NYU | TANDON SCHOOL OF ENGINEERING

CS6083: Database Systems

Design Example: Video Rental Chain

Scenario: Video Store (Blockbuster)

- Customers want to rent movies
- Branches (stores) have movies
- Movies have several (many) copies
- Copies belong to one branch
- Need to be returned to same branch
- Several copies of same movie in same branch
- Need to know which customer returned copy
- Customers may rent same movie or same copy of a movie many times

- **Tasks:**
  - How to design an ER diagram for this task
  - How to model a copy of a movie
  - How to model a rental of a copy of a movie
  - How various assumptions influence design
  - Weak and weaker entities
  - ID or no ID?
  - Converting to relational schema
  - Foreign keys

Customer

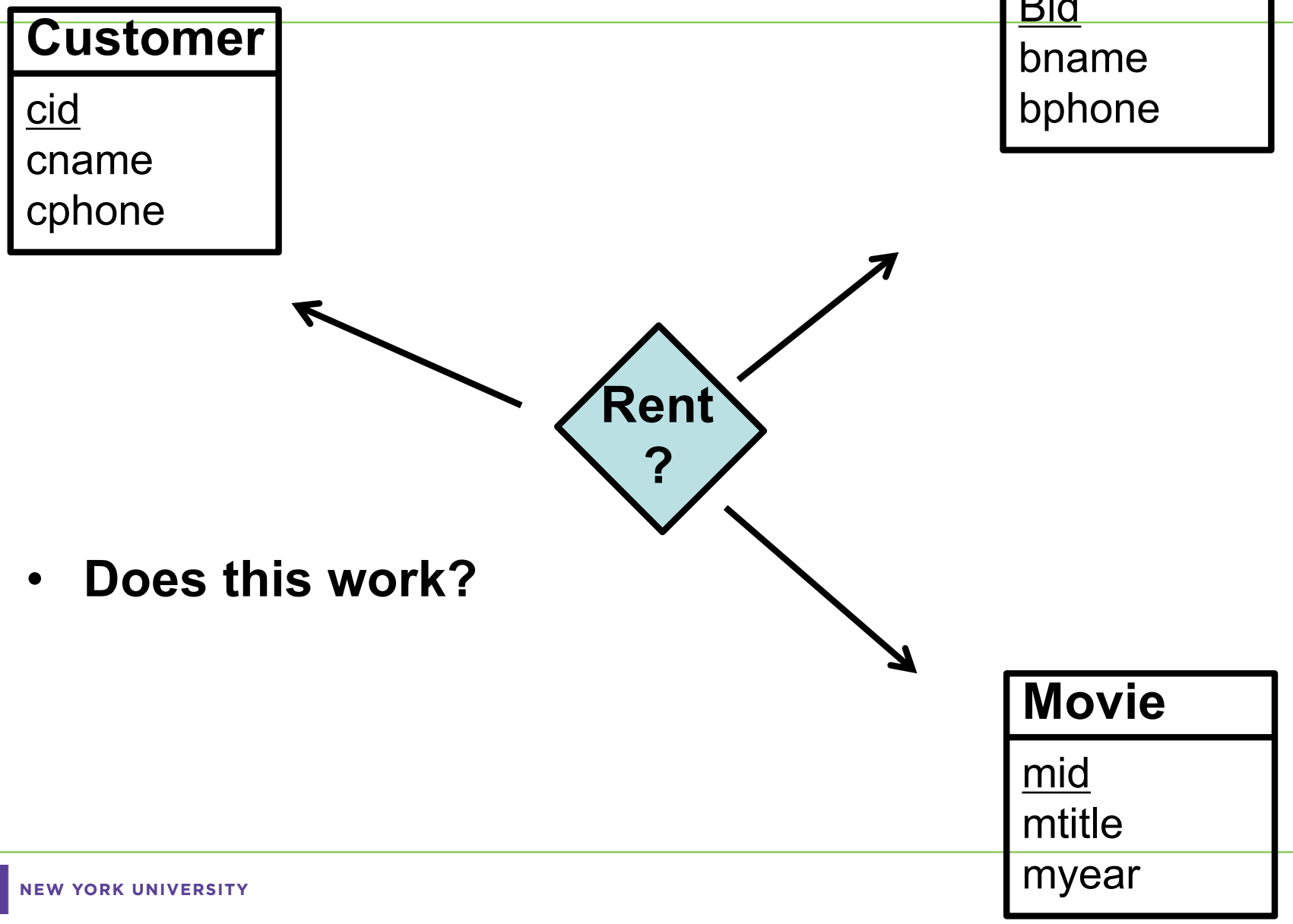
cid
cname
cphone

Branch

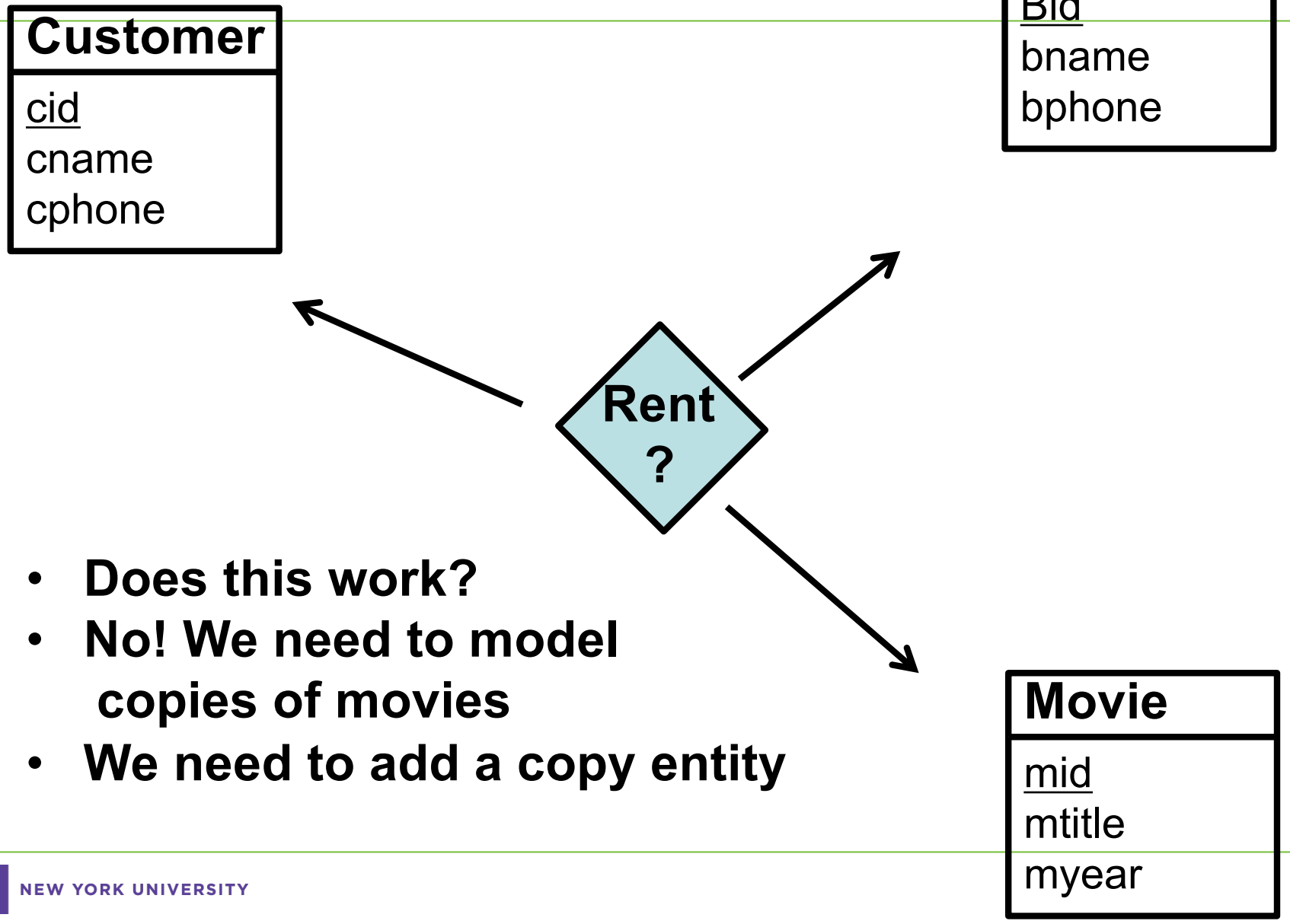
Bid
bname
bphone

Movie

