

RDBMS AND SQL ER MODEL

Venkatesh Vinayakarao

venkateshv@cmi.ac.in

<http://vvtesh.co.in>

Chennai Mathematical Institute

Slide contents are borrowed from the official website of the course text. For the authors' original version of slides, visit: <https://www.db-book.com/db6/slide-dir/index.html>.

The Words...

- people thought that he was crazy... now he's a genius and it **solved the biggest IT problem** in the history
- If you want to **compete** against me, then better be prepared to be **crushed** or don't compete against me
- He's trying to figure out a way that when **he's six feet under in a grave**, he can **still run the company**
- He sees **how the world can be** and then he actually tries to **make it that**
- I'm addicted to winning, **the more you win the more you learn.**

See <https://www.youtube.com/watch?v=mB2V0BXH608>



Database Design Using The Entity-Relationship Model

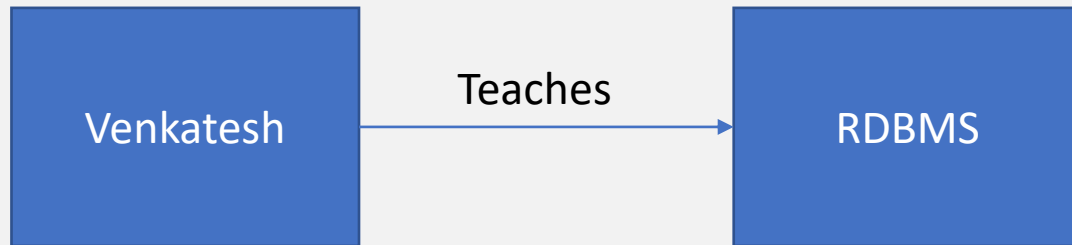
A Data Model

ER Model

The Idea



An Example



ER Model

- Models an enterprise as a collection of *entities* and *relationships*
 - Entity: a “thing” or “object” in the enterprise that is distinguishable from other objects
 - Described by a set of *attributes*
 - Relationship: an association among several entities
- Represented diagrammatically by an *entity-relationship diagram*.
- The ER data model employs three basic concepts:
 - entity sets
 - relationship sets
 - attributes

ER Model

An Attribute

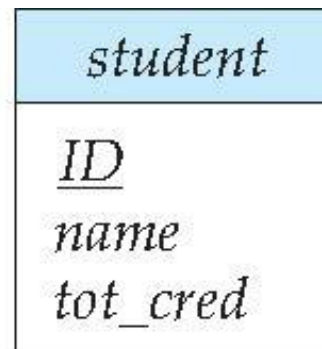
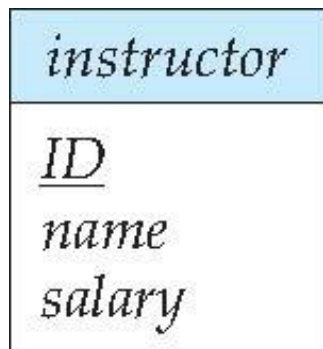
An Entity Set

<i>ID</i>	<i>name</i>	<i>dept_name</i>	<i>salary</i>
10101	Srinivasan	Comp. Sci.	65000
12121	Wu	Finance	90000
15151	Mozart	Music	40000
22222	Einstein	Physics	95000
32343	El Said	History	60000
33456	Gold	Physics	87000
45565	Katz	Comp. Sci.	75000
58583	Califieri	History	62000
76543	Singh	Finance	80000
76766	Crick	Biology	72000
83821	Brandt	Comp. Sci.	92000
98345	Kim	Elec. Eng.	80000

