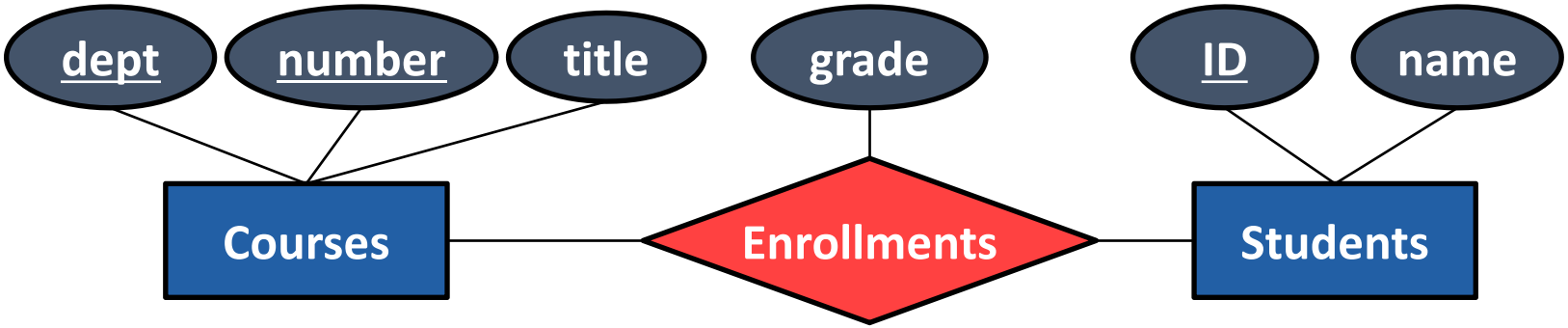
Administrative Notes – January 17, 2023

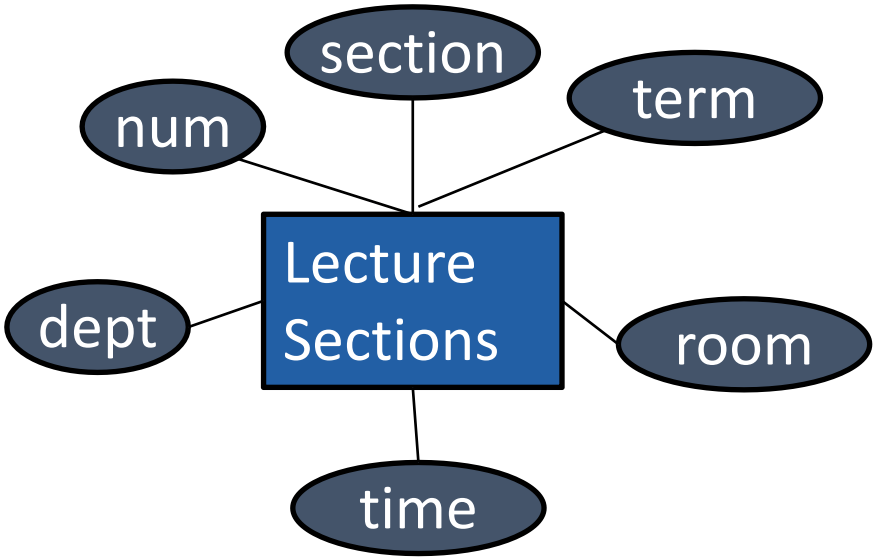
- If you haven't already, please register your clicker on Canvas
  - If you do not do this, then we will not be able to sync your iClicker grades to Canvas
- Don't forget to refer to the tentative schedule for assignment deadlines and tutorial information
- Full version of the slides from last class (clicker questions + answers) on Canvas
- Office hours start this week
- Jan 23: Last day to drop the class without a W
- Jan 27: Assignment 1 due

Now where were we…?



- A **key** is the minimal set of attributes that uniquely identify an entity; an entity may have many keys
- The **primary key** is the key we have chosen to identify entities; there is only one primary key
- Relationships are identified **by the entities** involved

Keys, keys, and more keys



Example entity:

dept = “CPSC”

num = 368

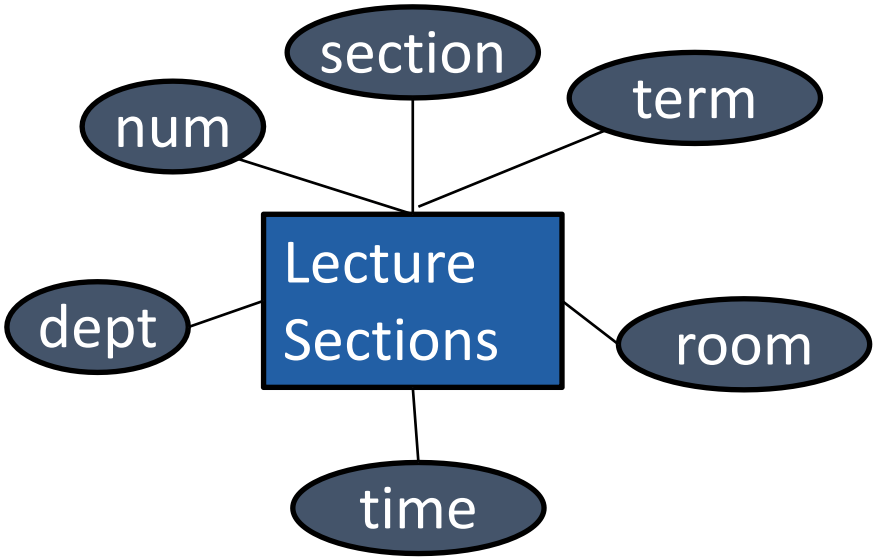
section = 201

term = “2022W2”

room = “DMP301”

time = “Tu/Thu 14:00”

Keys, keys, and more keys



Example entity:

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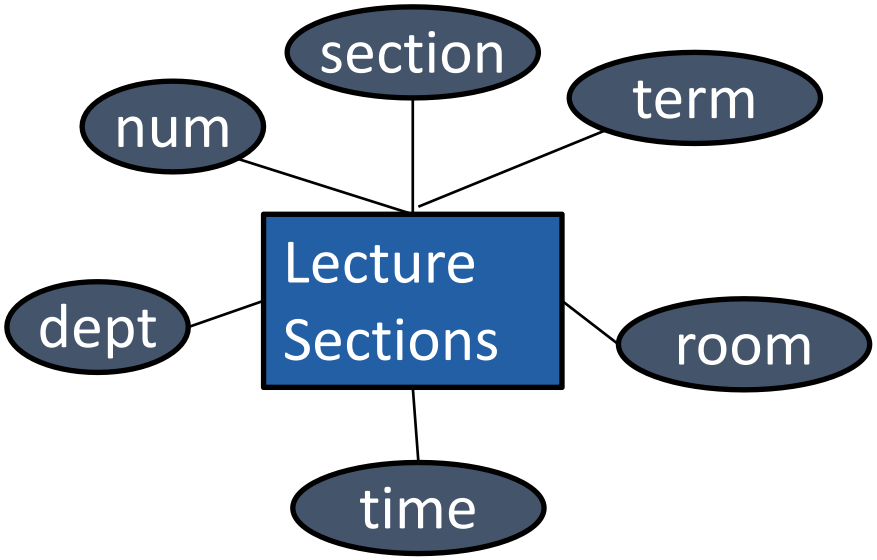
Is {dept, num, section, term} able to uniquely identify a lecture section?