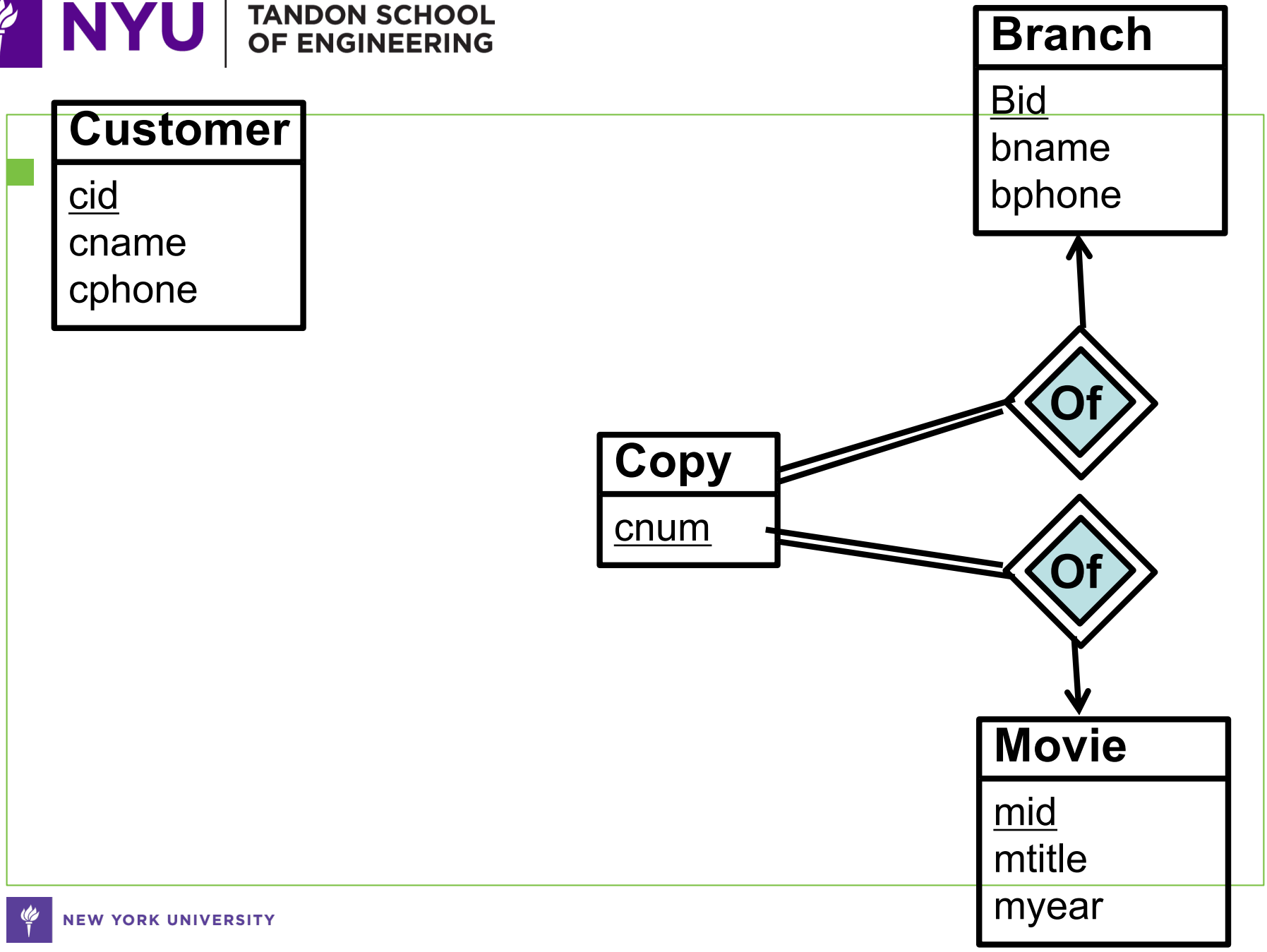
mid
mtitle
myear

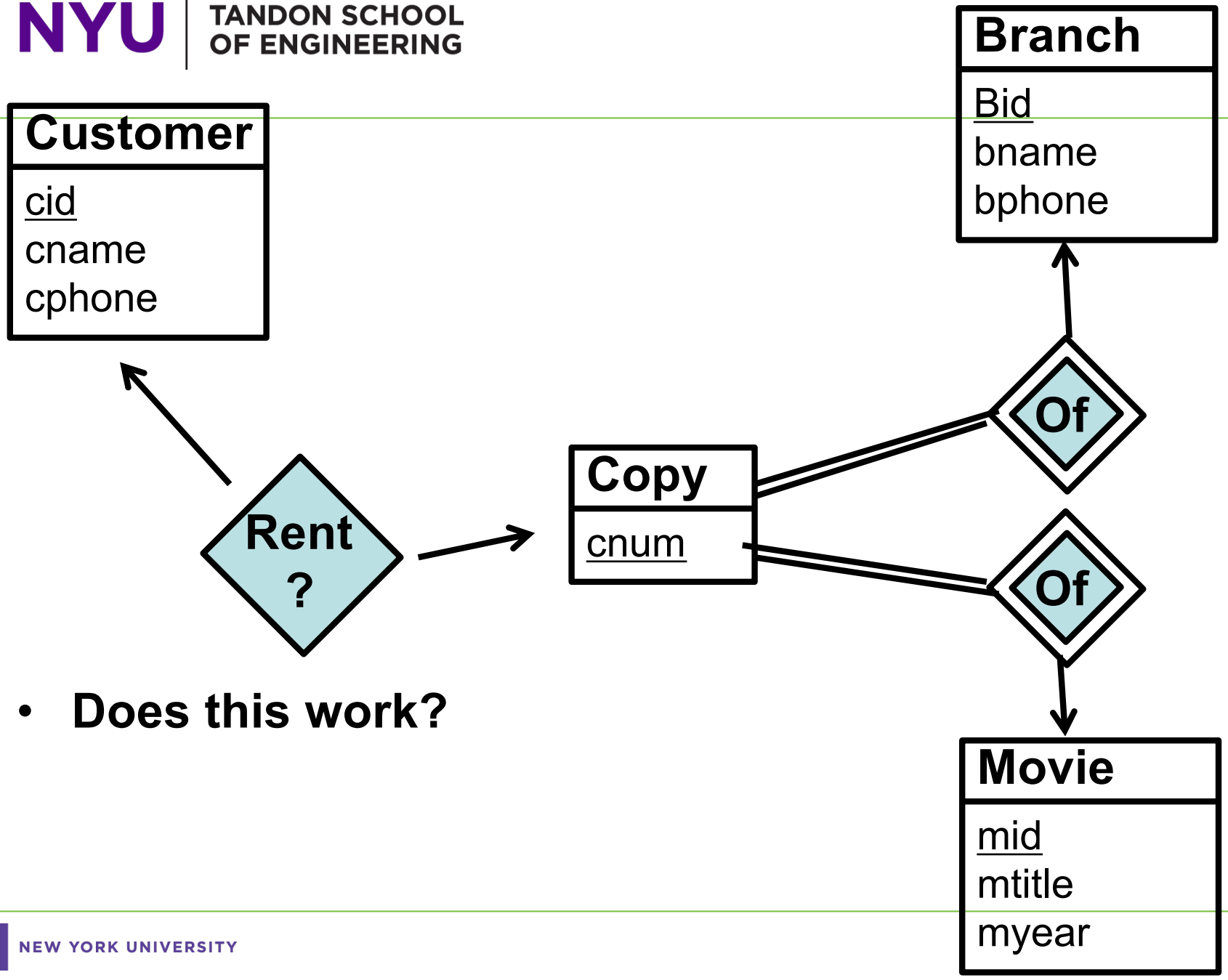


- **Does this work?**



- **Does this work?**
- **No! We need to model copies of movies**
- **We need to add a copy entity**


Customer
cid
cname
cphone
Branch
Bid
bname
bphone
Of
Copy
cnum
Of
Movie
mid
mtitle
myear



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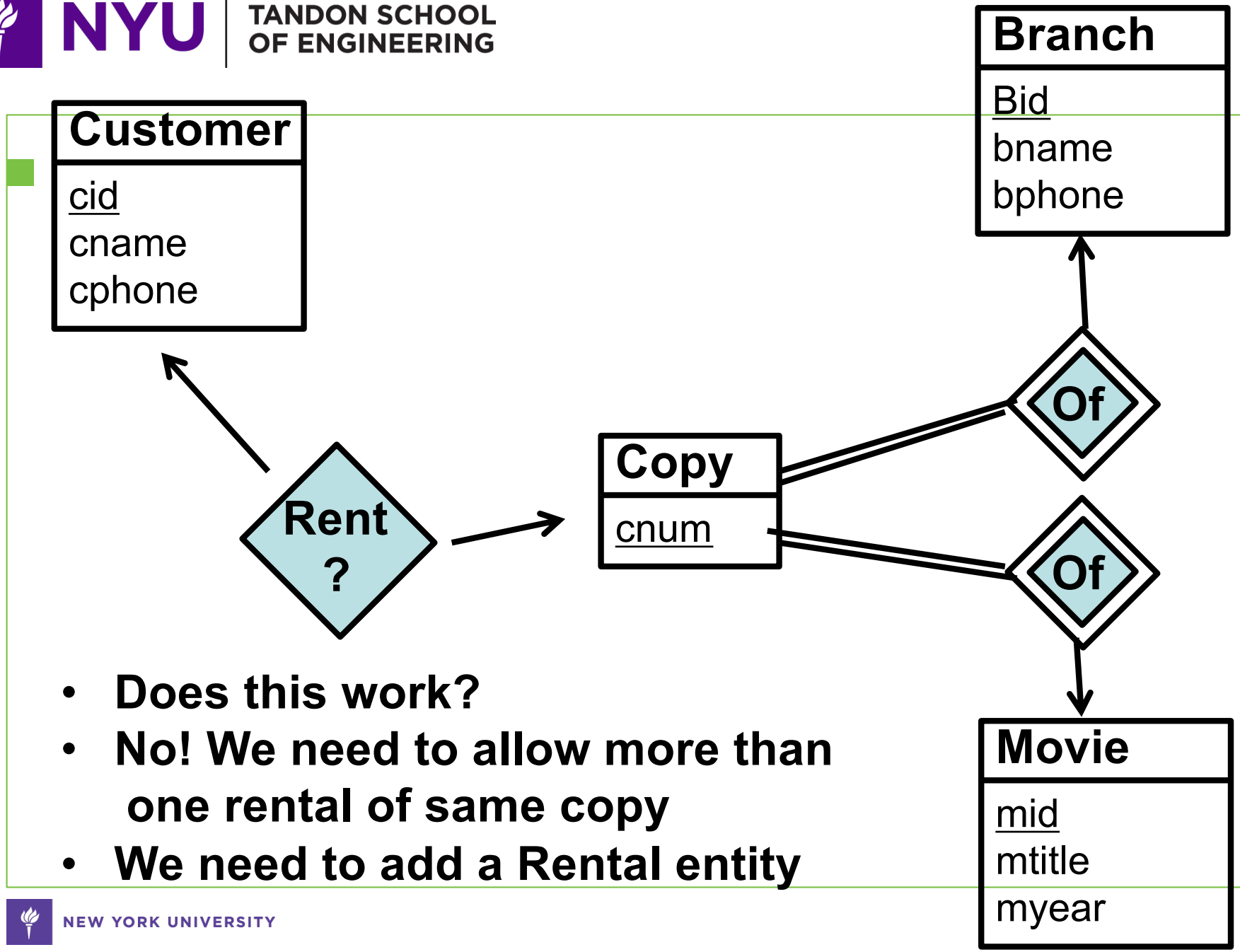
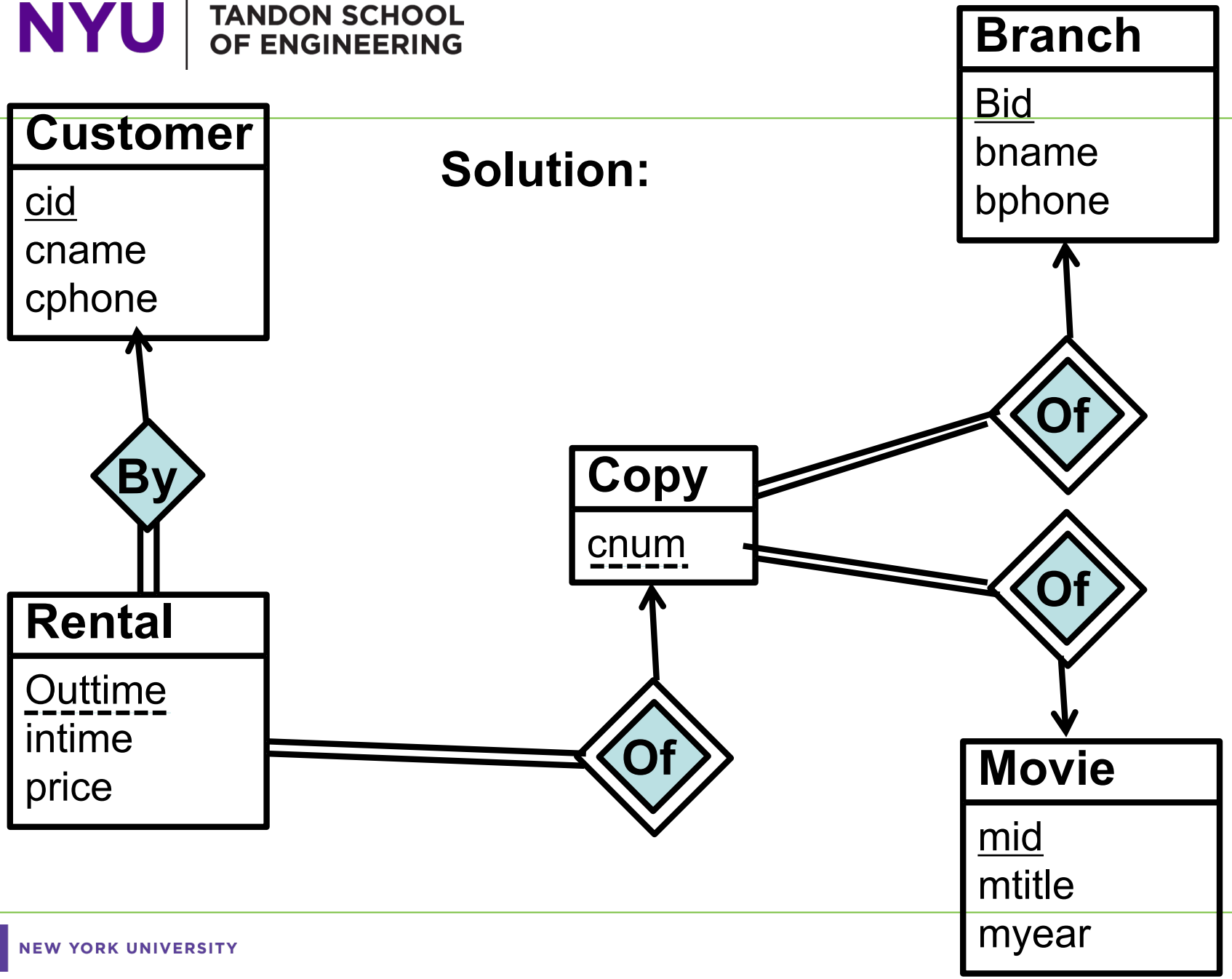


