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Пусть:

- S :: students
- G :: groups
- L :: lecturers
- C :: courses
- M :: marks
- GL :: grouplists
- SCH :: schedule

1. Информация о студентах с заданной оценкой по предмету «Базы данных».
   Пусть X – заданная оценка, тогда:
   select S where $\exists C(\exists M(S_{student\_id} = M_{student\_id} \wedge C_{course\_id} = M_{course\_id} \wedge C_{course\_name} =' Базы\ данных' \wedge M_{mark} = X))$

```
E1(student_id, student_name) :- S(student_id, student_name),
        C(course_id, course_name), M(student_id, course_id, mark),
        course_name = 'Базы данных', mark = X
```

```
SELECT students_id, student_name
FROM students, courses, marks
WHERE students.student_id = marks.student_id AND
        courses.course_id = marks.course_id AND
        course_name = 'Базы данных' AND mark = X;
```

2. Информация о студентах не имеющих оценки по предмету «Базы данных».

   - среди всех студентов
     select S where $\neg\exists M(\exists C(S_{student\_id} = M_{student\_id} \wedge C_{course\_name} =' Базы\ данных' \wedge C_{course\_id} = M_{course\_id}))$

```
E2A(student_id, student_name) :- S(student_id, student_name),
        not M(student_id, course_id, _), C(course_id, course_name),
        course_name = 'Базы данных'
```

```
SELECT * FROM students
WHERE NOT EXISTS
SELECT student_id, student_name FROM students, courses, marks
WHERE students.student_id = marks.student_id AND
        courses.course_id = marks.course_id AND
        course_name = 'Базы данных';
```

   - среди студентов, у которых есть этот предмет
     select S where (
     $\exists GL(\exists C(\exists SCH(S_{student\_id} = GL_{student\_id} \wedge GL_{group\_id} = SCH_{group\_id} \wedge SCH_{course\_id} = C_{course\_id} \wedge C_{course\_name=' Базыданных'})))$
     and
     $\neg\exists M(\exists C(S_{student\_id} = M_{student\_id} \wedge C_{course\_name} =' Базы\ данных' \wedge C_{course\_id} = M_{course\_id})))$

```
E2B(student_id, student_name) :- S(student_id, student_name),
        not M(student_id, course_id, _), C(course_id, course_name),
        GL(student_id, group_id), SCH(course_id, group_id, _),
        course_name = 'Базы данных'
```

```
SELECT * FROM students
WHERE EXISTS
SELECT student_id, student_name
        FROM students, grouplists, courses, schedule
        WHERE students.student_id = grouplists.student_id AND
                grouplists.group_id = schedule.group_id AND
                schedule.course_id = courses.course_id AND
                course_name = 'Базы данных'
AND NOT EXISTS
SELECT student_id, student_name
        FROM students, courses, marks
        WHERE students.student_id = marks.student_id AND
                courses.course_id = marks.course_id AND
                course_name = 'Базы данных';
```

3. Информация о студентах, имеющих хотя бы одну оценку у заданного лектора.
   Пусть X – идентификатор заданного лектора, тогда:
   select S *where* $\exists M(\exists GL(\exists SCH(S_{student\_id} = M_{student\_id} \wedge S_{student\_id} = GL_{student\_id} \wedge GL_{group\_id} = SCH_{group\_id} \wedge C_{course\_id} = M_{cours\_id} \wedge SCH_{lecturer\_id} = X)))$

```
E3(student_id, student_name) :- S(student_id, student_name),
        M(student_id, course_id, _), GL(student_id, group_id),
        SCH(course_id, group_id, lecturer_id), lecturer_id = X
```

```
SELECT * FROM students
WHERE EXISTS
SELECT student_id, student_name
        FROM students, marks, grouplists, schedule
        WHERE student.student_id = marks.student_id AND
                students.student_id = grouplists.student_id AND
                grouplists.group_id = schedule.group_id AND
                schedule.course_id = marks.course_id AND
                schedule.lecturer_id = X;
```

