2024/09/17 – DBMS-I – Week 02

* Why password?

e.g.: admin → can access all db (root password)

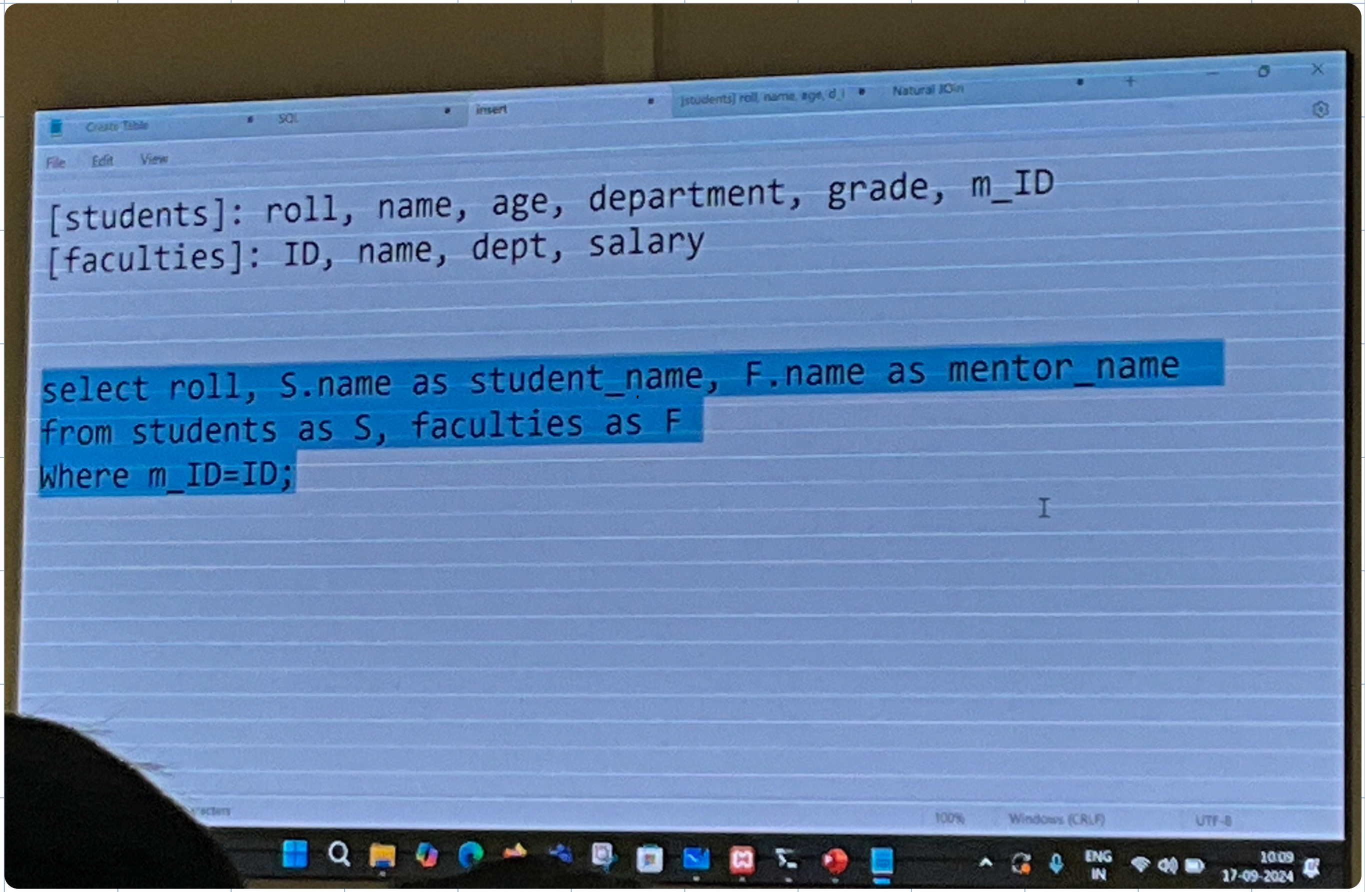
↓

worker → (other password)
users

only some tables

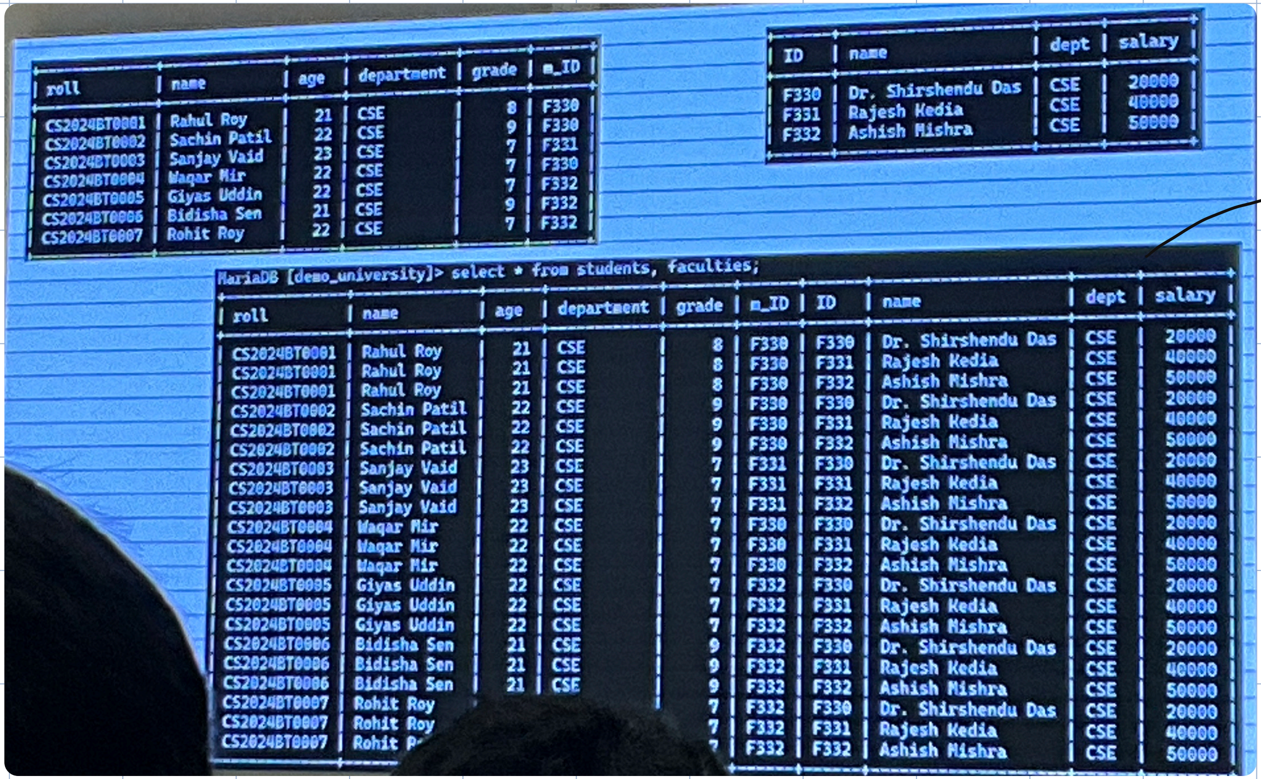
e.g.: intern from outside

keyword: grant access



```
[students]: roll, name, age, department, grade, m_ID
[faculties]: ID, name, dept, salary


select roll, S.name as student_name, F.name as mentor_name
from students as S, faculties as F
Where m_ID=ID;
```



```
+----------------+--------------+-----+------------+-------+------+
| roll           | name         | age | department | grade | m_ID |
+----------------+--------------+-----+------------+-------+------+
| CS2024BT0001   | Rahul Roy    |  21 | CSE        |     8 | F330 |
| CS2024BT0002   | Sachin Patil |  22 | CSE        |     9 | F330 |
| CS2024BT0003   | Sanjay Vaid  |  23 | CSE        |     7 | F331 |
| CS2024BT0004   | Waqar Mir    |  22 | CSE        |     7 | F330 |
| CS2024BT0005   | Giyas Uddin  |  22 | CSE        |     7 | F332 |
| CS2024BT0006   | Bidisha Sen  |  21 | CSE        |     9 | F332 |
| CS2024BT0007   | Rohit Roy    |  22 | CSE        |     7 | F332 |
+----------------+--------------+-----+------------+-------+------+
```

```
+------+----------------------+------+--------+
| ID   | name                 | dept | salary |
+------+----------------------+------+--------+
| F330 | Dr. Shirshendu Das   | CSE  |  20000 |