- **Does this work?**
- **No! We need to allow more than one rental of same copy**
- **We need to add a Rental entity**

Solution:


Customer
cid
cname
cphone
Branch
Bid
bname
bphone
By
Of
Copy
cnum
Of
Rental
Outtime
intime
price
Of
Movie
mid
mtitle
myear

Translation to Relational Model

Translation to Relational Model

- Customer (<u>cid</u>, cname, cphone, ...)
- Branch (<u>bid</u>, bname, bphone, ...)
- Movie (<u>mid</u>, mtitle, myear, mgenre, ...)

Translation to Relational Model

- Customer (<u>cid</u>, cname, cphone, ...)
- Branch (<u>bid</u>, bname, bphone, ...)
- Movie (<u>mid</u>, mtitle, myear, mgenre, ...)
- Copy (<u>cnum, mid, bid</u>)
  foreign keys: mid referencing mid in Movie,
  bid referencing bid in Branch
- Rental (cid, <u>cnum, bid, mid, outtime</u>, intime, price)
  foreign keys: cid referencing cid in Customer,
  (cnum, bid, mid) referencing (cnum, bid, mid) in Copy

Discussion: Actor-Movie vs. Purchase Schema

- Actor-ActedIn-Movie and Customer-Purchase-Product
- Look (almost) the same in the relational model
- 3 tables, with largest table (ActedIn and Purchase) in middle

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- What is the right ER Diagram for the Actor-Movie Table?

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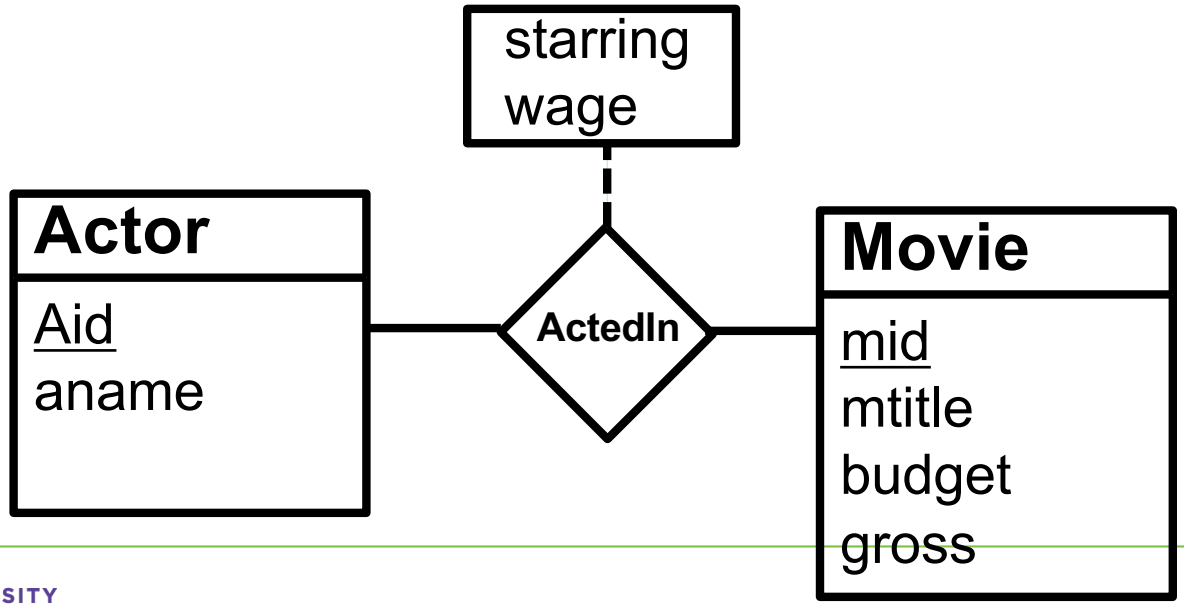

