Handout 2: Modelling Databases using E/R Diagrams

CS 4604 (Prakash, Spring 2015)

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This handout lists textual descriptions of scenarios we may want to model using databases. We will cover some of these in detail in class, especially the one on students, classes, and professors. You should use the other scenarios for practice. Keep in mind that E/R diagrams cannot model all aspects of a database application. For each scenario, you should add "notes" stating which aspects the design cannot represent.

University Classes 1 This scenario models the courses, students, professors, departments, and the like at a single university in a single semester. Each student enrolls in a certain number of courses in the semester. At most one professor teaches each course. Each student receives a grade in each course he/she is enrolled in. In turn, each student evaluates the professor teaching the course.

Each student has a name, a PID, and an address. A professor has a PID, a name and belongs to a department. The age of a professor can be one of "old," "very old," and "still alive". Each course has a name, a number, an offering department, a classroom, a maximum enrollment, and an actual enrollment. The actual enrollment must be at most the maximum enrollment. (This university has not invented the concept of CRNs.) A student can TA a course but not a course he/she is enrolled in.

Each department has a unique name. Each department has at most one chairperson who is its head (there are times when a department may not have a chairperson). Each chairperson can be the head of at most one department.

Professors advise students on what courses to enroll in. Each student can have at most one advisor and must have at least one advisor.

A course can have multiple pre-requisites. A course can be a pre-requisites for multiple courses. A course cannot be a pre-requisite for itself! A student enrolled in a course must have enrolled in all its pre-requisites.

University Classes 2 At this university, more than one professor can teach a course. Students continue to get a single grade for each course. However, each student must provide an evaluation to each professor teaching a course the student is enrolled in.

University Classes 3 At this university, more than one professor can teach a course. Students continue to get a single grade for each course. However, each student enrolled in a course is taught by at most one professor assigned to the course. Therefore, the student evaluates only one professor for each course.

University Employees All employees have a unique ID. In addition to professors, universities also employ staff. The university pays all its employees a salary. Professors come in three flavours: 9-month appointees, calendar year appointees, and research professors. Each 9-month appointee and research professor has a grant that pays part of the employee's salary. Calendar year and 9-month professors teach classes while research professors do not.

University Students Students enrolled in a university can be either undergraduates or graduates. Graduate students can be enrolled either in a Masters programme or a Ph.D. programme. Each graduate student must submit a thesis. The thesis can be uniquely identified by its title. Each student can be a TA for at most one course. Furthermore, a course can have at most one graduate student as a TA (it may have multiple undergraduate TAs).

The US Congress (Courtesy Saverio Perugini) The US Congress is *bicameral* meaning that it is composed of two houses: the House of Representatives and the Senate. Every state has exactly two Senators (a junior and a senior member), but a variable number of Representatives (exactly one per district). No senator can represent more than one state at a time. Likewise, no Representative can serve more than one district at a time. Every state has a variable number of districts (dependent on population), but every state has at least one district (in a state like Delaware the district boundaries are the state's borders). Districts have numbers (e.g., district 1). A given Congressperson (Senator or Representative) cannot serve in both houses at a given time. Congresspeople have names and e-mail addresses. Every Congressperson is a member of exactly one political party. Exactly one member of the House is designated as Speaker of the House. Lastly, Congresspeople belong to Congressional committees which have names and sponsor bills, which also have names."

Iron Chef (from the Fall 2005 midterm examination) In this question, you will draw an E/R diagram to model the television show "Iron Chef." Do not worry if you have not seen this show![1] The show features a set of four "Iron Chefs," each one an expert in precisely one of the following cuisines: Chinese, French, Italian, and Japanese. Iron Chefs are famous; their name serves to identify them uniquely. Each episode, identified by an episode number, features a competition between a challenger and one of the Iron Chefs. Each challenger is also quite famous; his/her name and restaurant are enough to identify the challenger. The challenger selects the Iron Chef he/she wants to compete with. Each competition features a secret ingredient unveiled at the beginning of the episode. The secret ingredient never repeats, i.e., two different competitions do not have the same secret ingredient. The challenger and the selected Iron Chef each have one hour to prepare a set of dishes that articulate the theme ingredient. At the end of the hour, a panel of four judges tastes these dishes. Each judge awards each competitor a score; the maximum score is 20. The competitor with the maximum number of points wins. There are no ties! A person can be a judge in multiple competitions. If you cannot model any aspect of this scenario, then mention them as notes. You may use notes to explain any other aspect of your design, for example, the type of an attribute. If you do not use notes, you are guaranteeing that your E/R diagram models this situation *exactly*.

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[1]This description is of the original Japanese version of the show, which used to appear on *Food Channel*. An American adaptation called *Iron Chef America* appears on the *Food Network*.