A. Yes

B. No

Keys, keys, and more keys



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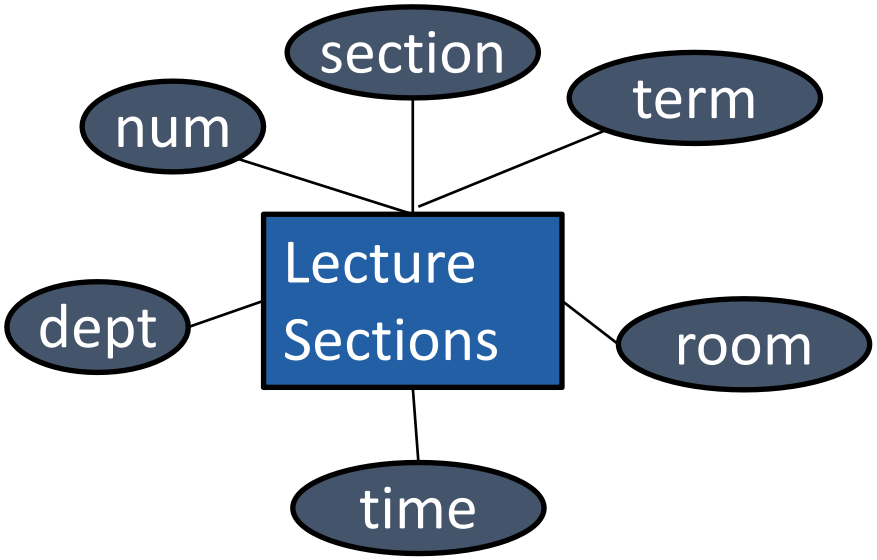

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A. Yes

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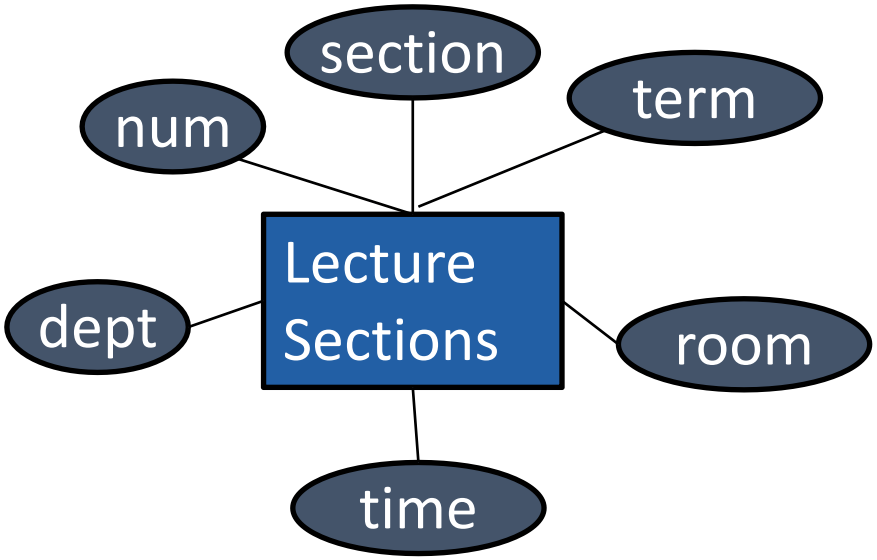

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Keys, keys, and more keys

Is {dept, num, section, term} minimal?

A. Yes

B. No

dept + num → not sufficient

dept + section → not sufficient

dept + term → not sufficient

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dept + num + term → not sufficient

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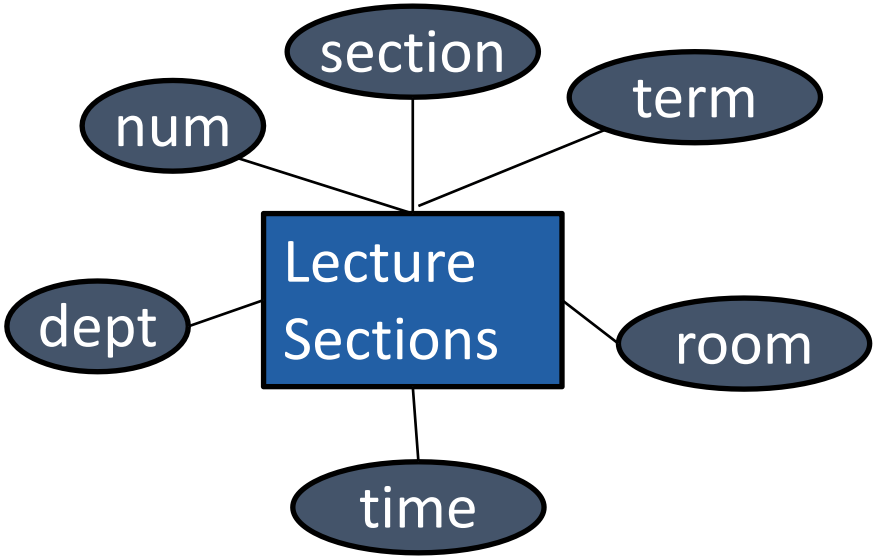
Keys, keys, and more keys

Is {dept, num, section, term} a key?