An Entity

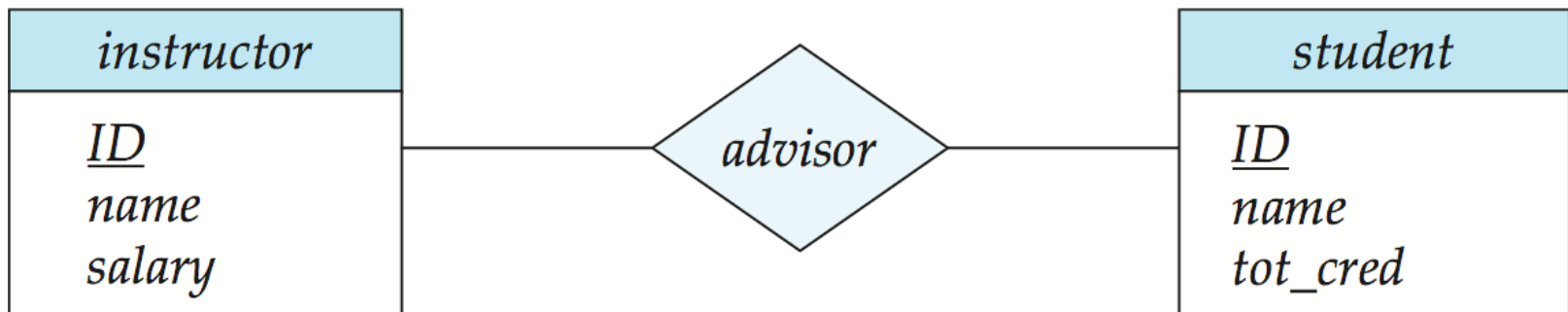
Entity Sets

- Graphical Representation
 - Rectangles represent entity sets
 - Attributes listed inside entity rectangle
 - Underline indicates primary key attributes



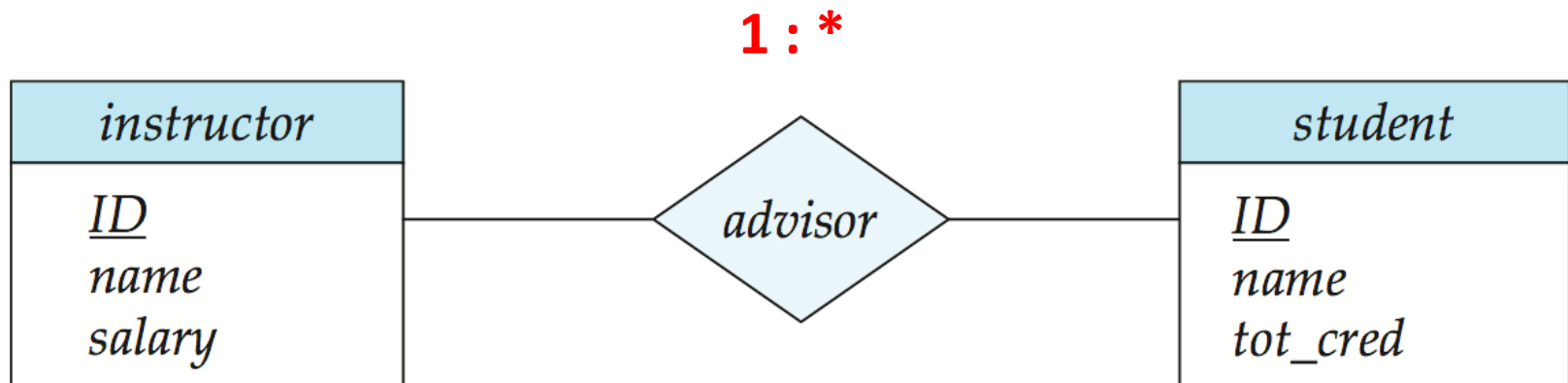
Relationship Sets

- Diamonds represent relationship sets.

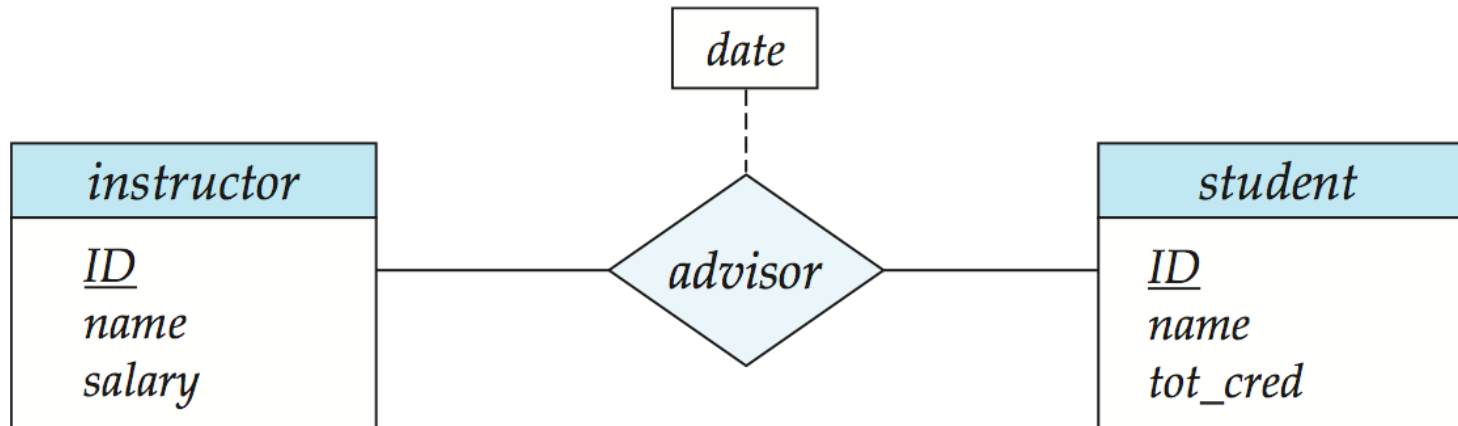


Mapping Cardinalities

- Specifies constraints on entity-entity association.

