Database Systems – Midterm Exam 2019/2020 summer 2020-04-28

1	2	3a	3b	3c	Σ
/6	/3	/2	/2	/2	/15

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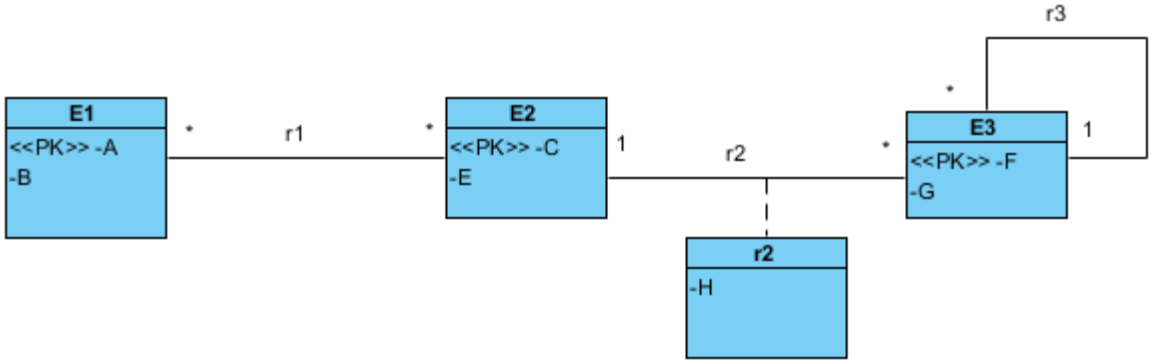
1 Assume you analyze requirements for a new faculty information system. Your task is to develop a conceptual data model for design of its database, namely the part of the database containing information about research projects solved at the faculty. Having analyzed the current information system and based on interviews with stakeholders you have found out that it is necessary to store information about projects solved by employees of the faculty. Each project is managed by one employee (known as the project's principal investigator) and is worked on by one or more employees (known as the project's co-investigators). Employees can manage and/or work on several projects. Each project has a unique project number, has its name and is funded by one grant agency. A grant agency, which has a unique acronym and has a name, can fund several projects. In addition, it is necessary to store information about results of projects. Consider two types of results – publications (e.g., an article in a journal) and products (e.g., software developed). The project can have several results; moreover, a result can be jointly created in several different projects. For results of both types it is necessary to know their authors (several for each project) including their share (as a percentage of the authorship). Moreover, in case of a publication it is necessary to know the title of the publication and the name of the journal, in case of a product its name and type of a license for the product (free, payed etc.). Each employee of the faculty as a unique personal number has a name and address. The information system must allow to list investigators and results of a given project on faculty web pages.

Draw an **ER diagram**. Consider only information contained in the specification above. Show also attributes of entities and relationships, and cardinality of relationship sets. You can add identifiers if necessary. Your diagram should be as clear as possible. If you use a notation different from the one employed on lectures, explain it, especially notation for cardinality (or use 0, 1, and * or M symbols). **6 points**

2 Design a **relational database schema** for the ERD below. Draw headings of tables, underscore primary keys of the tables, mark foreign keys, and draw arrows representing references between the tables. Your schema should be well designed, including avoiding unnecessary tables. “Ex” and “rx” are names of entity sets, and relationship sets, respectively. **3 points**



3 Consider a database containing tables *Teacher(teacherNo, tname, town)*, *Teaches(seacherNo, courseNo, year, form)* and *Course(courseNo, cname, credits)*. *TeacherNo* is the unique number of the teacher, *courseNo* is the unique number of the course and year identifies an academic year (e.g., 2018 means the academic year 2018/19). The attributes *tname* and *town* are the teacher's name and teacher's home address, respectively. Attributes *cname* and *credits* are the course name and course credit value, respectively. The row in the table *Teaches* contains information that a teacher identified by *teacherNo* taught a course identified by *courseNo* in a given *year* by a given *form*. (e.g., lecture, practice, project).

Write **SQL statements** that answer the following queries (a list of column names placed in parentheses, if any, specifies the required columns of the result):

3a List total number of courses taught by every teacher (all teachers should be included, even those without any course) in the last academic year (i.e., year 2018) *(teacherNo, tname, count_of_courses)*. Order by count of courses in descending order and by teacher name, if the count is the same. **2 points**

3b Who *(teacherNo, tname)* supervises the projects (i.e., the form of teaching is 'project' in a course named Database systems this academic year (i.e., 2018)? **2 points**

3c How many 4-credit courses are taught this academic year (i.e., 2018)? **2 points**