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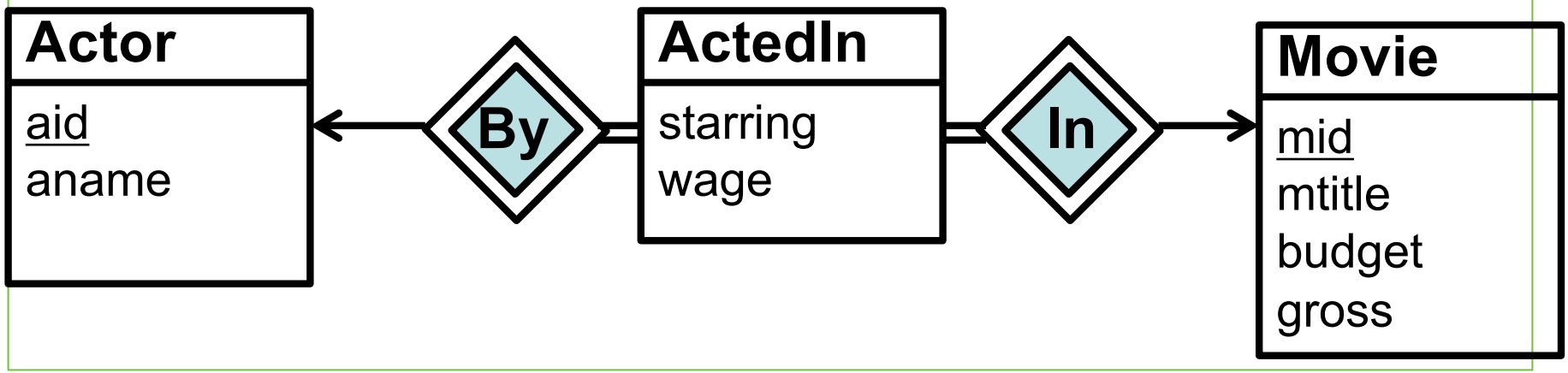

Discussion: Actor-Movie vs. Purchase Schema

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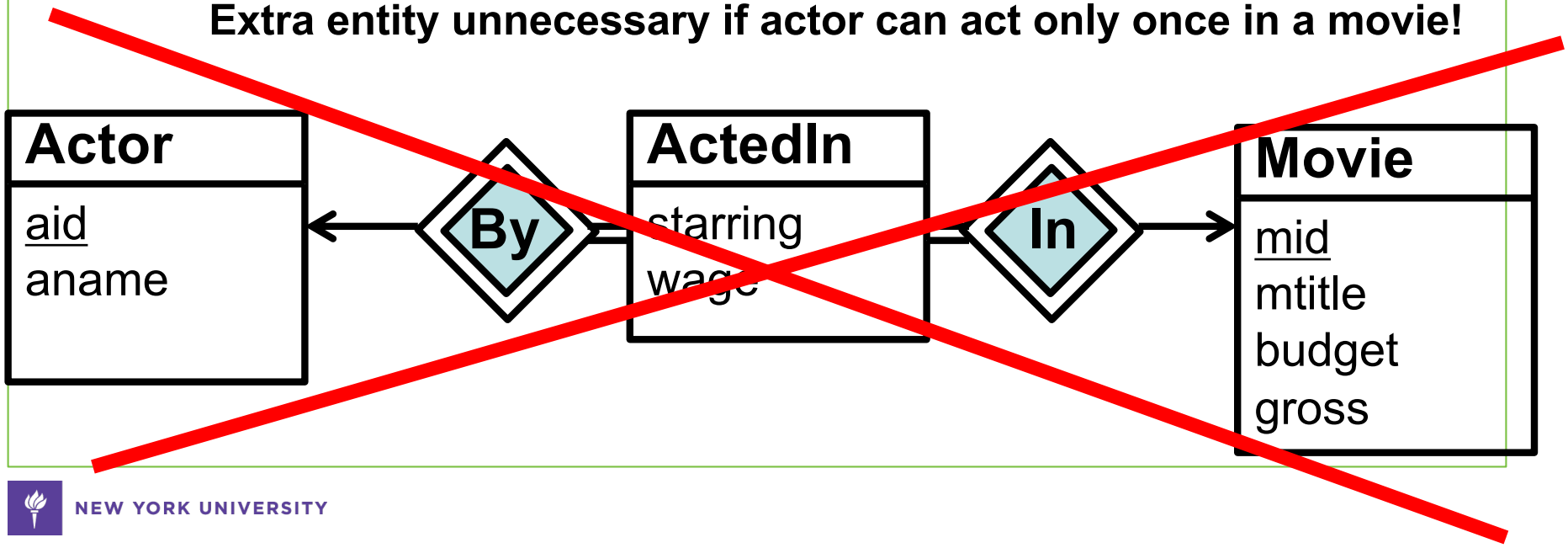
Extra entity unnecessary if actor can act only once in a movie!



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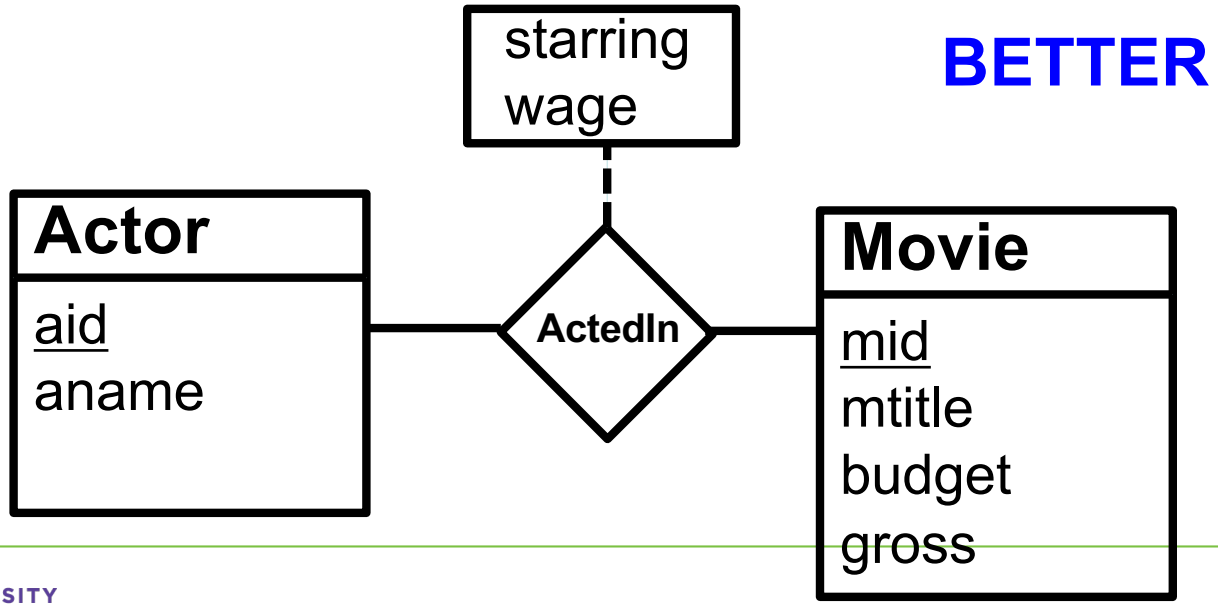

Discussion: Actor-Movie vs. Purchase Schema

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- What is the right ER Diagram for the Customer-Product Table?