| F331 | Rajesh Kedia         | CSE  |  40000 |
| F332 | Ashish Mishra        | CSE  |  50000 |
+------+----------------------+------+--------+
```

```
MariaDB [demo_university]> select * from students, faculties;
+--------------+--------------+-----+------------+-------+------+------+--------------------+------+--------+
| roll         | name         | age | department | grade | m_ID | ID   | name               | dept | salary |
+--------------+--------------+-----+------------+-------+------+------+--------------------+------+--------+
| CS2024BT0001 | Rahul Roy    |  21 | CSE        |     8 | F330 | F330 | Dr. Shirshendu Das | CSE  |  20000 |
| CS2024BT0001 | Rahul Roy    |  21 | CSE        |     8 | F330 | F331 | Rajesh Kedia       | CSE  |  40000 |
| CS2024BT0001 | Rahul Roy    |  21 | CSE        |     8 | F330 | F332 | Ashish Mishra      | CSE  |  50000 |
| CS2024BT0002 | Sachin Patil |  22 | CSE        |     9 | F330 | F330 | Dr. Shirshendu Das | CSE  |  20000 |
| CS2024BT0002 | Sachin Patil |  22 | CSE        |     9 | F330 | F331 | Rajesh Kedia       | CSE  |  40000 |
| CS2024BT0002 | Sachin Patil |  22 | CSE        |     9 | F330 | F332 | Ashish Mishra      | CSE  |  50000 |
| CS2024BT0003 | Sanjay Vaid  |  23 | CSE        |     7 | F331 | F330 | Dr. Shirshendu Das | CSE  |  20000 |
| CS2024BT0003 | Sanjay Vaid  |  23 | CSE        |     7 | F331 | F331 | Rajesh Kedia       | CSE  |  40000 |
| CS2024BT0003 | Sanjay Vaid  |  23 | CSE        |     7 | F331 | F332 | Ashish Mishra      | CSE  |  50000 |
