

1. (50 points) Consider the following set of requirements for a university database that is used to keep track of students' transcripts.
  - (a) The university keeps track of each student's name, student number, social security number, current address and phone, permanent address and phone, birth-date, sex, class (freshman, sophomore, ..., graduate), major department, minor department (if any), and degree program (B.A., B.S., ..., Ph.D.). Some user applications need to refer to the city, state, and zip of the student's permanent address, and to the student's last name. Both social security number and student number have unique values for each student.
  - (b) Each department is described by a name, department code, office number, office phone, and college. Both name and code have unique values for each department.
  - (c) Each course has a course name, description, course number, number of semester hours, level, and offering department. The value of course number is unique for each course.
  - (d) Each section has an instructor, semester, year, course, and section number. The section number distinguishes different sections of

the same course that are taught during the same semester/year;  
its values are 1, 2, 3, ...; up to the number of sections taught  
during each semester.

- (e) A grade report has a student, section, letter grade, and numeric grade (0, 1, 2, 3, 4 for F, D, C, B, A, respectively).

Design an ER schema for this application, and draw an ER diagram for that schema. Specify key attributes of each entity type and structural constraints on each relationship type. Note any unspecified requirements, and make appropriate assumptions to make the specification complete.

2. (30 points) Design an ER schema for keeping track of information about votes taken in the U.S. House of Representatives during the current two-year congressional session. The database needs to keep track of each US state's **Name** (e.g., 'Arizona', 'Texas', 'California') and include the Region of the state (whose domain is {'Northeast', 'Southeast', 'Southwest', 'West'}). States have between one (AK, DE, MT, ND, SD, VT, and WY) and 52 (CA) representatives. There are 435 congresspersons in the U.S. House of Representatives. Each **CONGRESS\_PERSON** in the House of Representatives is described by his or her **Name**, plus the District represented, the **Start\_date** when the congressperson was first elected, and the political **Party** to which he or she belongs (whose domain is {'Republican', 'Democrat', 'Independent', 'Other'}). The database keeps track of each **BILL** (i.e., proposed law), including the **Bill\_name**, the **Date\_of\_vote** on

the bill, whether the bill **Passed\_or\_failed** whose domain is {'Yes', 'No'}, and the **Sponsor** (the congressperson(s) who sponsored—that is, proposed—the bill). The database keeps track of how each congressperson voted on each bill (domain of **Vote** attribute is {'Yes', 'No', 'Abstain', 'Absent'}).

Draw an ER schema diagram for this application. State clearly any assumptions you make.