Discussion: Actor-Movie vs. Purchase Schema

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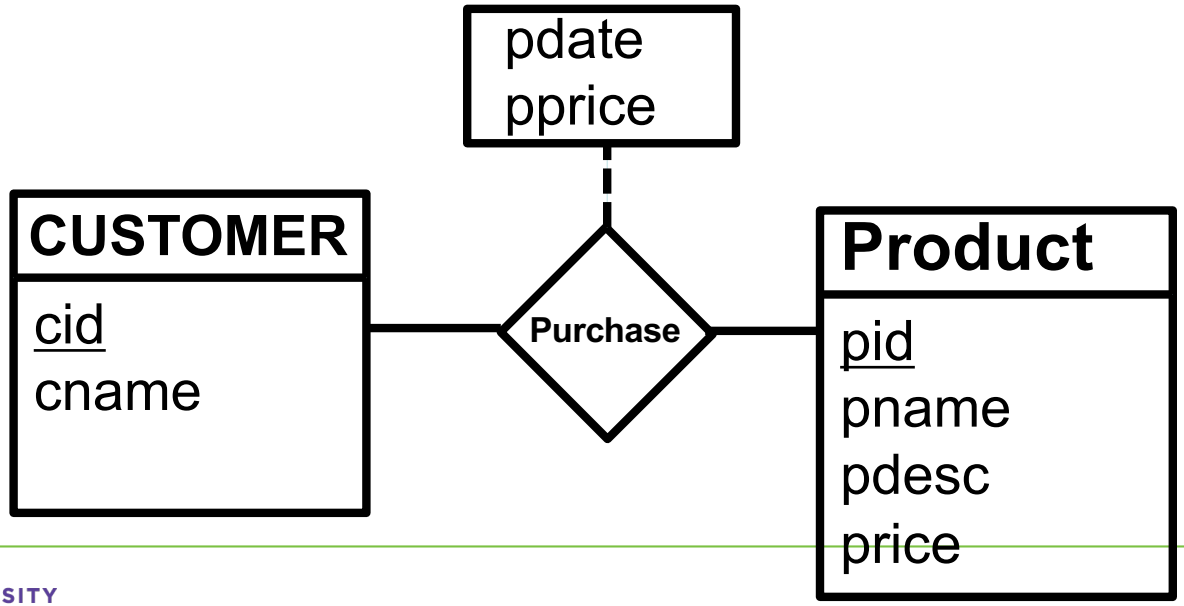

Discussion: Actor-Movie vs. Purchase Schema

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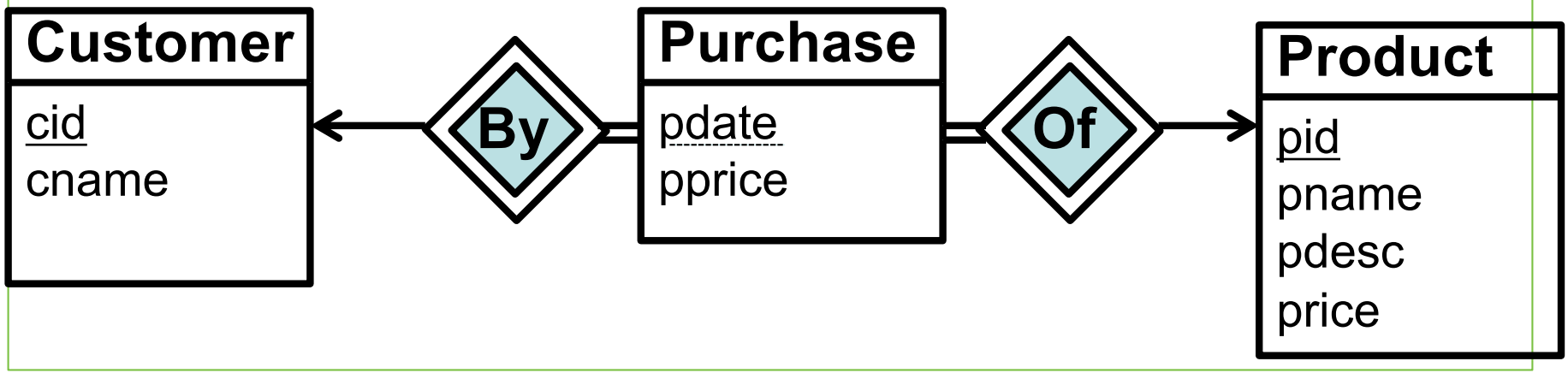
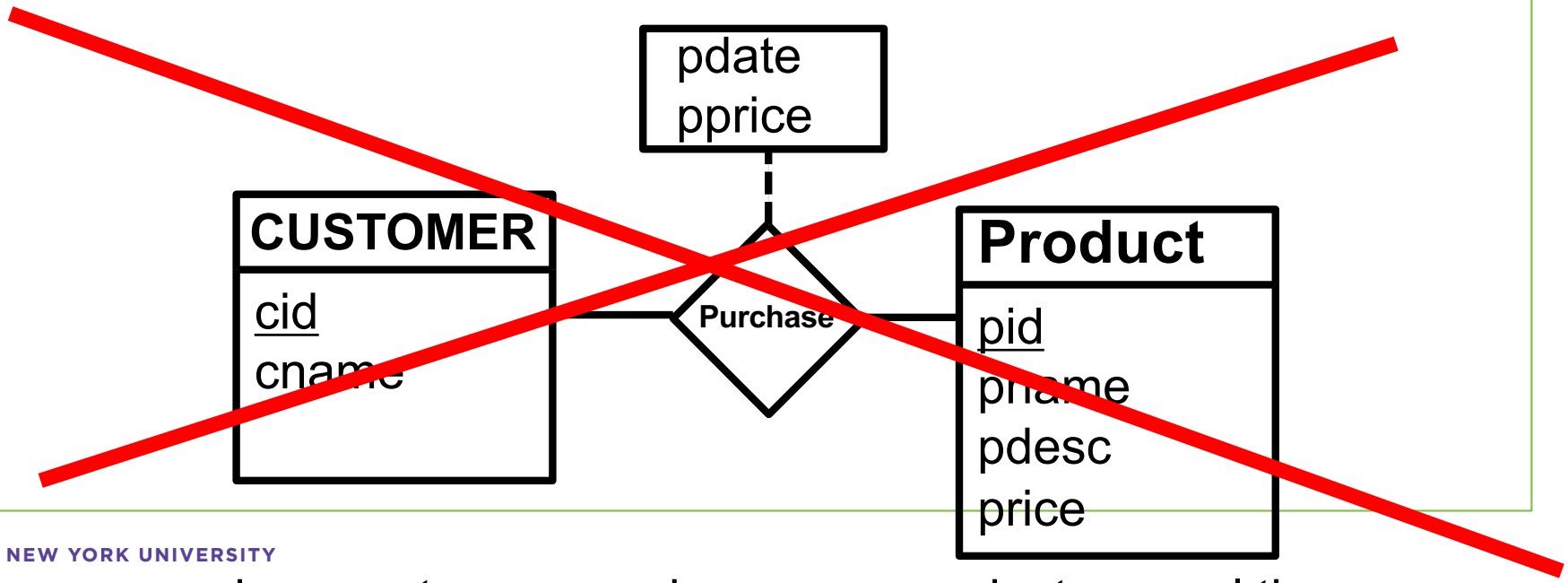