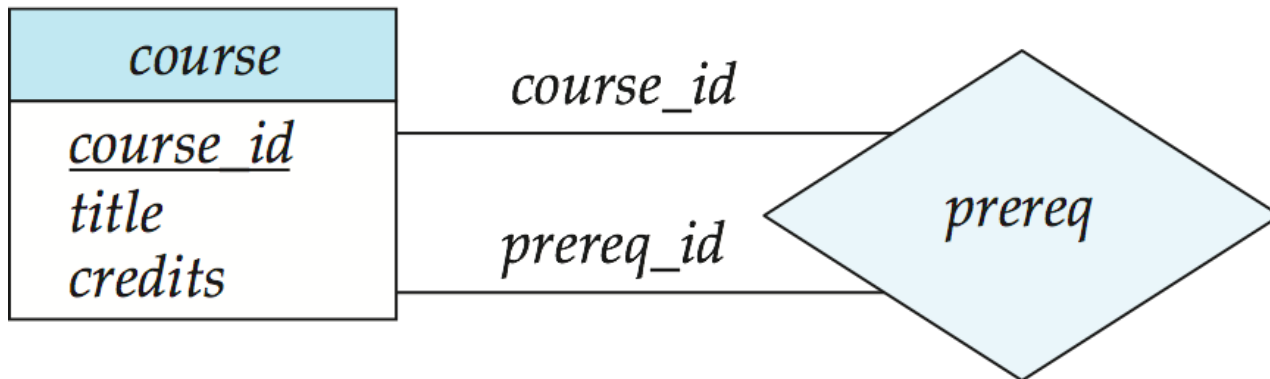


Relationship Sets with Attributes

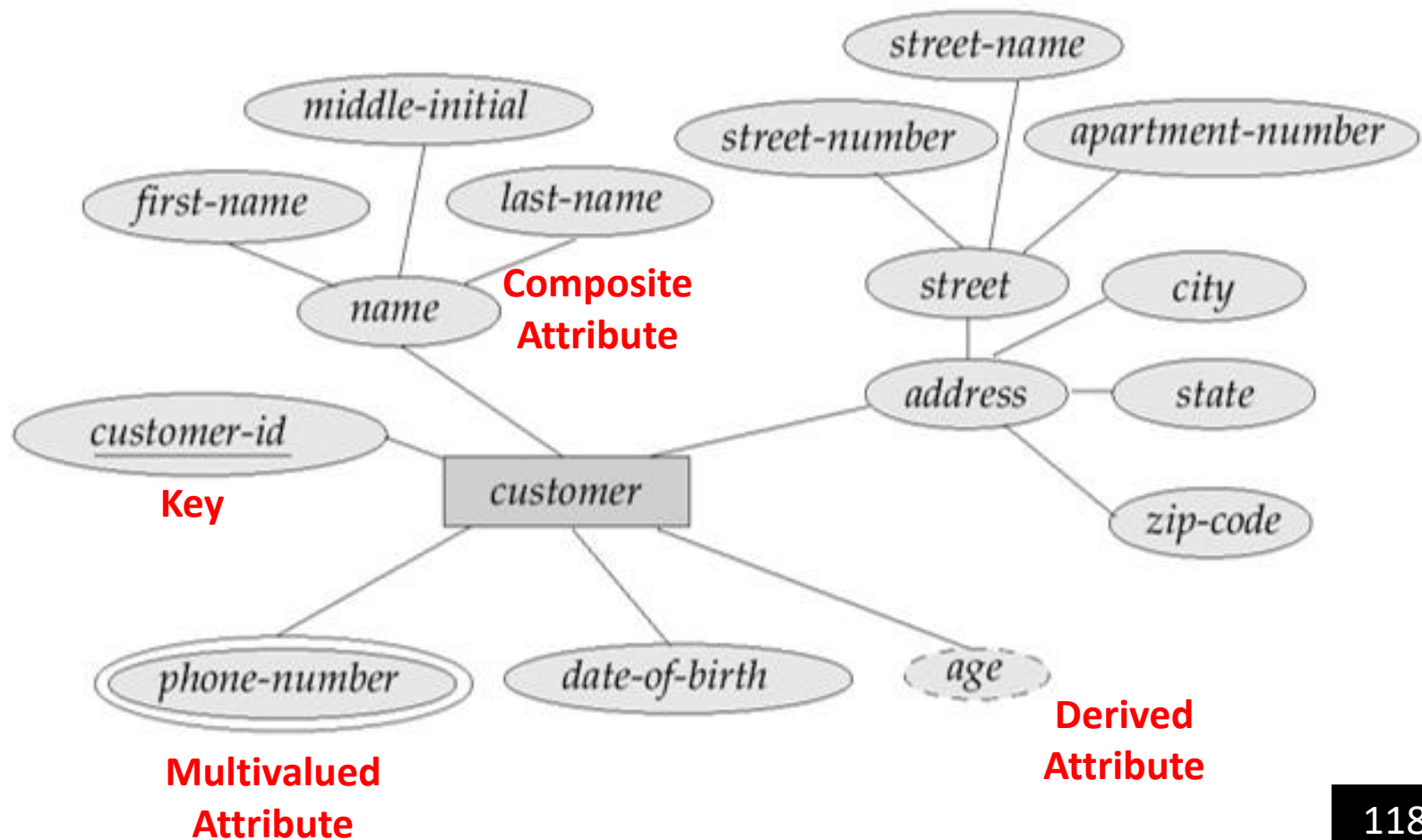


Roles

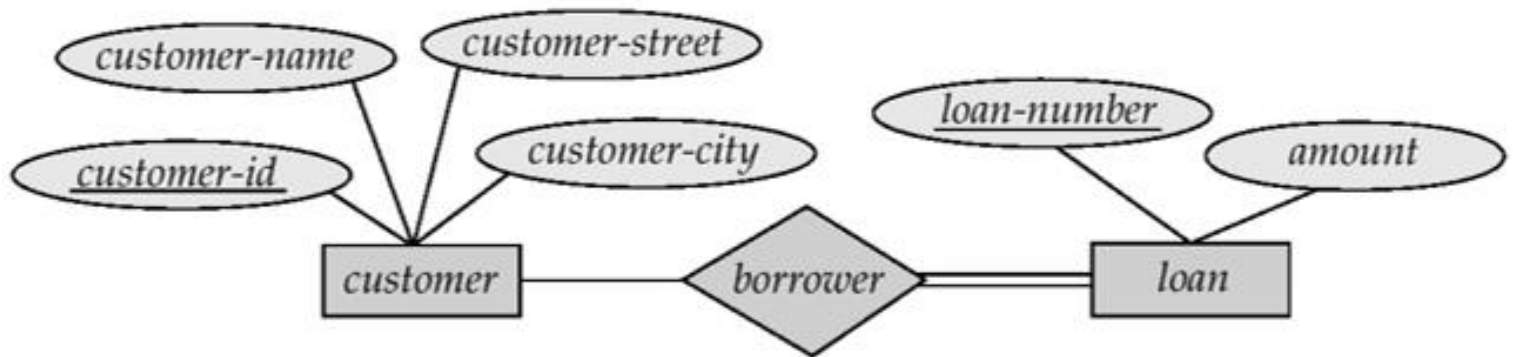
- Entity sets of a relationship need not be distinct
 - Each occurrence of an entity set plays a “role” in the relationship
- The labels “*course_id*” and “*prereq_id*” are called **roles**.