| CS2024BT0004 | Waqar Mir    |  22 | CSE        |     7 | F330 | F330 | Dr. Shirshendu Das | CSE  |  20000 |
| CS2024BT0004 | Waqar Mir    |  22 | CSE        |     7 | F330 | F331 | Rajesh Kedia       | CSE  |  40000 |
| CS2024BT0004 | Waqar Mir    |  22 | CSE        |     7 | F330 | F332 | Ashish Mishra      | CSE  |  50000 |
| CS2024BT0005 | Giyas Uddin  |  22 | CSE        |     7 | F332 | F330 | Dr. Shirshendu Das | CSE  |  20000 |
| CS2024BT0005 | Giyas Uddin  |  22 | CSE        |     7 | F332 | F331 | Rajesh Kedia       | CSE  |  40000 |
| CS2024BT0005 | Giyas Uddin  |  22 | CSE        |     7 | F332 | F332 | Ashish Mishra      | CSE  |  50000 |
| CS2024BT0006 | Bidisha Sen  |  21 | CSE        |     9 | F332 | F330 | Dr. Shirshendu Das | CSE  |  20000 |
| CS2024BT0006 | Bidisha Sen  |  21 | CSE        |     9 | F332 | F331 | Rajesh Kedia       | CSE  |  40000 |
| CS2024BT0006 | Bidisha Sen  |  21 | CSE        |     9 | F332 | F332 | Ashish Mishra      | CSE  |  50000 |
| CS2024BT0007 | Rohit Roy    |              |       7 | F332 | F330 | Dr. Shirshendu Das | CSE  |  20000 |
| CS2024BT0007 | Rohit Roy    |              |       7 | F332 | F331 | Rajesh Kedia       | CSE  |  40000 |
| CS2024BT0007 | Rohit R                     |       7 | F332 | F332 | Ashish Mishra      | CSE  |  50000 |
+--------------+--------------+-----+------------+-------+------+------+--------------------+------+--------+
```

