

作业3：数据库设计(2020春)

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姓名：_____ 学号：_____

题目	1	2	3	4	5	6	7	8	9	10	总分
得分											

- (10分) 举例说明3个实体型之间的三元联系型与这3个实体型之间的3个二元联系型表示的意义通常是不同的。在什么情况下3个实体型之间的三元联系型与这3个实体型之间的3个二元联系型表示的意义会是相同的？
- (60分) 根据下面的大学数据库信息，用ER图表示该数据库的概念模型，明确标出键、基数比、参与度约束、角色。
 - Professors have an SSN, a name, an age, a rank, and a research specialty.
 - Projects have a project number, a sponsor name (e.g., NSF), a starting date, an ending date, and a budget.
 - Graduate students have an SSN, a name, an age, and a degree program (e.g., M.S. or Ph.D.).
 - Each project is managed by one professor (known as the project's principal investigator).
 - Each project is worked on by one or more professors (known as the project's co-investigators).
 - Professors can manage and/or work on multiple projects.
 - Each project is worked on by one or more graduate students (known as the project's research assistants).
 - When graduate students work on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have a (potentially different) supervisor for each one.
 - Departments have a department number, a department name, and a main office.
 - Departments have a professor (known as the chairman) who runs the department.
 - Professors work in one or more departments, and for each department that they work in, a time percentage is associated with their job.
 - Graduate students have one major department in which they are working on their degree.
 - Each graduate student has another, more senior graduate student (known as a student advisor) who advises him or her on what courses to take.
- (20分) 将上题中的ER模型转换成关系数据库模式，明确给出关系的主键和外键。
- (10分) 该大学数据库上经常执行下面的查询：
 - 人事处经常按项目的负责人(principal investigator)和起止日期来查询项目信息；
 - 科研处经常按项目的资助方(sponsor)和起止日期来查询项目信息；

为该数据库设计一个索引来提高上述查询的处理效率，写出创建该索引的SQL语句，说明你用到了哪些索引技术。

答案

1. 如果满足下面的条件，则3个实体型之间的三元联系型与这3个实体型之间的3个二元联系型表示的含义相同：对于任意两个三元联系 (a, b, c) 和 (a', b', c') ，
 - 如果 $a = a'$ 且 $b = b'$ ，则 $c = c'$ 。
 - 如果 $a = a'$ 且 $c = c'$ ，则 $b = b'$ 。
 - 如果 $c = c'$ 且 $b = b'$ ，则 $a = a'$ 。
- 2.
3.
 - Professor(ssn, name, age, rank, speicality)
 - Project(id, sponsor, start_date, end_date, budget, pi)
 - Graduate(ssn, name, age, degree, department, advisor)
 - Department(id, name, office, chair)
 - CoI(id, ssn)
 - RA(id, ssn, supervisor)
 - Affiliation(id, ssn, time)

 - Project.pi参照Professor.ssn
 - Graduate.department参照Department.id
 - Graduate.advisor参照Graduate.ssn
 - Department.chair参照Professor.ssn
 - CoI.id参照Project.id
 - CoI.ssn参照Professor.ssn
 - RA.id参照Project.id
 - RA.ssn参照Graduate.ssn
 - RA.supervisor参照Professor.ssn
 - Affiliation.id参照Department.id
 - Affiliation.ssn参照Professor.ssn
4. CREATE INDEX idx_date ON Project(start_date, end_date, PI_SSN);
该索引不仅可以支持第一个查询，而且其前缀索引可以支持第二个查询。