Attribute Types



Total Vs. Partial Participation



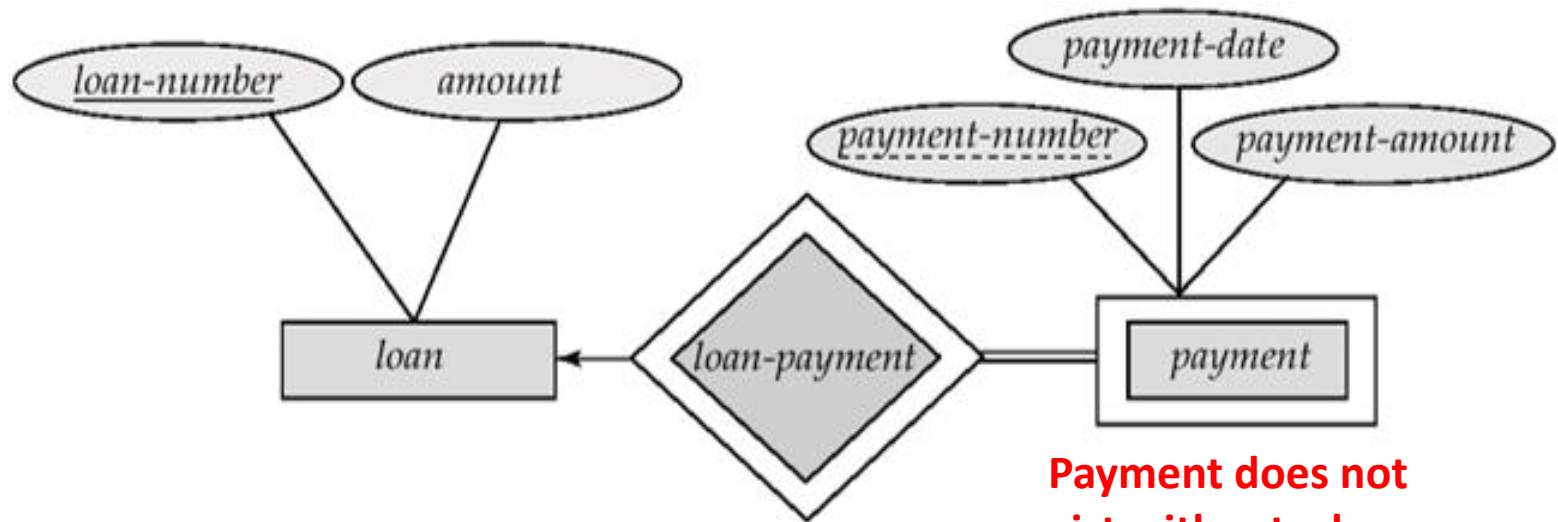
Partial Participation

Every customer need not borrow.
So, a single line!

Total Participation

Every loan must have a borrower.
So, a double line.

Weak Entities

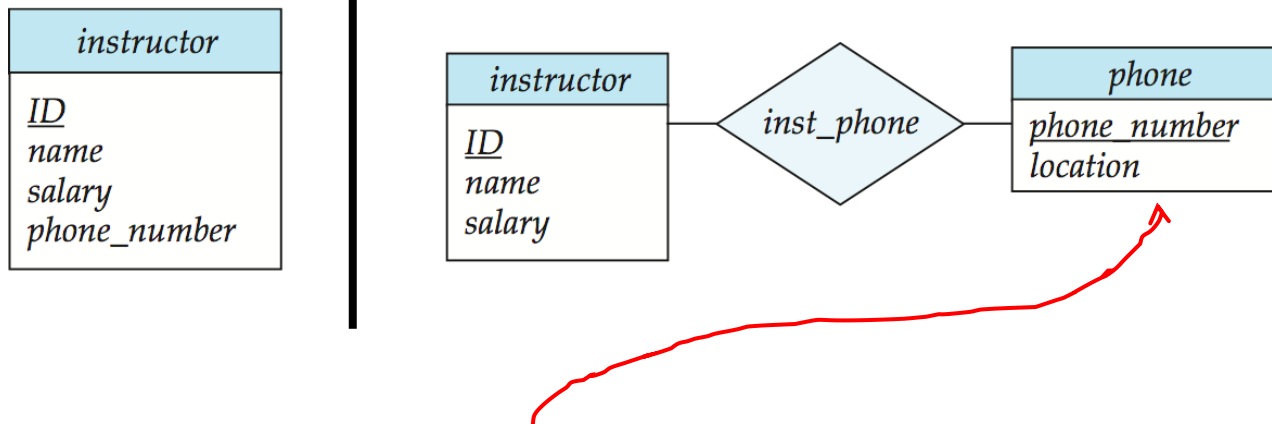


**Payment does not
exist without a loan.**

payment is
**existence
dependent** on
loan.

Entities vs. Attributes

- Use of entity sets vs. attributes – How will you model an instructor?