Discussion: Actor-Movie vs. Purchase Schema

- **Actor-ActedIn-Movie and Customer-Purchase-Product**
- **Look (almost) the same in the relational model**
- **3 tables, with largest table (ActedIn and Purchase) in middle**



wrong since customer may buy same product several times

Discussion: Actor-Movie vs. Purchase Schema

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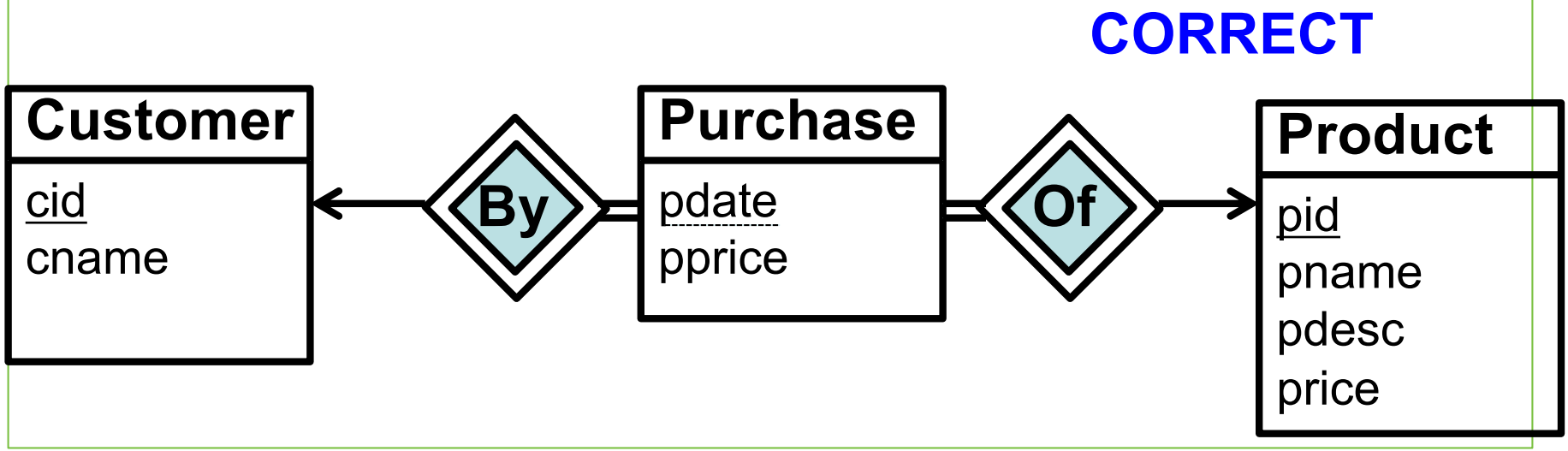


Discussion: Actor-Movie vs. Purchase Schema

- Actor-ActedIn-Movie and Customer-Purchase-Product
- Look (almost) the same in the relational model
- But in AM, ActedIn becomes a relationship in ER
- In CP, Purchase becomes its own entity in ER

- Why?
- Actors can only act once in one movie (assumption)
- ... but customers can buy the same product many times

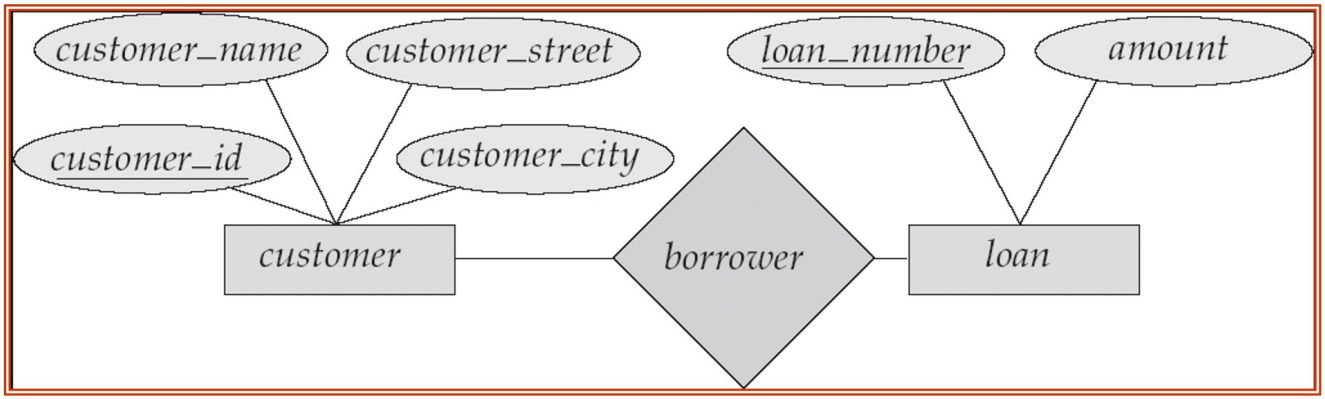
- Note: there is in fact a difference in the relational models for these two schemas
- (aid, mid) is key for ActedIn, but (cid, pid, pdate) for Purchase

ER Diagrams and Relational Diagram

- There are various forms of ER diagrams
- There are also relational diagrams that are not ER diagrams
- Sometimes hard to tell apart
- Please use ER diagrams as in book (old or new)
- Please do not use crow's foot diagrams