A. Yes

B. No



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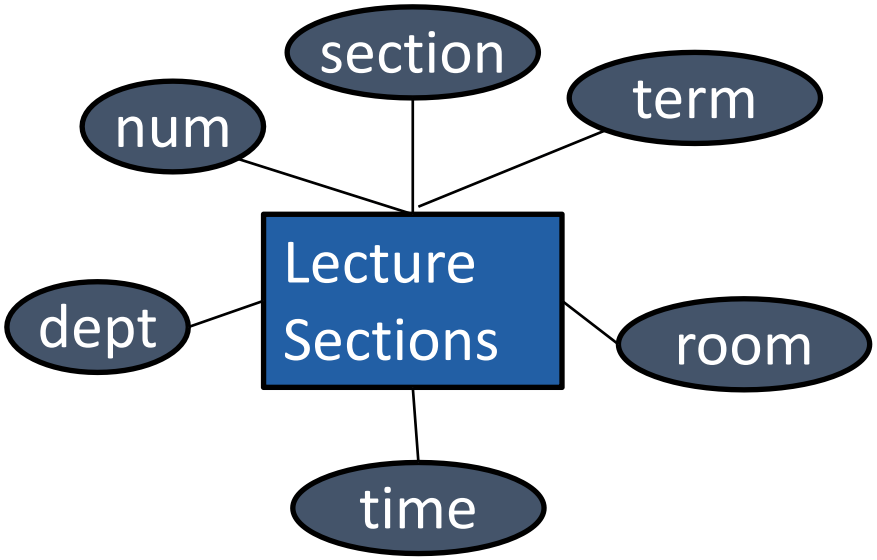

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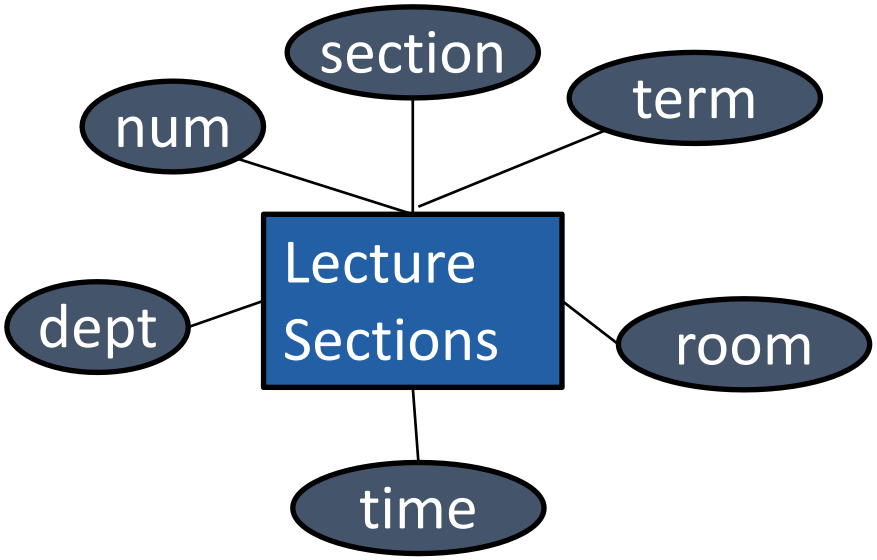
Is {term, room, time} able to uniquely identify a lecture section?

A. Yes

B. No

* Ignore the existence of cross listed sections

Keys, keys, and more keys



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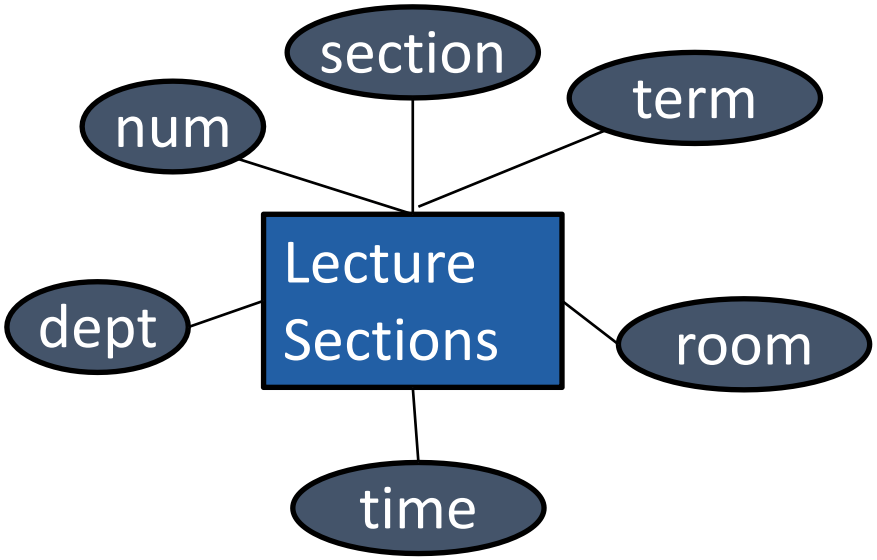

Example entity:

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num = 368

section = 201

term = “2022W2”

room = “DMP301”

time = “Tu/Thu 14:00”

Is {term, room, time} minimal?

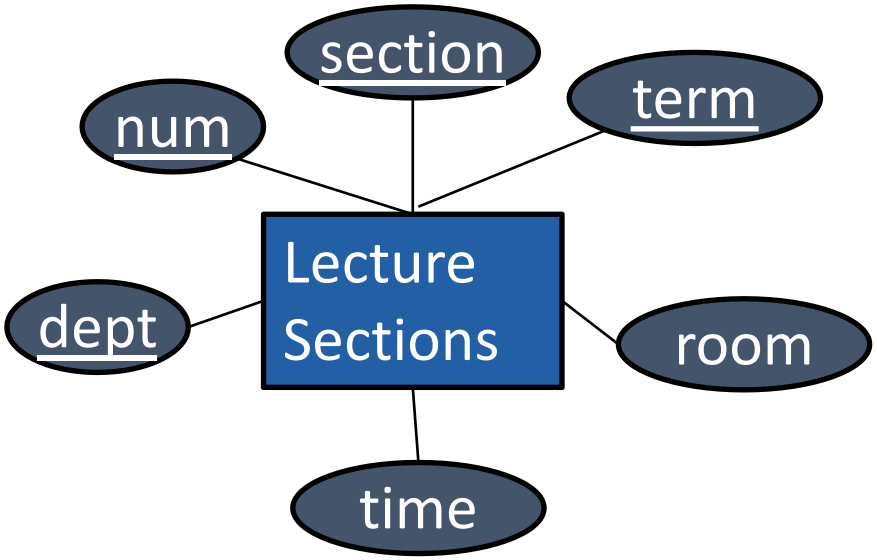
A. Yes

B. No

* Ignore the existence of cross listed sections

Therefore, {term, room, time} is also a key

Keys, keys, and more keys



Example entity:

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num = 368

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- Candidate keys:
  - {term, room, time}
  - {dept, num, section, term}

