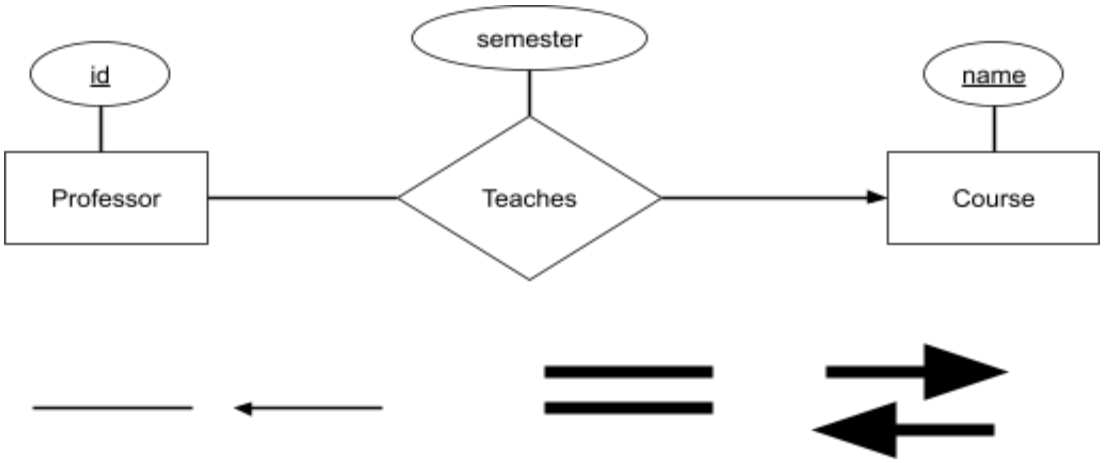
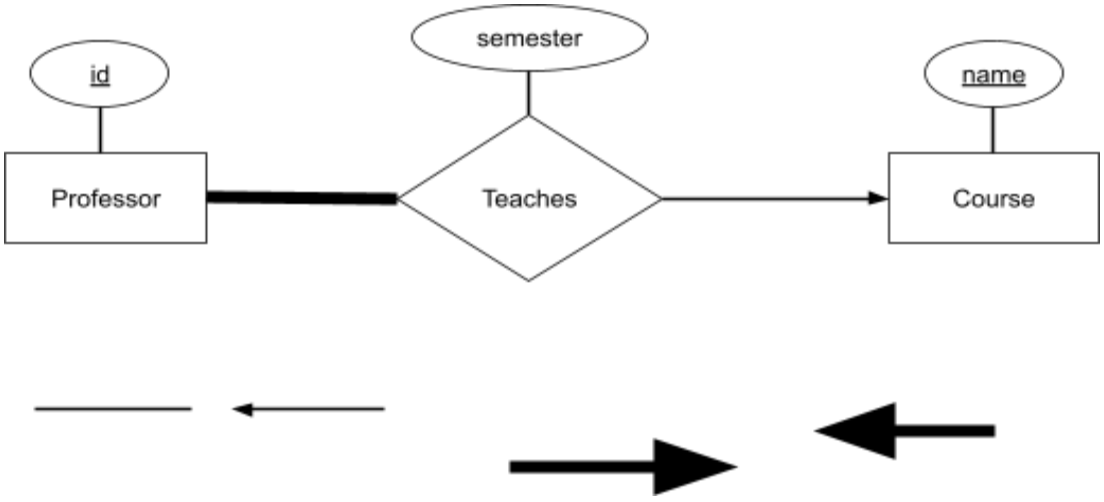
Problem Set 1: Part I

