1.
a.

```
create table enrolled(
    snum int,
    cnum string,
    primary key(snum, cname)
    foreign key(snum) references student,
    foreign key(cname) references class));

create table class(
    cname string,
    meets_at time,
    room string,
    fid int,
    primary key(cname));
    foreign key(fid) references faculty));

create table faculty(
    fid int,
    fname string,
    dept string,
    primary key(fid));

create table student(
    snum int,
    sname string,
    major string,
    age int,
    gpa float,
    primary key(snum));
```

1.b.

In order:

Students

Faculty

Class

Enrolled

```
2. select sname
    from  student
    where major = 'cs'
          and sname like 'M%';

3. select s.sname
    from  student s
    where s.age > (select s2.age
                   from  student s2
                   where s2.sname='Guldu');

4. select s.sname
    from  student s
    where s.age < all (select min(s2.age)
                       from  student s2
                       where s2.sname like 'Z%');

5. select f.fname
    from  faculty f
    where not exists (select c.cname
                      from  class c
                      where c.fid = f.fid);
```

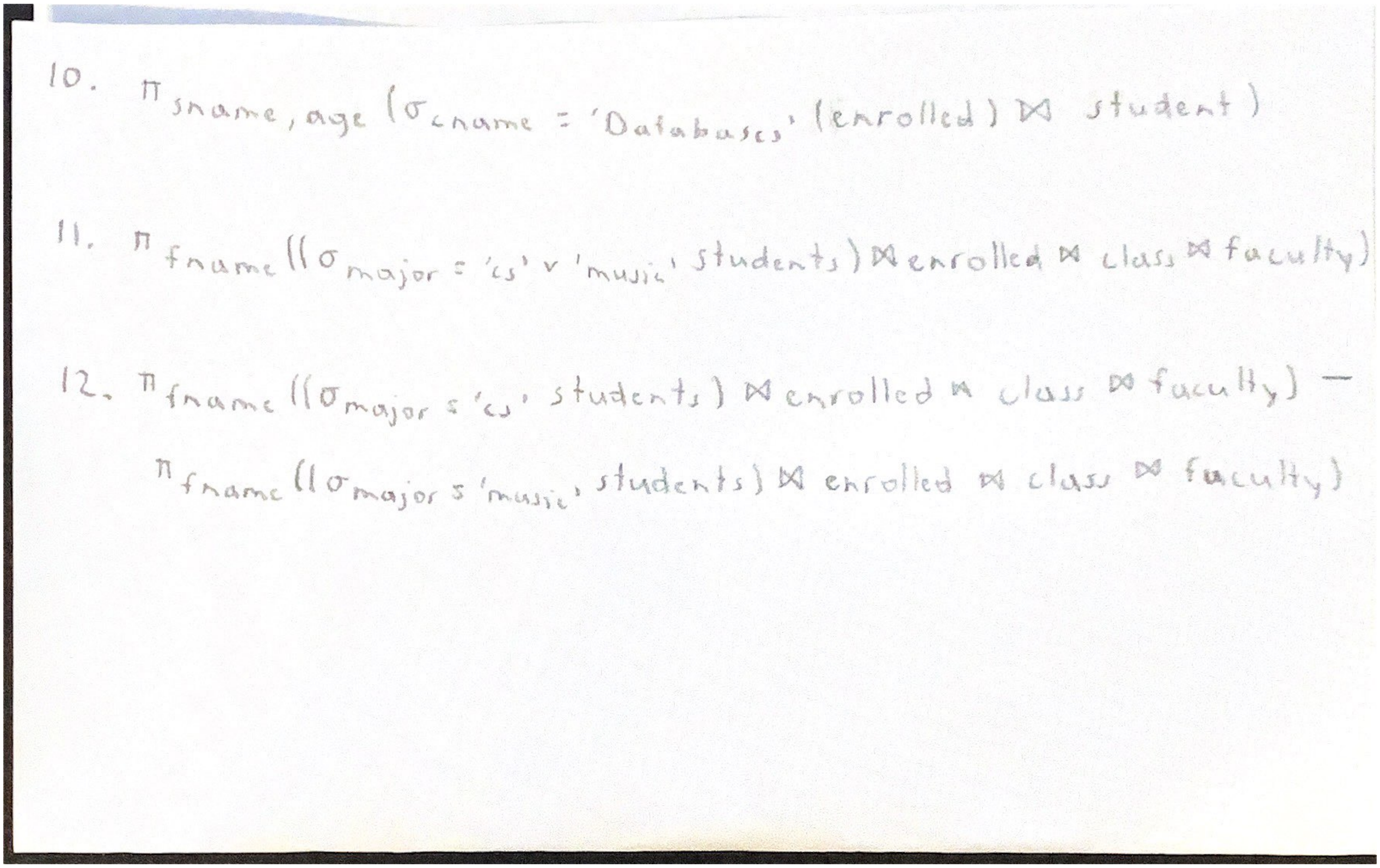
```
6. select f.fname
     from faculty f join class c on f.fid = c.fid,
                    join enrolled e on c.cname = e.cname,
                    join students s on e.snum = s.snum
      where s.major = 'music'
      intersect
      select f.fname
       from faculty f join class c on f.fid = c.fid,
                         join enrolled e on c.cname = e.cname,
                         join students s on e.snum = s.snum
        where s.major = 'cs';
```

7a. —

```
7.b. select s.sname
       from student s
       where s.age < all(select avg(s2.age)
                            from student s2);
```

```
8. select f.fname, s.sname, max(s.gpa)
    from faculty f, students s, enrolled e, class c
    where f.fid = c.cid
          and s.snum = e.snum
          and e.cname = c.cname;
```

```
9. select f.fname,
          count(c.cname) as 'Classes Taught
   from faculty f
   outer join class c on f.fid = c.fid
```



10. $\pi_{sname, age}(\sigma_{cname = 'Databases'}(enrolled) \bowtie student)$

11. $\pi_{fname}((\sigma_{major = 'cs' \vee 'music'} students) \bowtie enrolled \bowtie class \bowtie faculty)$

12. $\pi_{fname}((\sigma_{major = 'cs'} students) \bowtie enrolled \bowtie class \bowtie faculty) -$

$\pi_{fname}((\sigma_{major = 'music'} students) \bowtie enrolled \bowtie class \bowtie faculty)$