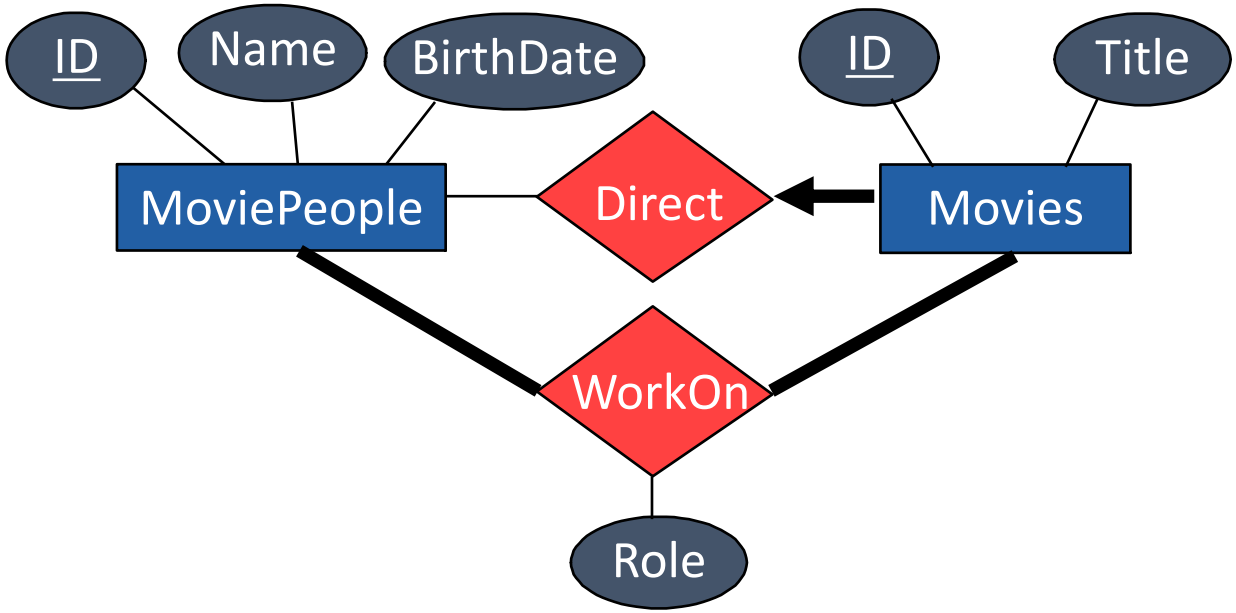
Choose a candidate key to become your primary key. **Only** primary key attributes are underlined.

Now where were we…?

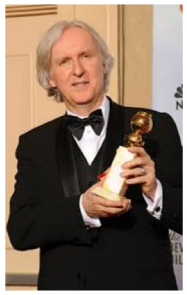
- A **cardinality ratio** for a relationship set specifies the number of relationships in the set that an entity can participate in.
  - 1 : 1
  - 1 : Many
  - Many : 1
  - Many : Many

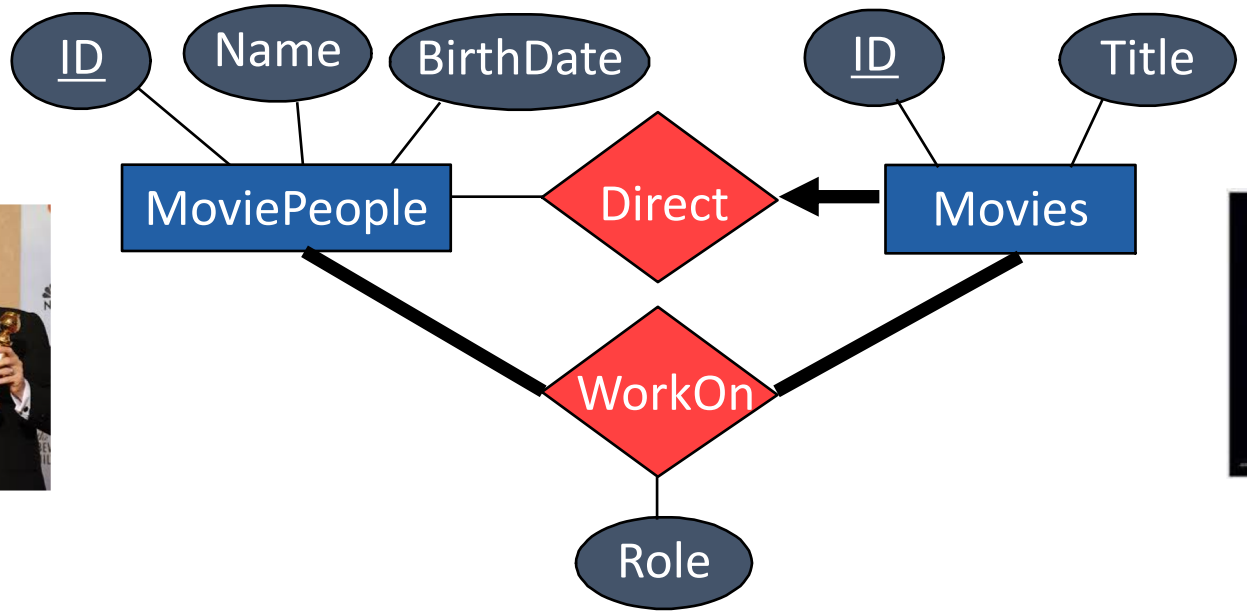
Participation Constraints

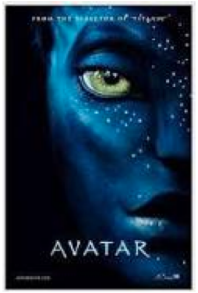
- Participation : Indicates if all entities participate in the relationship.
- An entity's participation can be ***total*** or ***partial***.
- Requiring total participation is a ***participation constraint*** and it is shown with a thick line
  - Important when considering deletions
  - i.e., participation of Movie in Directs is total (thick line)
    - Every movie must appear in some relationship in the Directs set



Why are participation constraints important







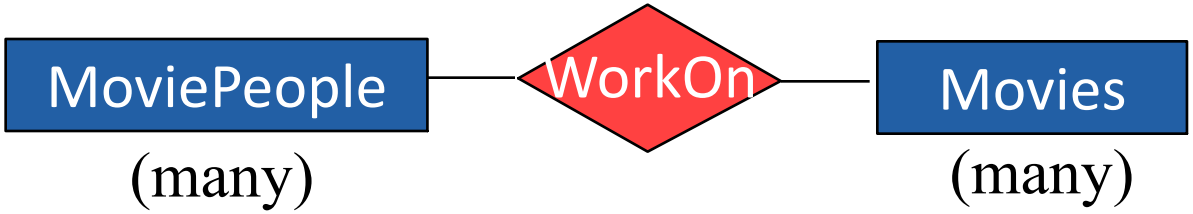
Would I be able to delete James Cameron without deleting Avatar? A. Yes B. No C. It depends

Would I be able to delete Avatar without deleting James Cameron?