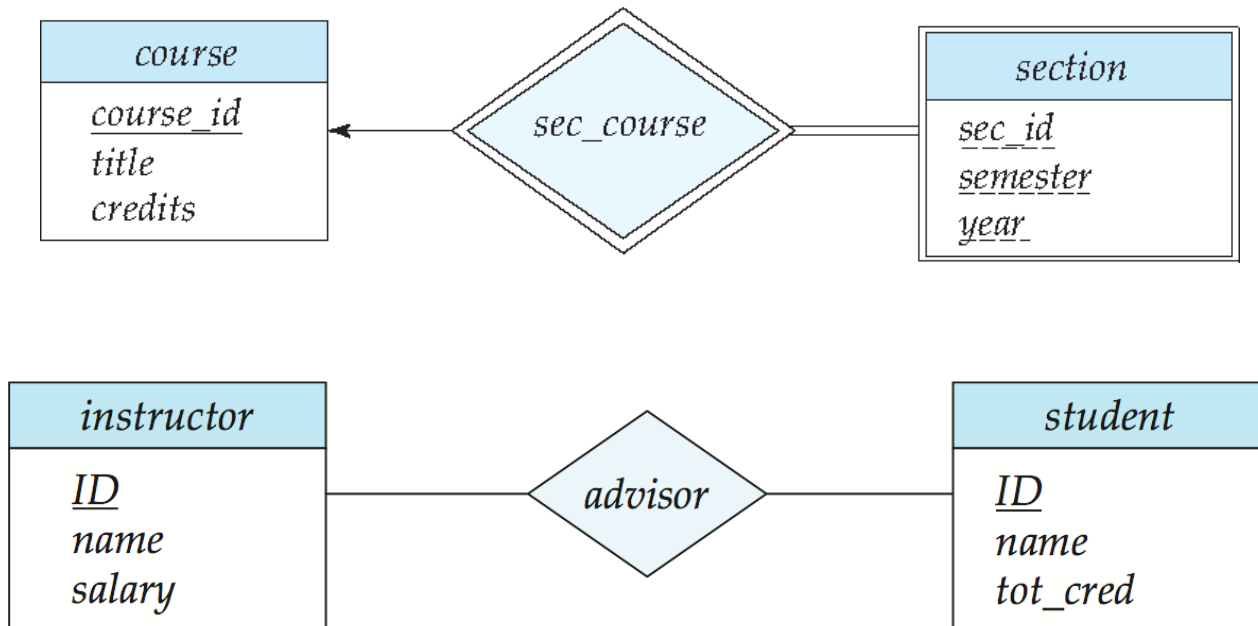
- Use of **phone as an entity** allows extra information about phone numbers (plus **multiple** phone numbers)

Reduction to Relation Schemas

- Entity sets and relationship sets can be expressed uniformly as *relation schemas*.
- A database which conforms to an E-R diagram can be represented by a collection of schemas.
- For each entity set and relationship set there is a unique schema that is assigned the name of the corresponding entity set or relationship set.

Quiz

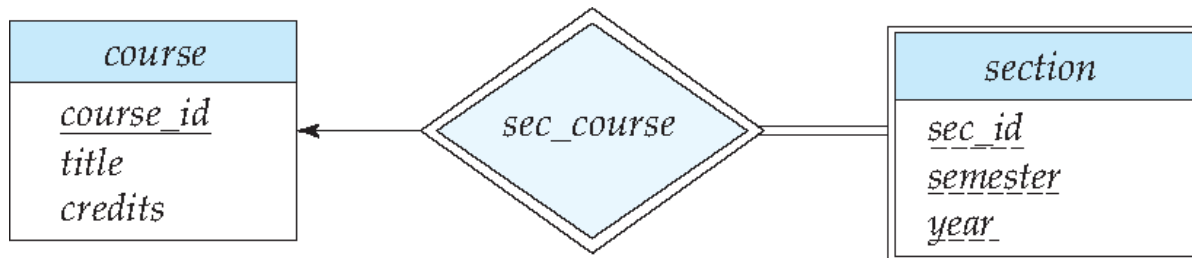
- For the ER Models given, suggest corresponding relational schema.



Representing Entity Sets

- A strong entity set reduces to a schema with the same attributes

student(ID, name, tot_cred)



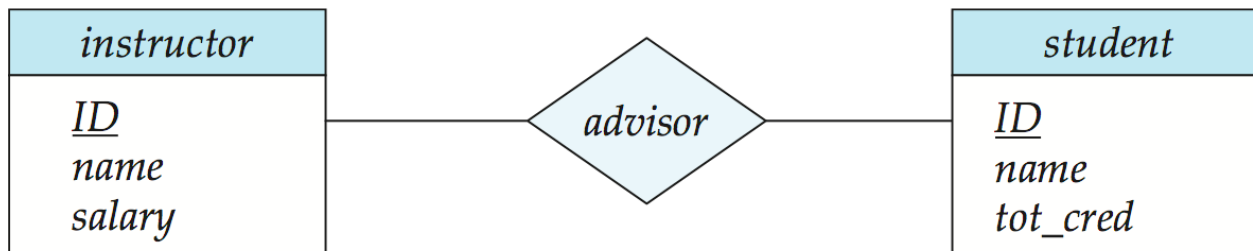
- A weak entity set becomes a table that includes a column for the primary key of the identifying strong entity set

section (course_id, sec_id, sem, year)

