Домашнее задание 5.

Составьте выражения реляционной алгебры и соответствующие SQL-запросы для базы данных «Деканат», позволяющие получать:

1 Информацию о студентах с заданной оценкой по предмету «Базы данных».

$\pi_{s.s\_id,\ s.s\_name,\ s.group\_id}$ (Students $\bowtie_{s.s\_id\ =\ m.s\_id}$ $\sigma_{mark\ =\ n}$(Marks) $\bowtie_{m.c\_id\ =\ c.c\_id}$ $\sigma_{c\_name\ =\ \text{‘Базы данных’}}$(Courses))

```
select (s.s_id, s.s_name, s.group_id)
from students as s
inner join marks as m
on s.s_id = m.s_id
inner join courses as c
on c.c_id = m.c_id
where c.c_name = 'Базы данных'
and m.mark = n;
```

n - заданная оценка.

2 Информацию о студентах не имеющих оценки по предмету «Базы данных»:

- среди всех студентов

$\pi_{s.s\_id,\ s.s\_name,\ s.group\_id}$ (Students - $\pi_{s.s\_id,\ s.s\_name,\ s.group\_id}$(Students $\bowtie_{s.s\_id\ =\ m.s\_id}$ $\sigma_{mark\ is\ null}$(Marks) $\bowtie_{m.c\_id\ =\ c.c\_id}$ $\sigma_{c\_name\ =\ \text{‘Базы данных’}}$(Courses)))

```
select (s_id, s_name, group_id) from students except all
(select (s.s_id, s.s_name, s.group_id)
from students as s
inner join marks as m
on s.s_id = m.s_id
```

```
inner join courses as c
on c.c_id = m.c_id
where c.c_name = 'Базы данных' and m.mark is null);
```

- среди студентов, у которых есть этот предмет

$\pi_{s.s\_id,\ s.s\_name,\ s.group\_id}(\text{Students} \bowtie_{s.s\_id = m.s\_id} \sigma_{mark\ is\ null}(\text{Marks}) \bowtie_{m.c\_id = c.c\_id} \sigma_{c\_name = \text{'Базы данных'}}(\text{Courses}))$

```
select (s.s_id, s.s_name, s.group_id)
from students as s
inner join marks as m
on s.s_id = m.s_id
inner join courses as c
on c.c_id = m.c_id
where c.c_name = 'Базы данных' and m.mark is null;
```

3 Информацию о студентах, имеющих хотя бы одну оценку у заданного лектора.

$\pi_{s.s\_id,\ s.s\_name,\ s.group\_id,\ l.l\_id,\ l.l\_name}(\text{Students} \bowtie_{s.group\_id = g.group\_id} \text{Groups} \bowtie_{g.group\_id = p.group\_id} \text{Plan} \bowtie_{p.l\_id = l.l\_id} \text{Lecturers} \bowtie_{p.c\_id = m.c\_id} \sigma_{mark\ is\ not\ null}(\text{Marks}))$

```
select distinct (s.s_id, s.s_name, s.group_id, l.l_id, l.l_name)
from students as s
inner join groups as g
on s.group_id = g.group_id
inner join plan as p
on g.group_id = p.group_id
inner join lecturers as l
on p.l_id = l.l_id
inner join marks as m
on p.c_id = m.c_id
where m.mark is not null;
```

4 Идентификаторы студентов, не имеющих ни одной оценки у заданного лектора.

$\pi_{s.s\_id}$ (Students) - $\pi_{s.s\_id}$(Students $\bowtie_{s.group\_id = g.group\_id}$ Groups $\bowtie_{g.group\_id = p.group\_id}$ Plan $\bowtie_{p.l\_id = l.l\_id}$ $\sigma_{l.l\_id = given\_id}$(Lecturers) $\bowtie_{p.c\_id = m.c\_id}$ $\sigma_{mark\ is\ not\ null}$(Marks))

```
select (s_id) from students except all
(select (s.s_id)
from students as s
inner join groups as g
on s.group_id = g.group_id
inner join plan as p
on g.group_id = p.group_id
inner join lecturers as l
on p.l_id = l.l_id
inner join marks as m
on p.c_id = m.c_id
where m.mark is not null
and l.l_id = given_id);
```

given_id - id лектора, для которого хотим узнать результат

5 Студентов, имеющих оценки по всем предметам заданного лектора.

$\pi_{s.s\_id,\ s.s\_name,\ s.group\_id}$ (Students - $\pi_{s.s\_id,\ s.s\_name,\ s.group\_id}$(Students $\bowtie_{s.group\_id = g.group\_id}$ Groups $\bowtie_{g.group\_id = p.group\_id}$ Plan $\bowtie_{p.l\_id = l.l\_id}$ $\sigma_{l.l\_name = given\_name}$(Lecturers) $\bowtie_{p.c\_id = m.c\_id}$ $\sigma_{mark\ is\ null}$(Marks)))

```
select (s_id, s_name, group_id) from students except all
(select (s.s_id, s.s_name, s.group_id)
from students as s
inner join groups as g
on s.group_id = g.group_id
```

```
inner join plan as p
on g.group_id = p.group_id
inner join lecturers as l
on p.l_id = l.l_id
inner join marks as m
on p.c_id = m.c_id
where m.mark is null
and l.l_name = given_name);
```

given_name - имя лектора, для которого хотим узнать результат

6 Для каждого студента имя и предметы, которые он должен посещать.