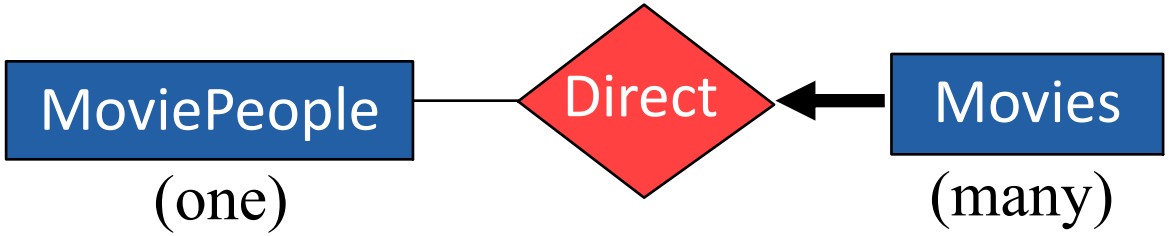
A. Yes B. No C. It depends

Line types summarized

- Plain lines mean many to many:

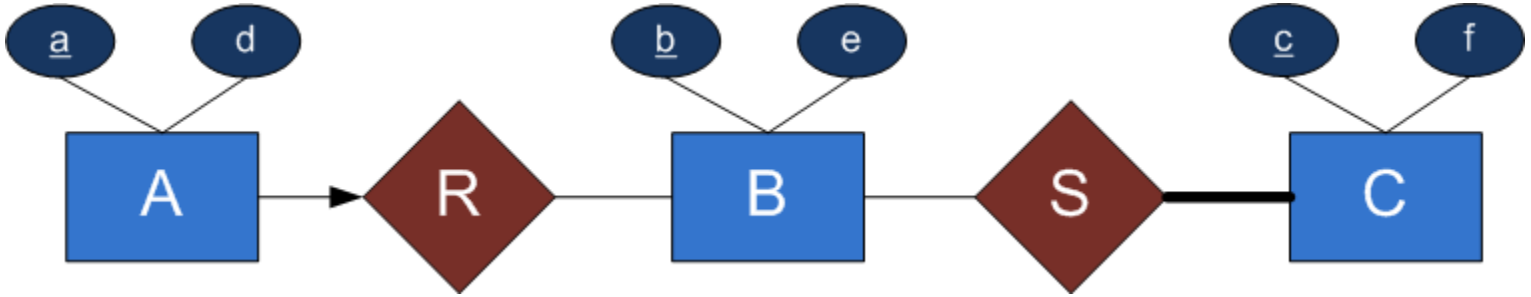


- Arrows mean the other side has a cardinality of one



- A thick line requires total participation and can be added to any line, arrow or not

Clicker Question



Suppose that a1 and a2 are the only entities of A, b1 and b2 are the only entities of B, and c1 and c2 are the only entities of C.

Which of the following relationship sets for R and S are possible according to the diagram, where T = {(e1,f1)} means a relationship between e1 and f1 exists in relationship set T

A. R = {}; S = {}
B. R = {(a1,b1)}, S = {(b2,c2)}
C. R = {(a1,b1), (a1,b2)}; S = {(b1,c1), (b2,c2)}
D. R = {(a1, b2)}; S = {(b1,c2), (b2, c1), (b1,c1)}
E. None of the above