Representing Relationship Sets

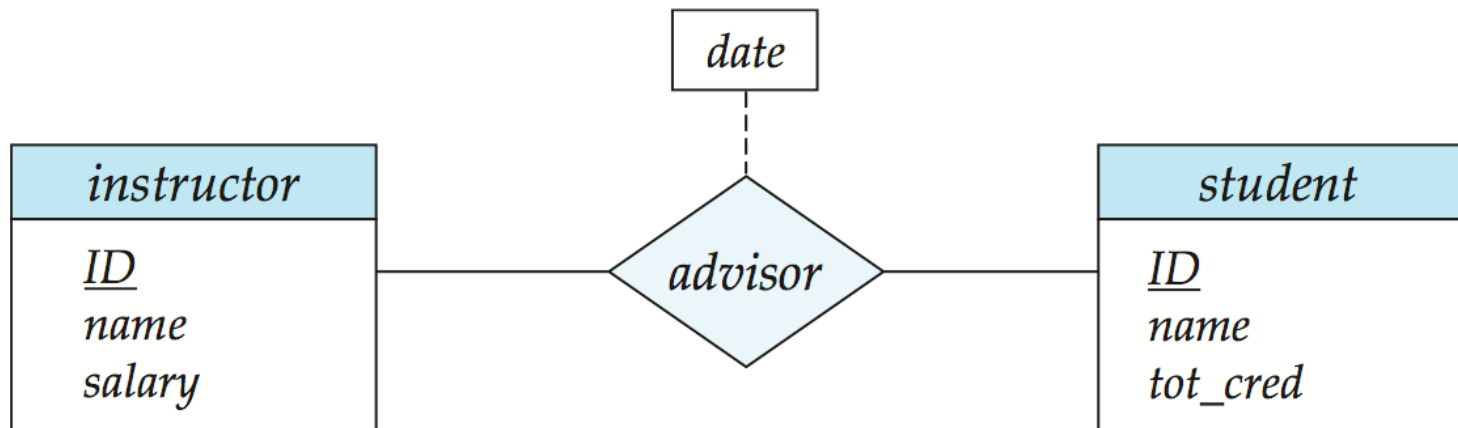
- A many-to-many relationship set is represented as a schema with attributes for the primary keys of the two participating entity sets, and any descriptive attributes of the relationship set.
- Example: schema for relationship set *advisor*

advisor = (*s_id*, *i_id*)



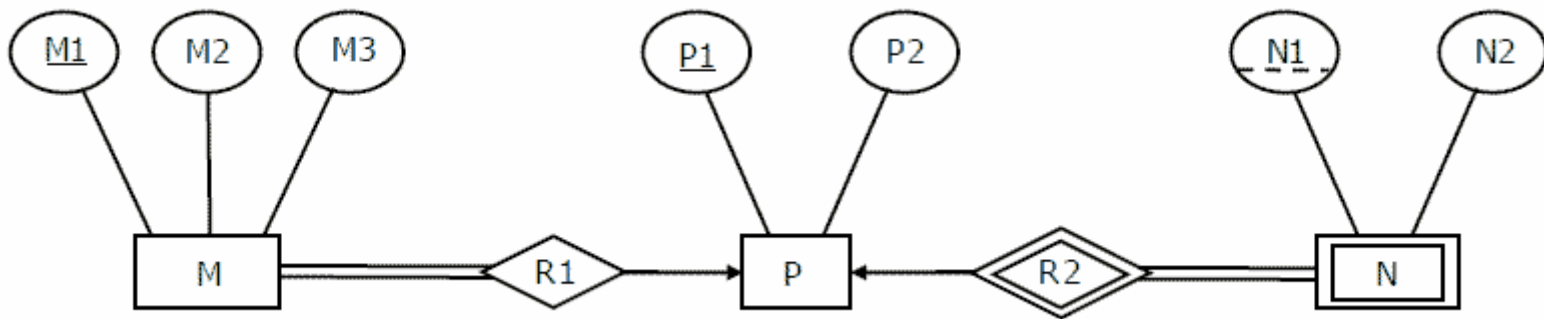
Quiz

- For the ER Model given, suggest a relational schema.



Quiz

- How many minimum number of tables are needed to represent M, N, P, R1, R2?



