CS W186 - Spring 2024
Exam Prep 9
DB Design

Database Design

As chancellor of UC Berkeley, you are tasked with designing a new final exam scheduling system to make it easier on students. Using the following assumptions, fill in the ER diagram we give you.

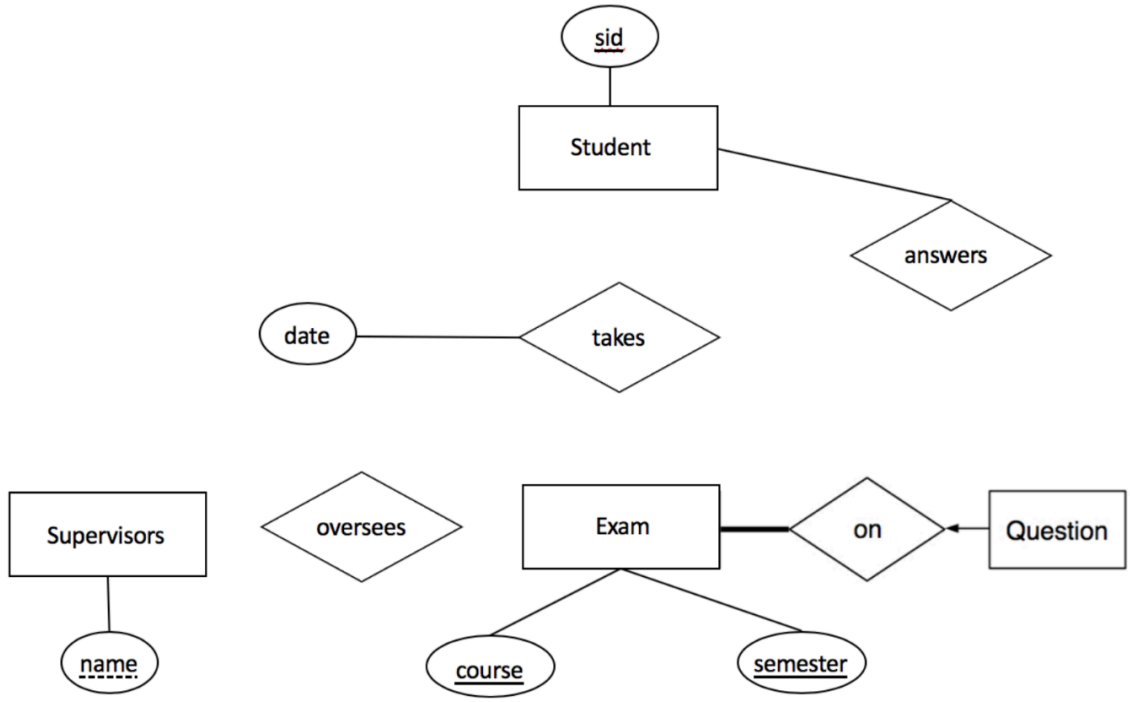
• A student may take any number of exams, and every exam is taken by at least one student.

• An exam is uniquely identified by the combination of a course and a semester.

• Every exam has at least one supervisor. A supervisor oversees exactly one exam.

• There is at least one question on every exam, and a question appears on at most one exam.

• A question on an exam may be answered by any number of students, and a student may answer any number of questions on an exam.



1. What type of edge should be drawn between the Supervisors entity and the oversees relationship set?

Bold Arrow - Each supervisor must oversees exactly one exam. This means that a supervisor must have a key constraint and participation constraint on their relationship with oversees.

2. What type of edge should be drawn between the Exam entity and the oversees relationship set?

Bold Line - At least one supervisor oversees the exam. This is a participation constraint.

3. What type of edge should be drawn between the Student entity and the takes relationship set?

Thin Line - Each student may take 0 or 1 or more exams on one day.

4. What type of edge should be drawn between the Exam entity and the takes relationship set?
Bold Line - Student takes at least one exam in total. It's a participation constraint.

5. What type of edge should be drawn between the Questions entity and the answers relationship set?
Thin Line - Each student may answer 0, 1 or more questions.

6. Consider the attribute set R = ABCDEF and the functional dependency set F = {BE → C, B → F, D → F, AEF → B, A → E}. Which of the following are candidate keys of R? Mark all that apply

(A) ACD

(B) AD

(C) FC

(D) BF

In computing attribute closure of a key *K*, we repeatedly process the set of functional dependencies *F* and add on attributes to the closure of *K* until there is nothing more that can be added. For ACD, we see that this leads first to ACDEF on the first processing of *F* and ABCDEF upon the second time we go through the loop. This means *ACD* is a superkey; however, for it to be a candidate key, we should check and make sure none of its subsets are superkeys for the table. Processing AD, however, gets us ADEF on the first iteration of the loop, ABDEF on the second, and ABCDEF on the third.

FC and BF are not superkeys (and therefore not candidate keys): both are their own attribute closures.

7. Given Attribute Set R = ABCDEFGH and functional dependencies set F = {CE → GH, F → G, B → CEF, H → G}. What relations are included in the final decomposition when decomposing R into BCNF in the order of functional dependencies set F?

- CE → GH violates BCNF, decompose into ABCDEF CEGH.
- F → G No relation contains FG, skip.
- B → CEF violates BCNF, decompose into ABD, BCEF, and CEGH.
- H → G violates BCNF, decompose into ABD, BCEF, CEH, GH.

Final relations are ABD, BCEF, CEH, GH.

8. True or False: The decomposition of attribute set R = ABCDEF, given the functional dependency set F = {B → D, E → F, D → E, D → B, F → BD}, into ABDE, BCDF is lossless.

False, it is lossy. ABDE ∩ BCDF = BD, BD → BDEF, which is not a superset of either ABDE or BCDF.