Practice 3: Until step 4 of the CSDP

All following exercises concern the CSDP until step 4 “add uniqueness constraints and check the arity of the fact types”.

Exercise 1

For each of the diagrams you created in practice 2: (i) use the examples tab in the fact editor to apply a population check on each of the diagrams you crated, (ii) generate the appropriate uniqueness constraints and (iii) use the Verbalizer to check out the model’s correctness. Modify the diagrams if necessary.

Exercise 2

Verbalize this report in terms of binaries, draw the fact types and add uniqueness constraints. The first column, headed “subject title”, actually lists the codes and titles of postgraduate topics (don’t expect all the names in real-life examples to be well chosen!). A topic is not the same kind of thing as a subject. A postgraduate student first enrolls in a subject (identified by subject code, e.g., CS451) and then later chooses a topic to study for this subject. Subject enrollments are not part of this question. A topic may be offered in semester 1 only, semester 2 only, or over the whole year (at half the pace).

The fact that different students might be enrolled in the same subject (as identified by subject code) and yet be studying different topics is a source of possible confusion. As information modelers, one of the most significant contributions we can make is to suggest improvements to the Universe of Discourse (UoD) itself. In this example, we might argue it would simplify things if topics were treated as subjects. The department involved eventually accepted this change. For this exercise, however, you are to model things as they were.

Subject title	Staff	When	Prerequisites
AIT: Advanced Information Technology	MEO,PNC,TAH	1st sem	CS315
CLVS: Computational logic and verification systems	JS,PJR	Year	CS260 Preferred
DBMS: Advanced topics in database management	MEO,PNC,RC,TAH	2nd sem	CS315
FP: Functional Programming	EJS,PAB	Year	CS225,CS220 preferred
GA: Genetic Algorithms	PDE	1st	CS340

Exercise 3

Many manufactured products contain parts that may themselves be products of even smaller parts. The structure of one such product is shown. Draw a schema diagram for this UoD, including uniqueness constraints, but make no use of nesting. The example is significant.

- A contains 2 Bs
- A contains 1 C
- B contains 1 D
- B contains 3 Es
- C contains 3 Es
- C contains 2 Fs
- C contains 4 Gs

Exercise 4

The following output report provides information on airplane flights between cities. The population of this table is significant with respect to uniqueness constraints. A novice information designer expresses the information on the first row in terms of the following ternary.

Flight(flight#) 'T74' goes from City(name) 'Paris' to City(name) 'London'

Discuss the correctness of this approach, and draw a correct conceptual schema diagram, including uniqueness constraints.

FlightNR	Origin	Destination
T74	Paris	London
AK2	Paris	London
B80	Sydney	New York
T23	London	Paris
B45	New York	Sidney

Exercise 5

The following table contains data about some moons in our solar system (assume that the data is significant)

Moon	Planet	Orbital Period (days)
Callisto	Jupiter	16.7
Deimos	Mars	30.0
Phobos	Mars	0.3

OBJ

- Schematize this as a ternary. Is this okay?
- Schematize this using nesting. Is this okay?
- Schematize this using only simple binaries. Is this okay?

Exercise 6

Consider the following table containing relation R:

Actor	Movie	Director
Gary Cooper	Meet John Doe	Frank Capra
Gary Cooper	High Noon	Fred Zinnemann
Gary Cooper	Bluebeard's Eight Wife	Ernst Lubtisch
Gary Cooper	Mister Deeds Goes To Town	Frank Capra
Irene Dunne	The Awful Truth	Leo McCarey
Cary Grant	Arsenic and Old Lace	Frank Capra
Cary Grant	The Awful Truth	Leo McCarey
Groucho Marx	Duck Soup	Leo McCarey

Use the projection-join test to determine if these data should be modeled using a ternary predicate or several binary facts. Draw the right schema.

Solution:

$$\pi_{\{Actor,Movie\}}(R) \bowtie \pi_{\{Movie,Director\}}(R) = R$$

The result is the same as the original, so the ternary fact can be split into two binary fact types.