Problem 1: ER diagram basics

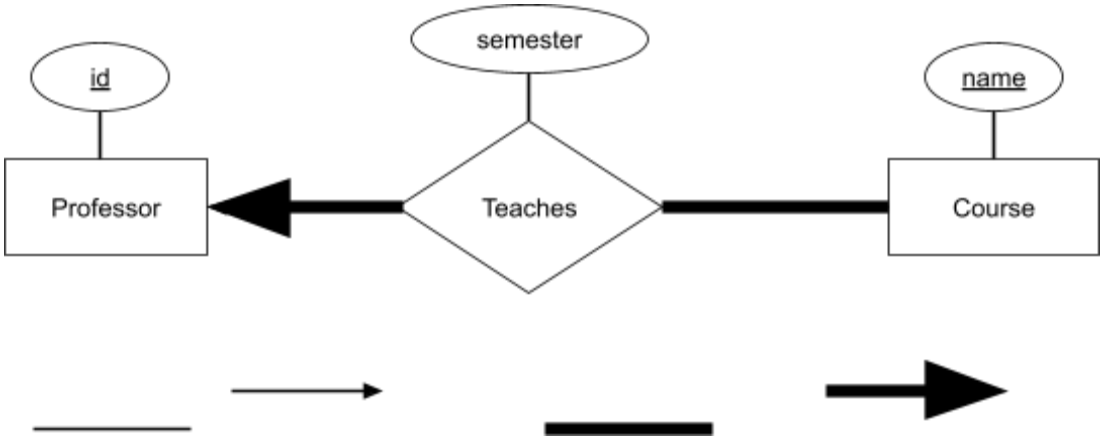
1. The only constraint: every professor teaches *at most one* (i.e., 0 or 1) course.



2. The only constraint: every professor teaches *exactly one* course.



3. every course must be taught by *exactly one* professor, and every professor must teach *at least one* (i.e., 1 or more) course.



Problem 1 (cont)

4.

Teaches(professor, course, semester) is not acceptable. The only constraint applied is that every professor teaches at most one course, which indicates a many-to-one relationship from Professor to Course. As a many-to-one relationship set, Teaches' primary key should only contain the primary key on the "many" side —- in other words, Teaches should only include 'id' attribute of the 'Professor' entity as the primary key.

Problem 2: Database design

1. Manages is a many-to-one relationship from Author to Agent.
2. Constraints:
    a. A given author is managed by at most one agent.
    b. A given author is managed by at least one agent, or a given author has full participation in 'manages.'
    c. a+b = A given author is managed by exactly one agent.
    d. A given appearance is related to at least one author, or a given appearance requires at least one author to show up.
    e. A given author can write multiple books, and a book can be written by more than one author.
3. Relational schema: [now haven't checked candidate keys or not]
    a. Wrote(_id_, _isbn_, publisher)
        i. Foreign keys: id is the primary key of Author; isbn is the primary key for Book
        ii. Referential-integrity constraint: Each value of the id attribute in Wrote must match a value of the id attribute from the Author entity; each value of the isbn attribute in Wrote must match a value of the isbn attribute from the Book entity.
    b. Will Appear(_id_, _date_, _location_)
        i. Foreign keys: id is the primary key of Author; the combination of date and location is the primary key for Appearance
        ii. Referential-integrity constraint: Each value of the id attribute in Will Appear must match a value of the id attribute from the Author entity; each value of the date attribute in Will Appear must match a value of the isbn attribute from the Book entity; each value of the location attribute in Will Appear must match a value of the isbn attribute from the Apper entity.
    c. Author(_id_, name, address, agent_id)
        i. Since "Manages" is a many-to-one relationship set, which can be captured and whose primary key gets included to the "many" side – the "Author" entity – and renamed accordingly.
        ii. Referential-integrity constraint: Each value of the agent_id attribute in Author must match a value of the id attribute from the Agent entity
    d. Book(_isbn_, title)
        i. Since Wrote is a many-to-many relationship set, Wrote cannot be captured by either entity set. No foreign key(s) are present in Book.

ii. No referential integrity is to be enforced.

e. Appearence(_date_, _location_)
   i. Since Will Appear is a many-to-many relationship set, Wrote cannot be captured by either entity set. No foreign key(s) present in Appearence.
   ii. No referential integrity is to be enforced.

f. Agent(_id_, name, office_number)
   i. No foreign key, so no referential integrity to be enforced.

Problem 3: Combining relations

Use the Insert->Table menu option to insert an appropriate table for each answer.

1. **Cartesian product of R and S**

R.a	R.b	c	S.b	S.a
1	2	1	2	3
1	2	3	4	3
1	2	7	6	5
3	4	1	2	3
3	4	3	4	3
3	4	7	6	5
5	6	1	2	3
5	6	3	4	3
5	6	7	6	5

2. **Natural join of R and S**

a	b	c
3	4	3
5	6	7

3. **Left outer join of R and S**

a	b	c
1	2	NULL

3	4	3
5	6	7

4. **Right outer join of R and S**

a	b	c
3	2	1
3	4	3
5	6	7

5. **Full outer join of R and S**

a	b	c
1	2	NULL
3	2	1
3	4	3
5	6	7