

1a) Entity sets - professor: with SIN underlined as the primary key, - course: with CID underlined as the primary key, - semester: with SID underlined as the primary key. Relationship set - teaches : associates professor, course and semester. No other attributes. The cardinality constraint is m-to-m. There is a single candidate key of the teaches relationship: {SIN, CID, SID}. The participation constraint can be anything; let say that it is total on professor and course entity sets.

1b) Semester does not need to be an entity set here. Teaches is a binary relation between professor and course. Semester is attribute of teaches. The key of teaches is {SIN, CID}.

1c) This means total participation from professors and total participation from courses. Because it is still m-to-m, the candidate key remains {SIN, CID}.

1d) This time the relationship is 1-to-1. There are now two candidate keys: either {SIN} or {CID}