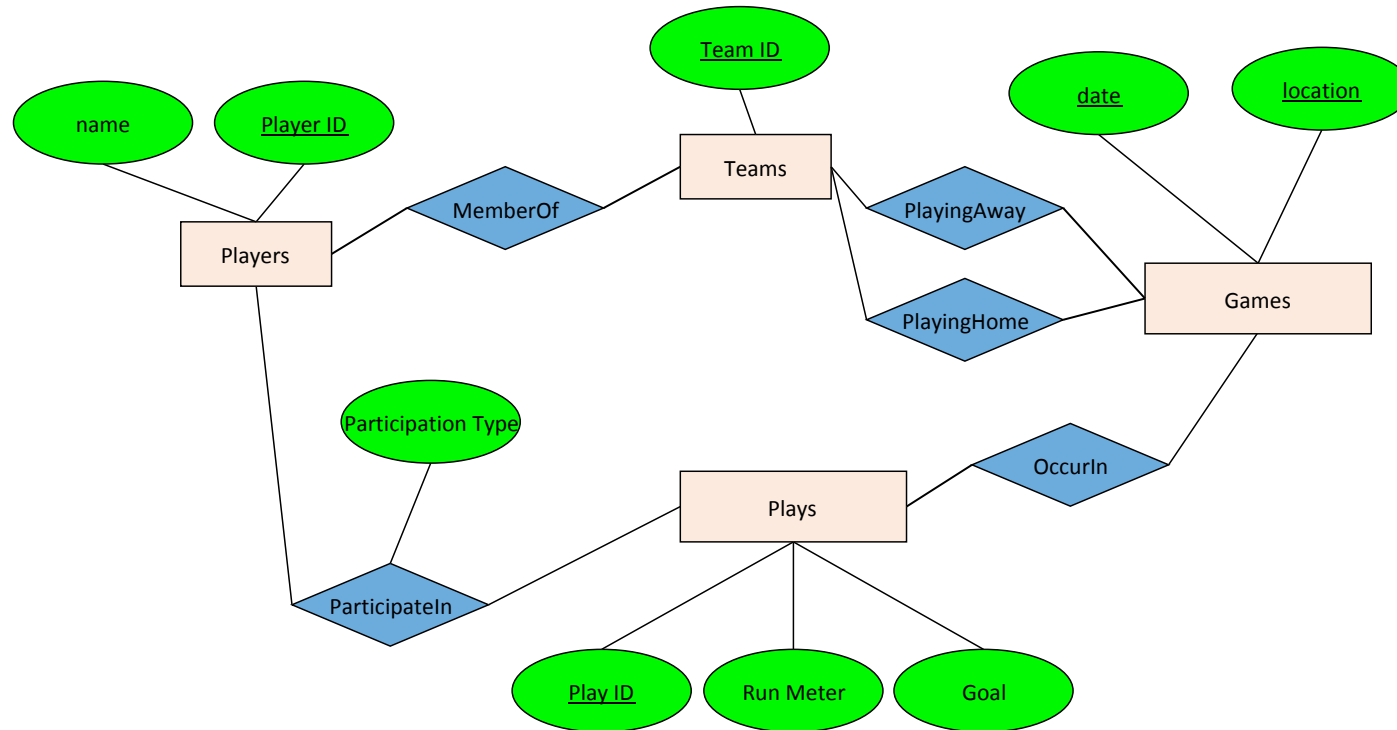
<u>name</u>	<u>firstname</u>	<u>lastname</u>	<u>date</u>
Gizmo1	Bob	Joe	01/01/15
Gizmo2	Joe	Bob	01/03/15
Gizmo1	JoeBob	Smith	01/05/15

From E/R Diagram to Relational Schema

How do we represent this as a relational schema?



ACTIVITY: E/R Diagrams Pt. II



به نمودار موجودیت-رابطه‌تان فلش اضافه کنید!

همچنین، مفاهیم جدید که زیرشان خط کشیده شده است را هم اضافه کنید



یک بازیکن فقط می‌تواند
متعلق به یک تیم باشد
یک حرکت (مثل پاس گل
یا کرنر زدن) فقط می‌تواند
در یک بازی باشد.

بازیکنان می‌توانند یک
رکورد شخصی داشته
باشند که به یک بازی و
حرکت مشخص مرتبط
است.

بازیکنان می‌توانند یک
وزن داشته باشند که در
طول فصل و در خارج از
فصل تغییر می‌کند.