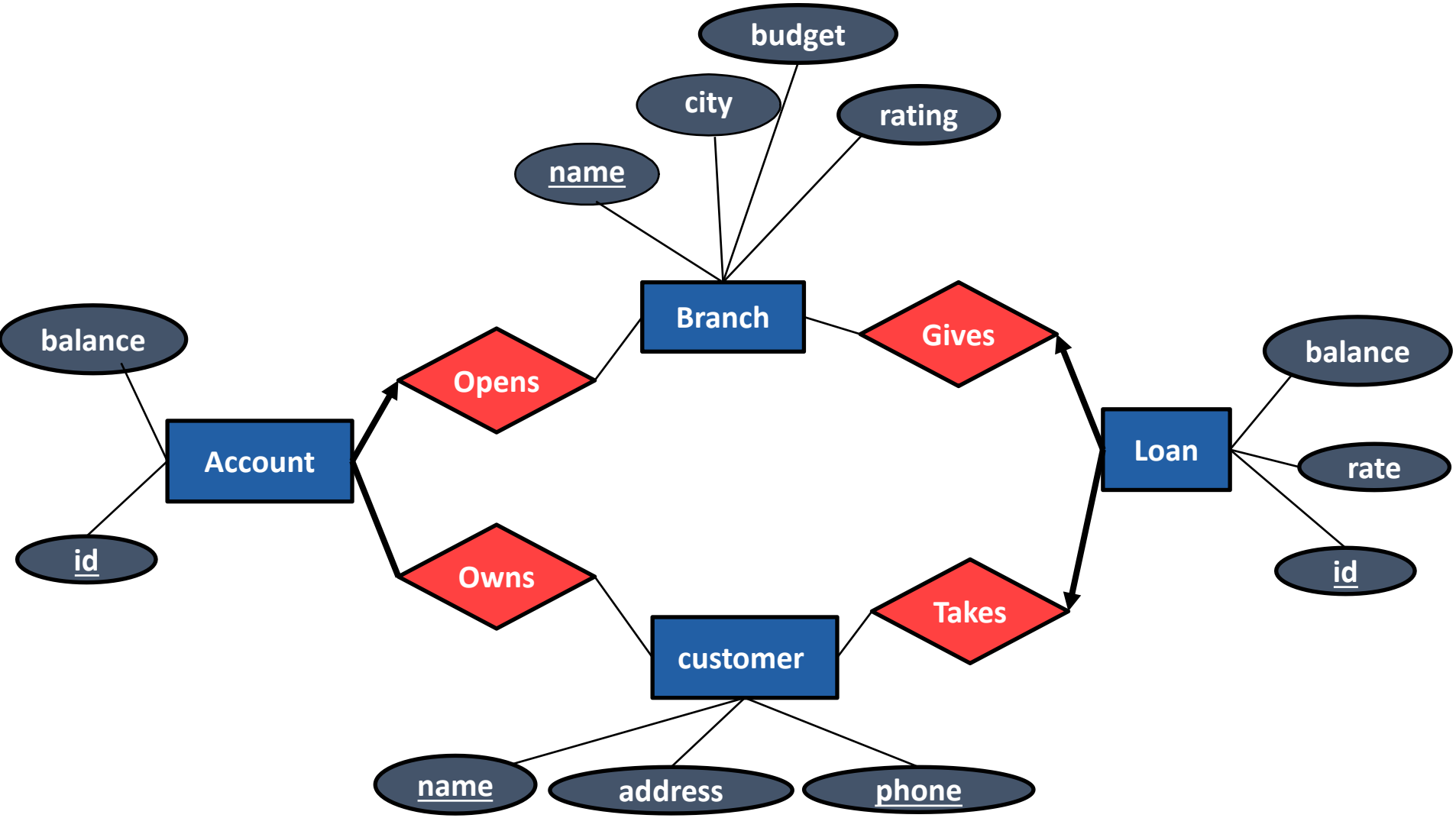
In-Class Exercise

- Find the in-class exercise on Canvas (Modules -> Course Content -> In-Class Exercises)
- Deadline is an exception from what is stated in the syllabus due to the add/drop date (due Jan 24 @ 10PM)
- Do Q1 now (back at 2:54)
  - Feel free to work with the people around you but make sure you write down their names on your submission to acknowledge the collaboration
- Try Q2 some time after class

Exercise: ABC Banks

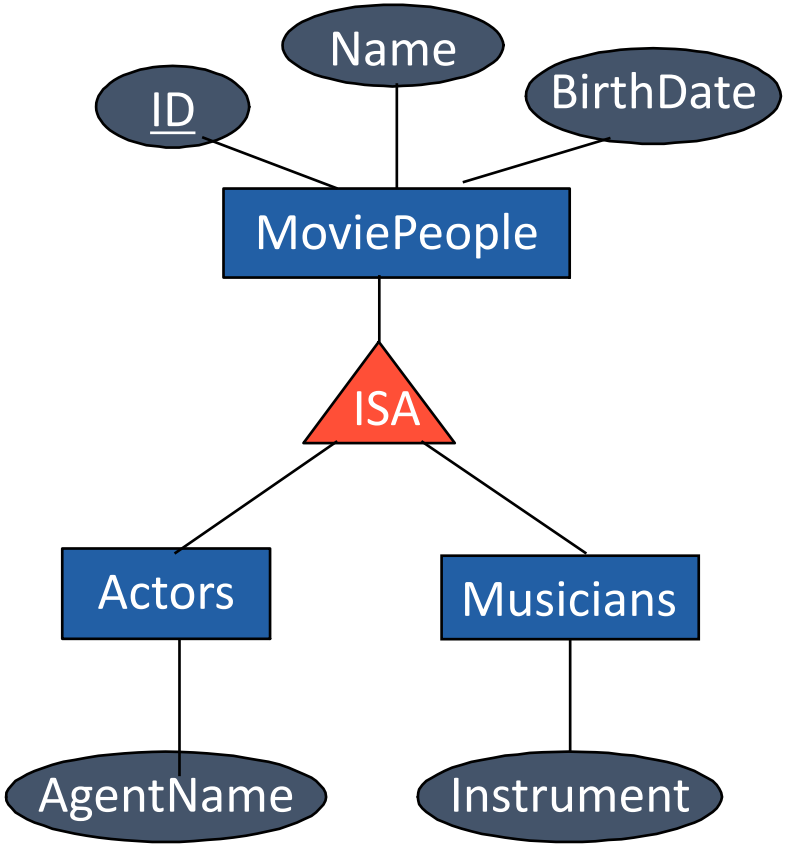
- A bank branch is located in a particular city and is identified by a unique name. Each year the bank's board defines the yearly budget and the rating (which is a number from 1 to 10) for each branch.
- A bank customer is identified by their customer name and phone number. The bank also keeps track of each customer's current address.
- The bank offers accounts and loans to its customers. Each account and loan has a unique number and is created and maintained by a single branch.
- Each account is assigned to one or more customers and its balance can never be negative.
- A loan is always assigned to a single customer, has a fixed interest rate and its balance cannot be negative either.

Sample solution

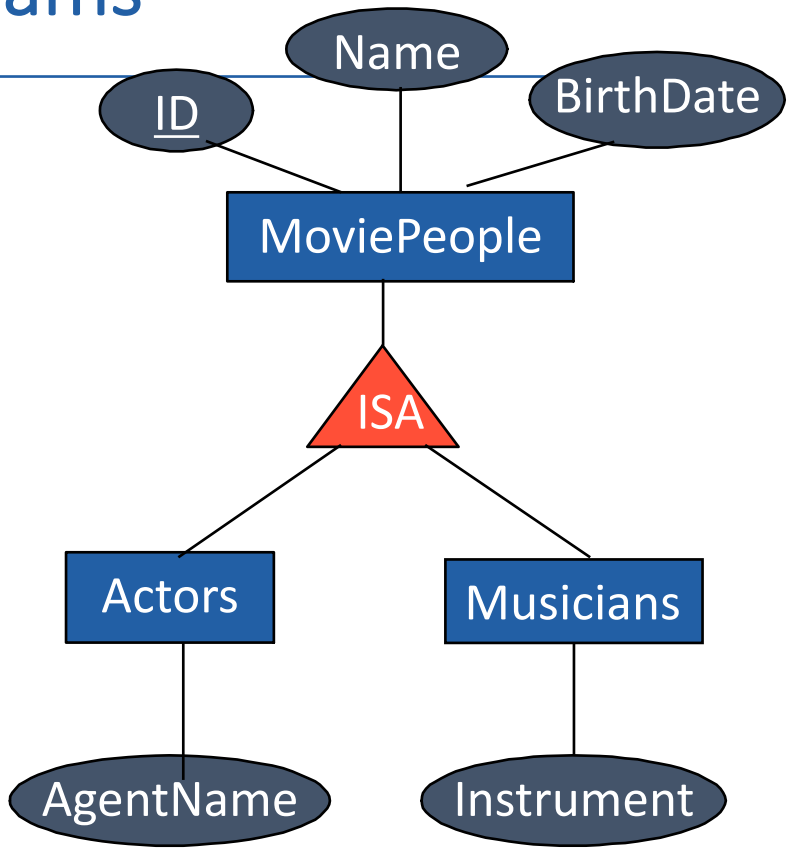


Generalization/Specialization (ISA relationships)

- As in Java, or other PLs, attributes can be inherited.
- If we declare A ***ISA*** B, every A entity is a B entity.
- Reasons for using ISA:
  - To add descriptive attributes specific to a subclass.
  - To restrict entities that participate in a relationship.