$\pi_{s.s\_name,\ c.c\_name}$ (Students $\bowtie_{s.group\_id\ =\ g.group\_id}$ Groups $\bowtie_{g.group\_id\ =\ p.group\_id}$ Plan $\bowtie_{p.c\_id\ =\ c.c\_id}$ Courses $\bowtie_{m.s\_id\ =\ s.s\_id\ and\ m.c\_id\ =\ c.c\_id}$ $\sigma_{mark\ is\ null}$ (Marks))

```
select (s.s_name, c.c_name)
from students as s
inner join groups as g
on s.group_id = g.group_id
inner join plan as p
on g.group_id = p.group_id
inner join courses as c
on p.c_id = c.c_id
inner join marks as m
on m.s_id = s.s_id and m.c_id = c.c_id
where m.mark is null;
```

7 По лектору всех студентов, у которых он хоть что-нибудь преподавал.

$\pi_{s.s\_id,\ s.s\_name,\ s.group\_id,\ l.l\_id,\ l.l\_name}$ (Students $\bowtie_{s.group\_id\ =\ g.group\_id}$ Groups $\bowtie_{g.group\_id\ =\ p.group\_id}$ Plan $\bowtie_{p.l\_id\ =\ l.l\_id}$ Lecturers)

```
select distinct (s.s_id, s.s_name, s.group_id, l.l_id, l.l_name)
from students as s
inner join groups as g
on s.group_id = g.group_id
inner join plan as p
on g.group_id = p.group_id
inner join lecturers as l
on p.l_id = l.l_id;
```

8 Пары студентов, такие, что все сданные первым студентом предметы сдал и второй студент.

9 Такие группы и предметы, что все студенты группы сдали предмет.

$$\pi_{g.group\_name,\ c.c\_name}(Groups \bowtie_{g.group\_id = p.group\_id} Plan \bowtie_{p.c\_id = c.c\_id} Courses) - \pi_{g.group\_name,\ c.c\_name}(Students \bowtie_{s.group\_id = g.group\_id} Groups \bowtie_{g.group\_id = p.group\_id} Plan \bowtie_{p.c\_id = c.c\_id} Courses \bowtie_{c.c\_id = m.c\_id \text{ and } s.s\_id = m.s\_id} \sigma_{mark \text{ is null or } mark <= 2}(Marks))$$

```
(select (g.group_name, c.c_name)
from groups as g
inner join plan as p
on g.group_id = p.group_id
inner join courses as c
on p.c_id = c.c_id) except all
(select (g.group_name, c.c_name)
from students as s
inner join groups as g
on s.group_id = g.group_id
inner join plan as p
on g.group_id = p.group_id
inner join courses as c
on p.c_id = c.c_id
inner join marks as m
on c.c_id = m.c_id and s.s_id = m.s_id
```

where m.mark is null or m.mark <= 2);

10 Средний балл студента.

- по идентификатору

$\text{avg}_{\text{m.mark}}(\sigma_{\text{s.s\_id = given\_id}}(\text{Students}) \bowtie_{\text{s.group\_id = g.group\_id}} \text{Groups} \bowtie_{\text{g.group\_id = p.group\_id}} \text{Plan} \bowtie_{\text{p.c\_id = c.c\_id}} \text{Courses} \bowtie_{\text{c.c\_id = m.c\_id and s.s\_id = m.s\_id}} \sigma_{\text{mark is not null}}(\text{Marks}))$

```
select avg(m.mark)
from students as s
inner join groups as g
on s.group_id = g.group_id
inner join plan as p
on g.group_id = p.group_id
inner join courses as c
on p.c_id = c.c_id
inner join marks as m
on c.c_id = m.c_id and s.s_id = m.s_id
where m.mark is not null and s.s_id = given_id;
```

given_id - id данного студента

- для каждого студента

$\text{avg}_{\text{m.mark, \{s.s\_name, s.s\_id\}}}(\text{Students} \bowtie_{\text{s.group\_id = g.group\_id}} \text{Groups} \bowtie_{\text{g.group\_id = p.group\_id}} \text{Plan} \bowtie_{\text{p.c\_id = c.c\_id}} \text{Courses} \bowtie_{\text{c.c\_id = m.c\_id and s.s\_id = m.s\_id}} \sigma_{\text{mark is not null}}(\text{Marks}))$

```
select (avg(m.mark), s.s_name, s.s_id)
from students as s
inner join groups as g
on s.group_id = g.group_id
inner join plan as p
on g.group_id = p.group_id
```

```
inner join courses as c
on p.c_id = c.c_id
inner join marks as m
on c.c_id = m.c_id and s.s_id = m.s_id
where m.mark is not null
group by s.s_id;
```

11 Средний балл средних баллов студентов каждой группы.

12 Для каждого студента число предметов, которые у него были, число сданных предметов и число не сданных предметов.

$$\varepsilon_{total = passed + not\_passed}(count_{not\_passed, \{s.s\_id, s.s\_name, s.group\_id\}}\ \varepsilon_{not\_passed = 1}((\pi_{s.s\_id, s.s\_name, s.group\_id}(Students \bowtie_{s.group\_id = g.group\_id} Groups \bowtie_{g.group\_id = p.group\_id} Plan \bowtie_{p.l\_id = l.l\_id} \bowtie_{p.c\_id = m.c\_id} \sigma_{mark <= 2}(Marks)))) \bowtie (count_{passed, \{s.s\_id, s.s\_name, s.group\_id\}}\ \varepsilon_{passed = 1}((\pi_{s.s\_id, s.s\_name, s.group\_id}(Students \bowtie_{s.group\_id = g.group\_id} Groups \bowtie_{g.group\_id = p.group\_id} Plan \bowtie_{p.l\_id = l.l\_id} \bowtie_{p.c\_id = m.c\_id} \sigma_{mark > 2}(Marks))))))$$