Database Design Exercise Set 1

Exercise 1

A university DB contains information about professors (identified by SIN) and courses (identified by course ID). Professors teach courses; each of the following situations concerns the Teaches relationship set. For each situation, draw an ER diagram that describes it, and list all candidate keys of the Teaches relationship set.

a. Professors can teach the same course in several semesters, and each offering must be recorded.
b. Professors can teach the same course in several semesters, but only the most recent such offering needs to be records.

Assume the situation b (above) applies in all subsequent situations. Then, draw an ER diagram that describes each of the following situations:

c. Every professor teaches a course, and every course is taught by some professor.
d. Every professor teaches exactly one course, and every course is taught by exactly one professor.

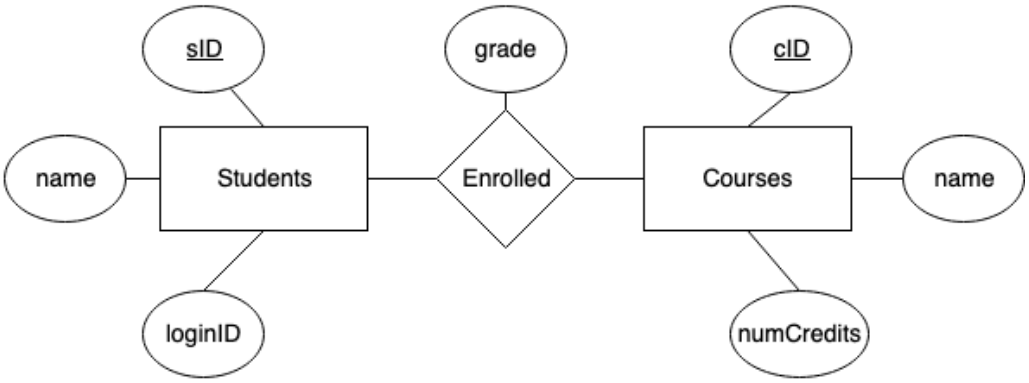
Exercise 2

Consider the following company DB. It stores information about employees (identified by SIN, with salary and phone attributes) and departments (identified by dept ID, with department name and budget as attributes). Employees work in departments. The DB records the interval during which an employee works for a department. Draw an ER diagram that describes each of the following situations.

a. Employee is not allowed to work in a department for two or more intervals.
b. Employee is allowed to work in a department for one or more intervals.

Exercise 3

Consider the following ER diagram. List all superkeys, candidate keys, and primary keys for entities sets Students and Courses, and for relationship set Enrolled.



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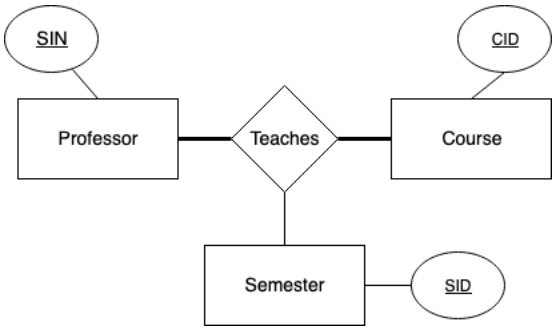
ANSWERS

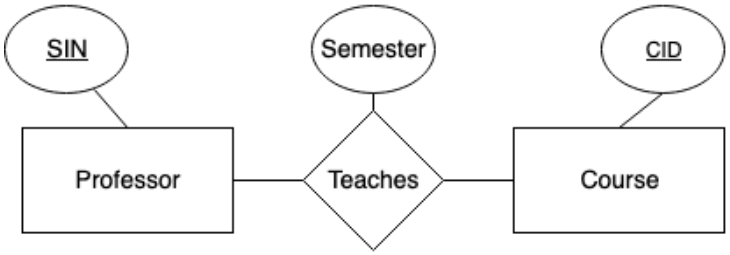
1a)



There is a single candidate key of the Teaches relationship: {SIN, CID, SID}.