4. Идентификаторы студентов, не имеющих ни одной оценки у заданного лектора.
   Пусть X – идентификатор заданного лектора, тогда:
   select $S_{student\_id}$ *where* $\neg\exists M(\exists GL(\exists SCH(S_{student\_id} = M_{student\_id} \wedge S_{student\_id} = GL_{student\_id} \wedge GL_{group\_id} = SCH_{group\_id} \wedge M_{course\_id} = SCH_{course\_id} \wedge SCH_{lecturer\_id=X})))$

```
E4(student_id) :- S(student_id, _), not M(student_id, course_id, _),
        GL(student_id, group_id), SCH(course_id, group_id, lecturer_id),
        lecturer_id = X
```

```
SELECT student_id FROM students
WHERE NOT EXISTS
SELECT students.student_id
        FROM students, marks, grouplists, schedule
        WHERE students.student_id = marks.student_id AND
                students.student_id = grouplists.student_id AND
                grouplists.group_id = schedule.group_id AND
                schedule.course_id = marks.course_id AND
                schedule.lecturer_id = X;
```

5. Всех студентов, имеющих оценки по всем предметам заданного лектора.
   Пусть X – идентификатор заданного лектора, тогда:
   select S where $\exists GL(\exists M(\forall SCH(S_{student\_id} = M_{student\_id} \wedge S_{student\_id} = GL_{student\_id} \wedge GL_{group\_id} = SCH_{group\_id} \wedge SCH_{course\_id} = M_{course\_id} \wedge SCH_{lecturer\_id} = X)))$

```
Losers(student_id, student_name) :- S(student_id, student_name),
        M(student_id, course_id, _), GL(student_id, group_id),
        SCH(course_id, group_id, lecturer_id), lecturer_id = X

E5(student_id, student_name) :- S(student_id, student_name),
        not Losers(student_id, student_name)
```

6. Для каждого студента имя и курсы, которые он должен посещать.
   select $S_{student\_name}, C_{course\_name}$ *where* $\exists GL(\exists SCH(S_{student\_name} = GL_{student\_name} \wedge GL_{group\_id} = SCH_{group\_id} \wedge SCH_{course\_id} = C_{course\_id}))$

```
E6(student_name, course_name) :- S(student_id, student_name),
        C(course_id, course_name), GL(student_id, group_id),
        SCH(course_id, group_id, _)
```

```
SELECT student_name, course_name
FROM students, marks, grouplists, schedule
WHERE students.student_id = grouplists.student_id AND
        grouplists.group_id = schedule.group_id AND
        schedule.course_id = courses.course_id;
```

7. По лектору всех студентов, у которых он хоть что-нибудь преподавал.
   Пусть X – идентификатор заданного лектора, тогда:
   select $S_{student\_name}$ *where* $\exists GL(\exists SCH(S_{student\_id} = GL_{student\_id} \wedge GL_{group\_id} = SCH_{group\_id} \wedge SCH_{lecturer\_id} = X))$

```
E7(student_name) :- S(student_id, student_name),
        GL(student_id, group_id), SCH(_, group_id, lecturer_id),
        lecturer_id = X
```

```
SELECT student_name
FROM students, grouplists, schedule
WHERE students.student_id = grouplists.student_id AND
        grouplists.group_id = schedule.group_id AND
        schedule.lecturer_id = X;
```

8. Пары студентов, такие, что все сданные первым студентом предметы сдал и второй студент.
   select S as S1, S as S2 where $\forall M$ *as* $M1(\exists M$ *as* $M2(S1_{student\_id} <> S2student\_id \wedge M1_{course\_id} = M2_{course\_id} \wedge S1_{student\_id} = M1_{student\_id} \wedge S2_{student\_id} = M2_{student\_id}))$

```
E8(student_id1, student_name1, student_id2, student_name2) :- S(student_id1, student
        M(student_id1, course_id1, _), M(student_id2, course_id2, _),
        student_id1 <> student_id2
```

```
SELECT * FROM students AS s1, students AS s2
WHERE s1.student_id <> s2.student_id AND
        NOT EXISTS
        SELECT * FROM marks AS m1
        WHERE s1.student_id = m1.student_id AND
                NOT EXISTS
                SELECT * FROM marks AS m2
                WHERE s2.student_id = m2.student_id AND
                        m1.course_id = m2.course_id;
```