M (M1, M2, M3, P1) P (P1, P2) N (P1, N1, N2)

Representation of Entity Sets with Composite Attributes

<i>instructor</i>
<u><i>ID</i></u>
<i>name</i>
<i>first_name</i>
<i>middle_initial</i>
<i>last_name</i>
<i>address</i>
<i>street</i>
<i>street_number</i>
<i>street_name</i>
<i>apt_number</i>
<i>city</i>
<i>state</i>
<i>zip</i>

- Composite attributes are flattened out by creating a separate attribute for each component attribute
 - *instructor*(*ID*,
 first_name, *middle_initial*,
 last_name, *street_number*,
 street_name, *apt_number*, *city*, *state*,
 zip_code)

Quiz

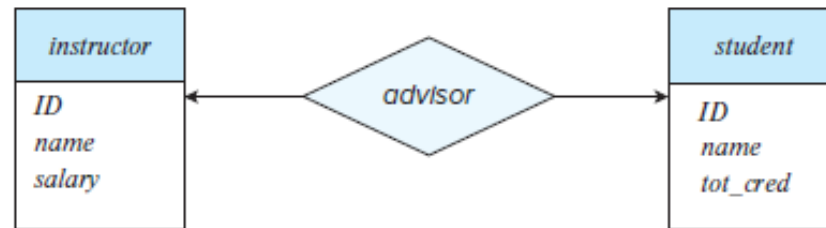
- **Choose the best answer. An Entity – relationship diagram is a tool to represent:**
 - Data model
 - Process model
 - Event model
 - Customer model

Quiz

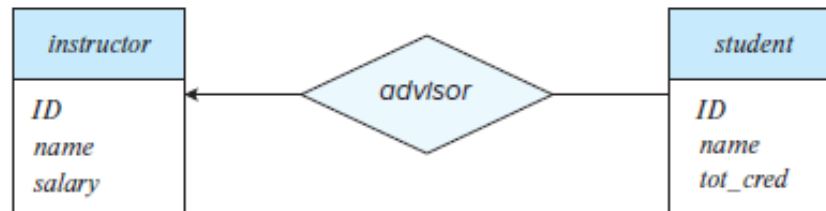
- **Choose the best answer. An Entity – relationship diagram is a tool to represent:**
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Summary

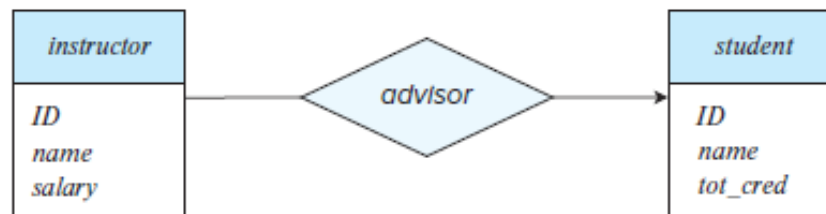
- ER Model is made of
 - entity sets,
 - relationship sets and
 - attribute sets.
- We have a standard UML-kind notation to draw ER diagrams.
- Although it looks natural, designing a good ER model requires creativity.



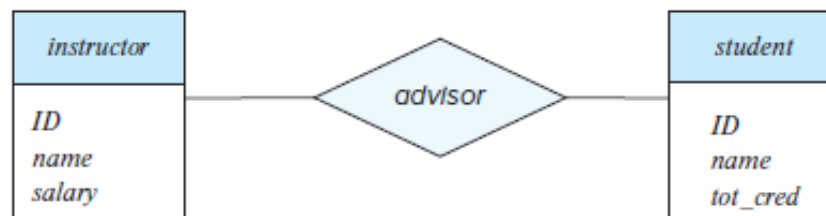
(a) One-to-one



(b) One-to-many



(c) Many-to-one



(d) Many-to-many

Quiz

- An ER model of a database consists of entity types A and B. These are connected by a relationship R which does not have its own attribute. Under which of the following conditions, can the relational table for R be merged with that of A?
 - Relation R is one-to-many and the participation of A in R is total.
 - Relation R is one-to-many and the participation of A in R is partial.
 - Relation R is many-to-one and the participation of A in R is total.
 - Relation R is many-to-one and the participation of A in R is partial.

Quiz

- An ER model of a database consists of entity types A and B. These are connected by a relationship R which does not have its own attribute. Under which of the following conditions, can the relational table for R be merged with that of A?
 - Relation R is one-to-many and the participation of A in R is total.
 - Relation R is one-to-many and the participation of A in R is partial.
 - **Relation R is many-to-one and the participation of A in R is total.**
 - Relation R is many-to-one and the participation of A in R is partial.