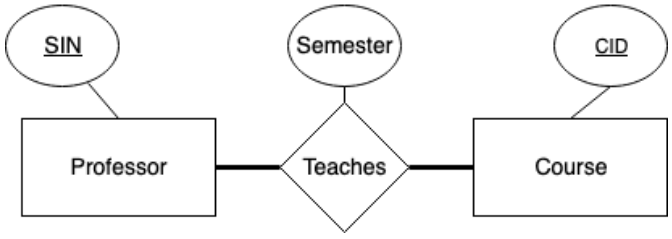
The participation constraint can be anything; let's say that it is total on professor and course entity sets (i.e., all professors must teach and all courses must be taught).

1b)



The key of Teaches is {SIN, CID} (In the flavour of ER diagrams introduced by the textbook, an attribute of a relationship cannot be part of the primary key. Do note that other versions of ER diagrams may have an attribute in a relationship be part of the key.).

1c)



The key of Teaches remains {SIN, CID}.

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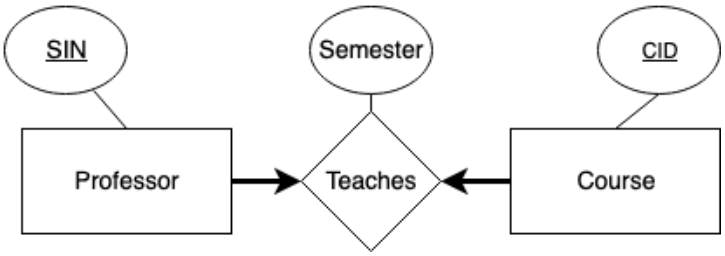
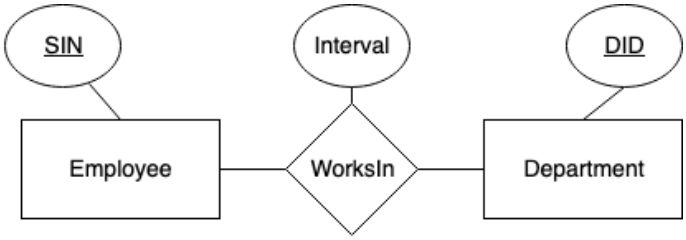
1d)



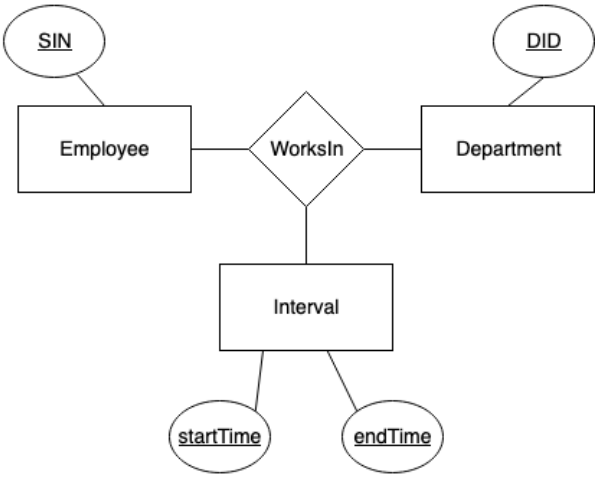
The key for Teaches can be either {SIN} or {CID}.

2a)



The key for WorksIn is {SIN, DID}.

2b)



WorksIn will be a ternary relationship with the key being {SIN, DID, startTime, endTime}.

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3) For Student:

- sID is a superkey, candidate key and primary key.
- Any set of Student's attributes that contain sID is a superkey.

For Course:

- cID is a superkey, candidate key and primary key.
- Any set of Course's attributes containing cID is a superkey.

Enrolled:

- The key of this relationship is {sID, cID}.
- Both {sID, cID} and {sID, cID, grade} are superkeys of this relationship.