There are some ISA constraints we can't express in ER diagrams

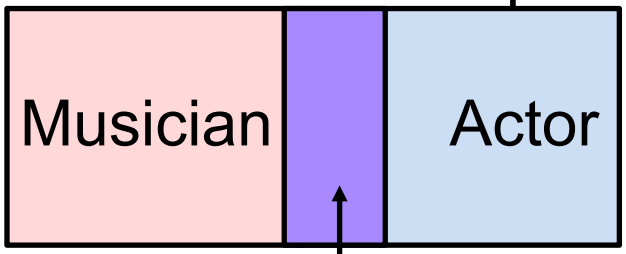


- ***Overlap constraints*** can be:
  - ***Disjoint :*** a superclass entity belongs to no more than a single subclass
  - ***Overlapping :*** subclasses may overlap
- ***Covering constraints*** can be:
  - ***Total :*** a superclass entity must belong to some subclass
  - ***Partial :*** some superclass entity may not be in any subclass

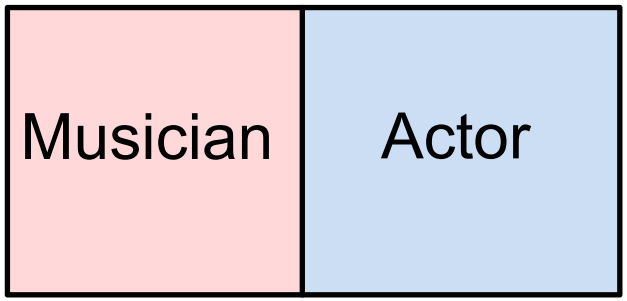
We can represent these constraints by just writing them in.

ISA constraints Illustrated

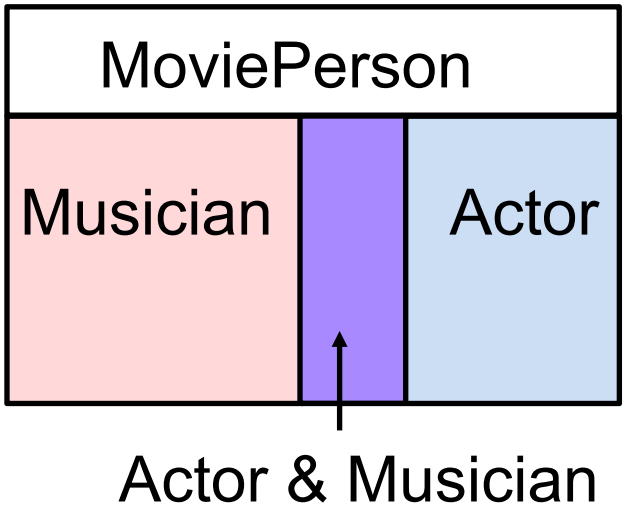
Total + Overlap



Total + Disjoint



Partial + Overlap



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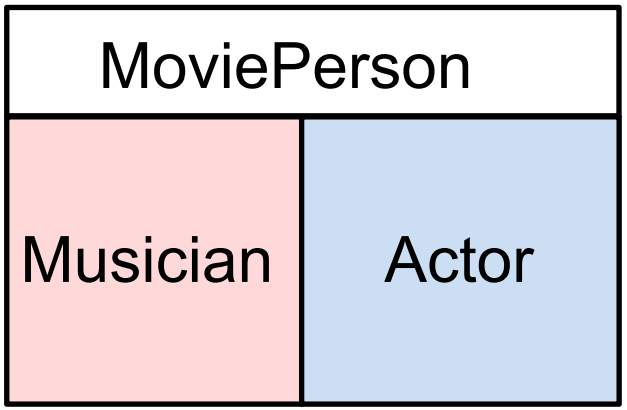
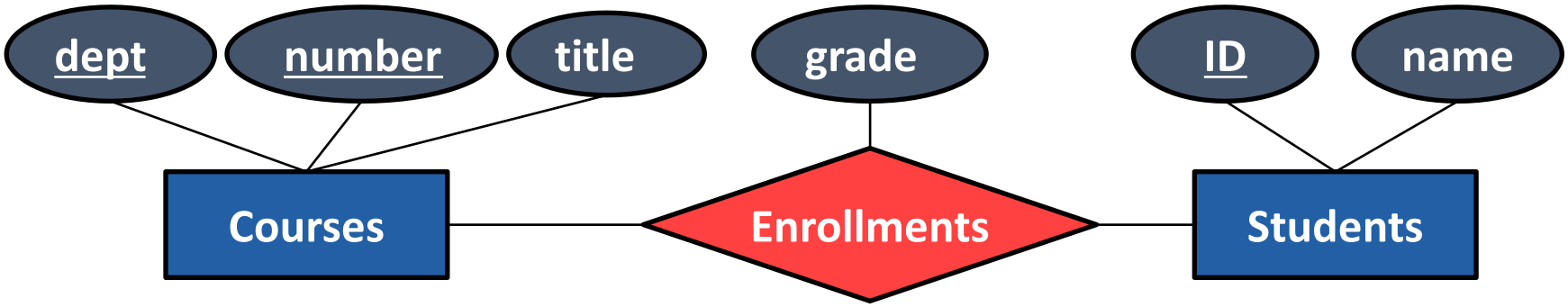
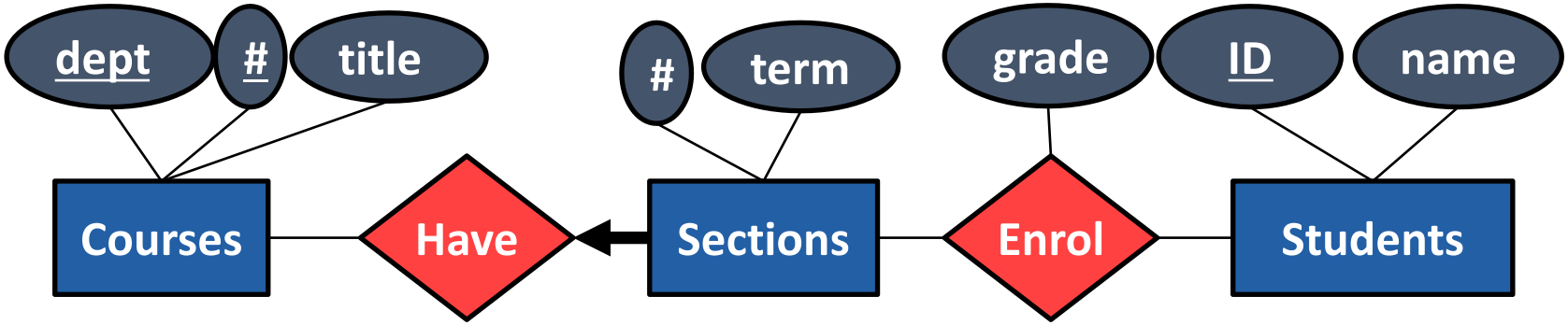