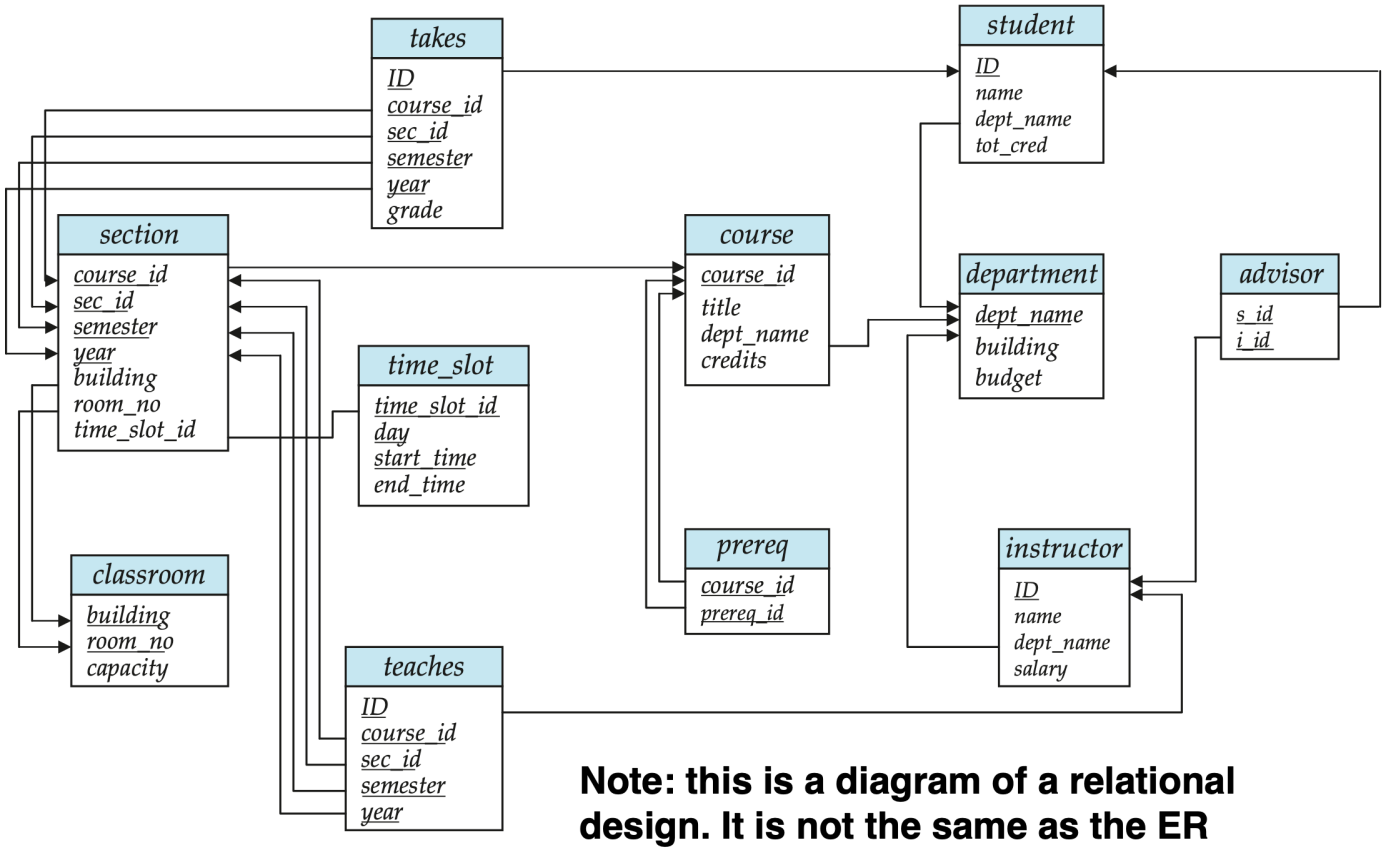
ER Diagrams in the Book

new



old

Relational Diagrams in the Book



Note: this is a diagram of a relational design. It is not the same as the ER diagrams we will see in a few weeks.

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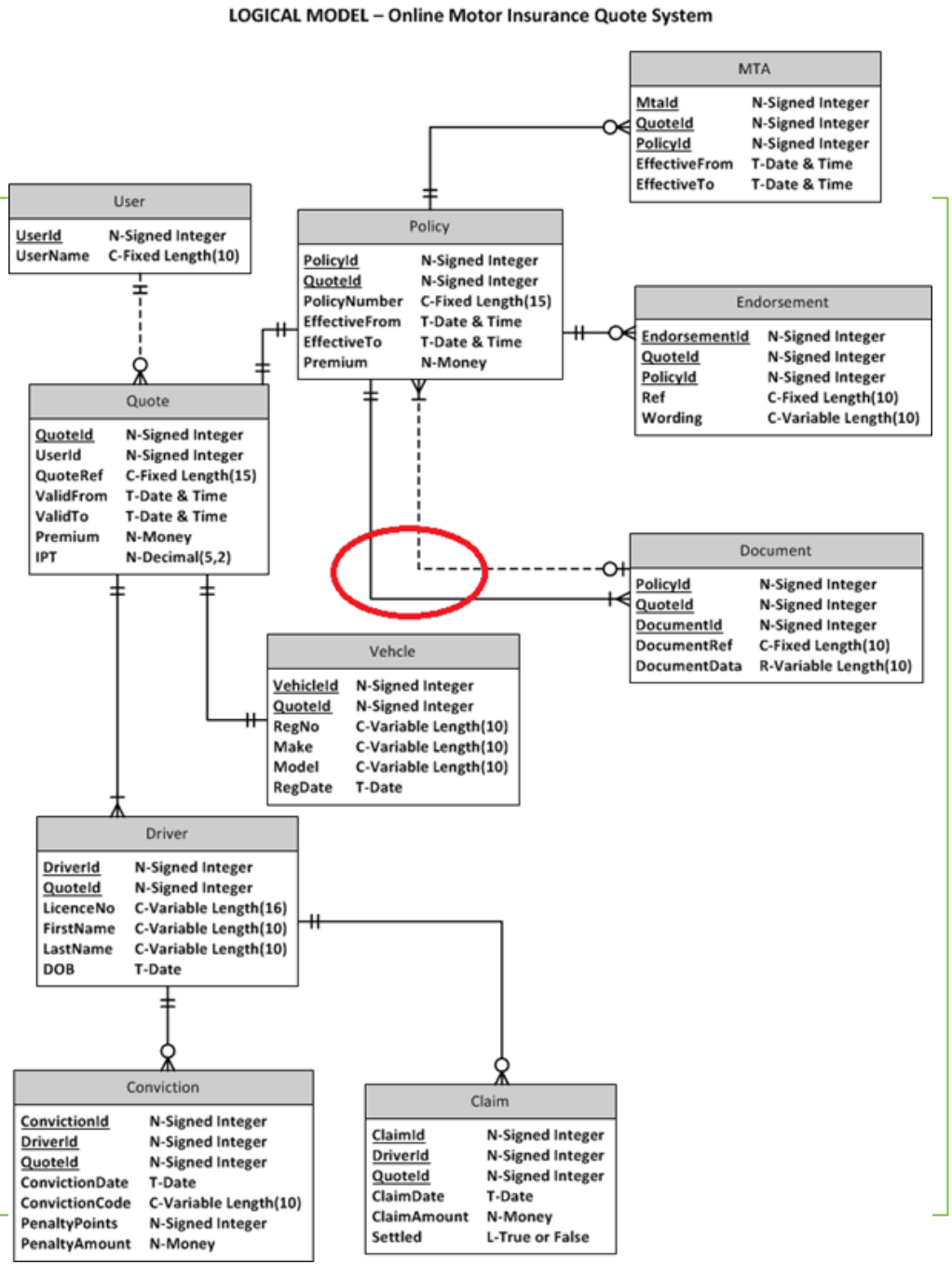
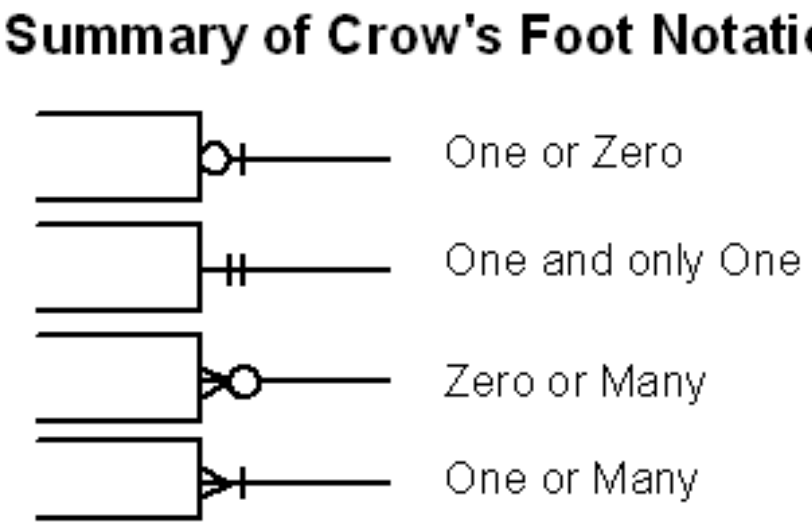
Other Relational Diagrams

This is not a real ER diagram!



From https://www.codeproject.com/Articles/878359/Data-Modelling-using-ERD-with-Crow-Foot-Notation

Crow's Foot Notation



- There are various forms of crow's foot type diagrams
- Some of them are ER diagrams but most are relational
- Please do not use
- Too many problems in the past

From https://www.codeproject.com/Articles/878359/Data-Modelling-using-ERD-with-Crow-Foot-Notation