1 Towards Deductive Databases in Prolog (8 points)

We consider the participation of students in courses of a summer academy. There are
students with attributes name and discipline (cv, im, inf) and courses with attributes
name, hours and the name of the lecturer. Moreover, we model the attendance of students
in courses as well as grades of students from previous exams.

The students belong to the following groups: hanspeter (cv), angela (cv), guido (cv),
sabine (im), rainer (im), wolfgang (inf), kristina (inf) and philipp (inf).

There are the following courses, represented by name, weekly hours and lecturer name:
semantic_web (4, tim), ai (2, stuart), databases (4, peter), economics (2, ludwig) and ti
(4, uwe).

From previous courses, we now the following grades of students: Guido passed exam1
with grade 1 and exam2 with grade 2. Wolfgang got grade 2 in exam1 and 3 in exam2.

Finally, the attendance of students in courses is as follows:
hanspeter and angela attend semantic_web, sabine and rainer attend databases, wolfgang,
angela and guido are interested in the ti course, rainer and guido are interested in econom-
ics, and sabine and guido attend the course ai.

1.1 Modeling

• Represent these data by facts using the following predicates: student/2 with student
name and discipline, course/3 with course name, hours and lecturer, attend/2 with
student name and course name and grades/3 with student name, exam and grade.

• Define a new predicate achievement(Student, Grades), to represent all achieved gra-
des of a student by one list. The first argument (Student) is the name of the student,
the second argument (Grades) is a list of lists, where each list entry represents a
pair (list of two elements) of exam and the corresponding grade ([Exam,Grade]).
Thus, all grades (together with the corresponding exam) that are given by the
predicate grade are represented as a list in achievement.

• Define a predicate classmate(Student1, Student2) to describe pairs of students that
attend the same courses in the current term.
1.2 Queries
Formulate the following queries in Prolog and check the results. Use the unary predicates query1, query2 and query3.

- query1/1 lists all cv-students that attend the course semantic_web.
- query2/1 lists all im-students that attend a course but not the economics course.
- query3/1 lists all students that attend a course together with angela.

1.3 Integrity Constraints
Formulate the following integrity constraints. Use the predicate inconsistent/0 which is true if an integrity constraint is violated, otherwise inconsistent/0 evaluates to false.

- Each student has to attend at least one course.
- No lecturer is allowed to give more than one course.
- Each course needs at least one attendee.

2 Lists in Prolog - revisited (2 points)
Formulate a prolog predicate flatten(InputList, FlatList). The first argument (InputList) is an input list, where the elements can be atomic elements, lists, lists of lists, ... The result is represented by the second argument FlatList, which is a list of all atomic elements which appear in the input list. The elements occur in the same ordering.

For instance, the list [a, [b, c], [d], [e, [f]], g] is flattened to the list of atoms [a, b, c, d, e, f, g].

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