In a previous clicker question, we had a problem

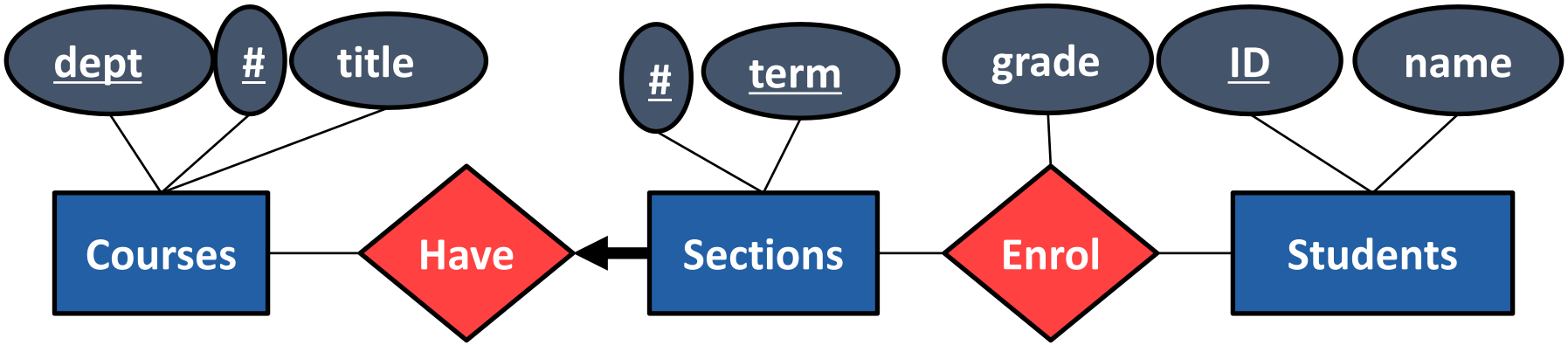


But then a student couldn't take a class more than once. Next try:



But what should the key of Sections be?

A better solution would be if Sections could depend on Courses



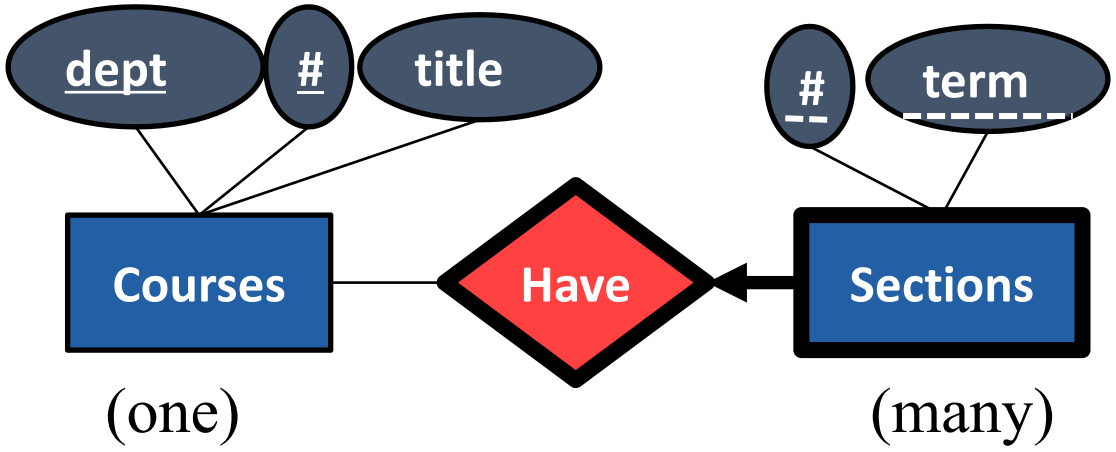
Logically, what should the key of Sections be?

- Looking only at Sections: 201 2022W2 is not unique
- Looking at Courses + Sections: CPSC 368 201 2022W2 is unique

We can do this with a *weak entity*

Weak Entities

- A ***weak entity*** can be identified uniquely only by additionally considering the key of another (*owner*) entity.
  - Owner entity set and weak entity set must participate in a one-to-many relationship set (one owner, many weak entities).
  - Weak entity set must have total participation in this ***identifying*** relationship set.
  - Think of this as a "belongs to" relationship.
- Weak entity sets and their identifying relationship sets are shown with thick lines.



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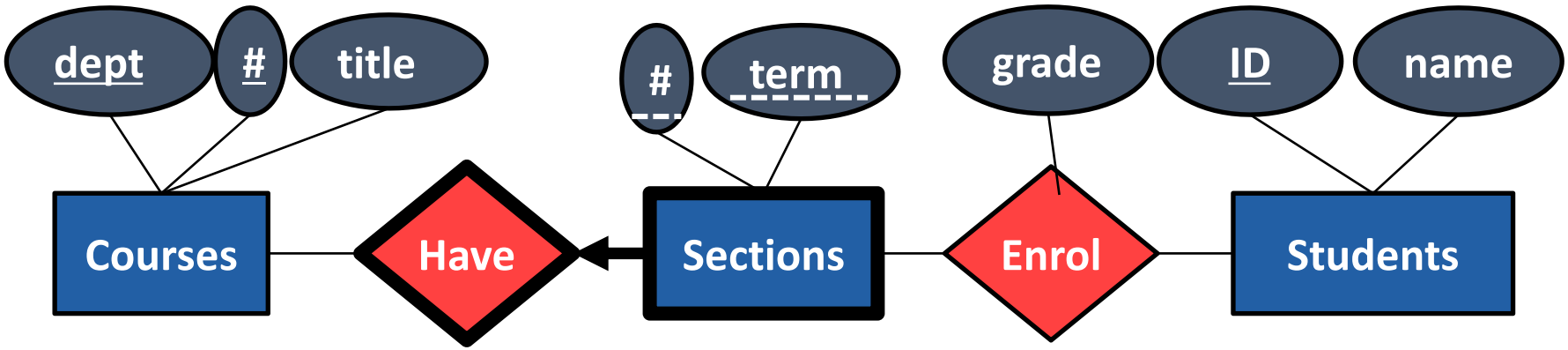

Is this what we want for the key of Sections?

- Looking only at Sections: 201 2022W2 is not unique
- Looking at Courses + Sections: CPSC 368 201 2022W1 is unique

Congratulations, you can now take CPSC 368 twice (yay?)