

CMPS 340 File Processing

Fall 2016

HW #1 : Relationship Constraints and ER Modeling

Due: September 9 (at beginning of class)

1. (a) Suppose that A and B are entity types having (at some moment in time) associated entity sets $\{a_1, a_2, a_3, a_4\}$ and $\{b_1, b_2, b_3\}$, respectively. Suppose also that there exist binary relationship types R_1 through R_6 involving A and B . The corresponding relationship sets (at the same moment in time) are listed in (i) through (vi) below. For each one, you are to indicate the *strongest* cardinality ratio constraint and the *strongest* participation constraint (with respect to each of A and B) with which it is consistent (i.e., that it does not violate). For each one, then, your answer should be a member of the set

$$\{1:1, 1:N, N:1, M:N\} \times \{\text{total, partial}\} \times \{\text{total, partial}\}$$

For example, the answer (1:N, total, partial) would indicate that

- the given relationship set satisfied the 1:N cardinality ratio constraint but not the (stronger) 1:1 constraint,
- participation of A was consistent with the total participation constraint, and
- participation of B was consistent with the partial participation constraint (which is really no constraint at all) but not with the (stronger) total participation constraint.

(i) Relationship set of R_1 : $\{(a_2, b_2), (a_3, b_3), (a_1, b_1)\}$

(ii) Relationship set of R_2 : $\{(a_2, b_3), (a_3, b_3), (a_4, b_2), (a_1, b_3)\}$

(iii) Relationship set of R_3 : $\{(a_1, b_2), (a_1, b_1)\}$

(iv) Relationship set of R_4 : $\{(a_3, b_2), (a_3, b_1), (a_3, b_3), (a_4, b_3), (a_4, b_1)\}$

(v) Relationship set of R_5 : $\{(a_2, b_2), (a_2, b_1), (a_3, b_1)\}$

(vi) Relationship set of R_6 : \emptyset (empty set)

(b) Devise a relationship set for a binary relationship type involving entity sets A and B , using the same entity sets for A and B as in part (a), for which the correct answer (to the question repeatedly posed in part (a)) is (N:1, total, total).

(c) The set of possible answers for each of parts (i) through (vi) of part (b) has sixteen elements ($4 \cdot 2 \cdot 2$, corresponding to the product of the number of choices for each component). Five of the sixteen are impossible, given our choice of entity sets, namely $\{a_1, a_2, a_3, a_4\}$ for A and $\{b_1, b_2, b_3\}$ for B . Identify at least three of the impossible answers and, for each one, tell why it is impossible.

2. Design an ER schema diagram like that in Figure 3.2 of Elmasri & Navathe (7th edition, but Figure 7.2 in 6th edition) for the following set of requirements pertaining to a **United States House of Representatives** database application. The term **congressman** refers to a member of the House, male or female.

Each congressional district:

- is in a particular state (e.g., Pennsylvania)
- has a number (e.g., 5)
- is uniquely identified by the two attributes mentioned above
- is adjacent to zero or more neighboring congressional districts within the same state
- is represented by one congressman

Each congressman:

- is identified by SSN
- has a name
- has a birthdate
- represents a particular congressional district
- has been a sponsor of zero or more bills
- has participated in zero or more House votes

Each bill:

- has an ID Number uniquely identifying it
- has a name (e.g., “Kate’s Law”)
- has a description (i.e., the language of the bill)
- is sponsored by one or more congressmen
- has been the subject of zero or more House votes

Each House vote:

- was with respect to some particular bill
- occurred on some particular date
- is uniquely identified by the two attributes mentioned above
- had a result described by the number of votes “for” and the number of votes “against”
- was participated in by zero or more congressman, each of whom cast a vote

Employ the diagrammatic conventions shown in Figure 3.14 (7.14 in the 6th edition) and used in Figure 3.2 (7.2 in 6th edition) in order to indicate

- which are the *strong* and which are the *weak* entity types
- key attribute(s) of each strong entity type
- partial key attribute(s) of each weak entity type
- which are the regular and which are the *identifying* relationship types
- for each relationship type, to which constraints (of the *cardinality ratio* and *participation* varieties) it must conform

Note any assumptions you made to fill in missing requirements or to clarify existing ones. Note any (conditions specified within the) requirements that you could not figure out how to express within the ER schema.