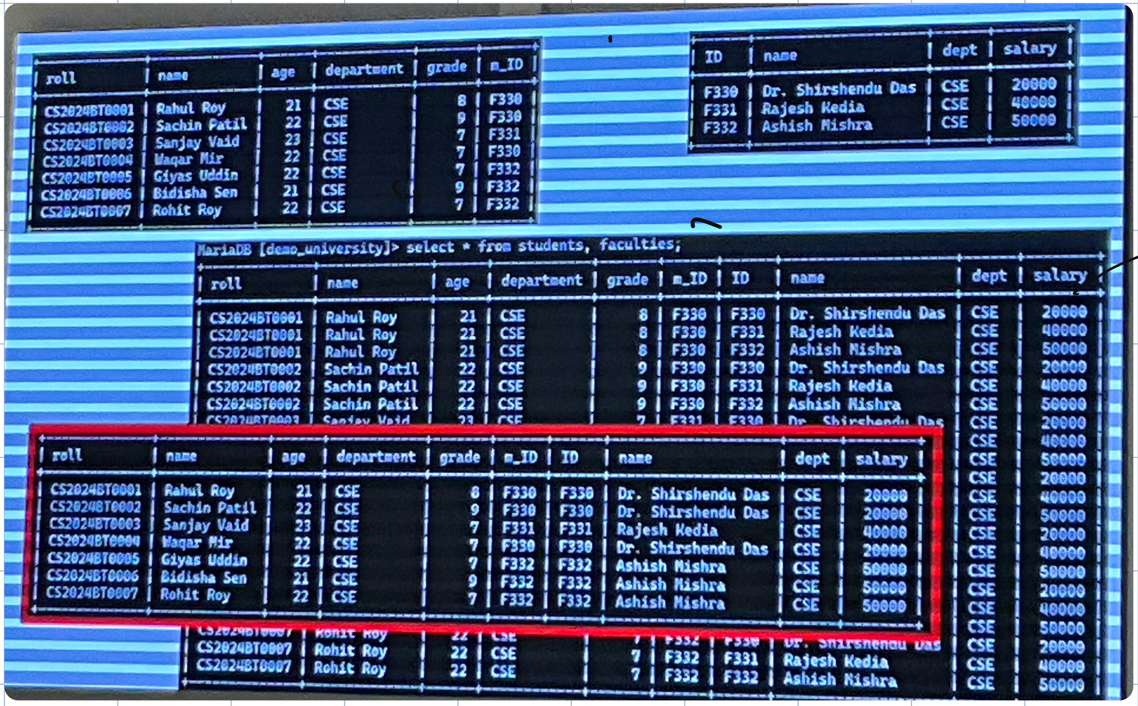
select * from
student , faculty

cartesian product
↓
redundant results

m_ID	ID

↓
solution

where m_ID = ID



```
+--------------+--------------+-----+------------+-------+------+
| roll         | name         | age | department | grade | m_ID |
+--------------+--------------+-----+------------+-------+------+
| CS2024BT0001 | Rahul Roy    |  21 | CSE        |     8 | F330 |
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| CS2024BT0007 | Rohit Roy    |  22 | CSE        |     7 | F332 |
+--------------+--------------+-----+------------+-------+------+
```

```
+------+---------------------+------+--------+
| ID   | name                | dept | salary |
+------+---------------------+------+--------+
| F330 | Dr. Shirshendu Das  | CSE  |  20000 |
| F331 | Rajesh Kedia        | CSE  |  40000 |
| F332 | Ashish Mishra       | CSE  |  50000 |
+------+---------------------+------+--------+
```

```
MariaDB [demo_university]> select * from students, faculties;
+--------------+--------------+-----+------------+-------+------+------+--------------------+------+--------+
| roll         | name         | age | department | grade | m_ID | ID   | name               | dept | salary |
+--------------+--------------+-----+------------+-------+------+------+--------------------+------+--------+
| CS2024BT0001 | Rahul Roy    |  21 | CSE        |     8 | F330 | F330 | Dr. Shirshendu Das | CSE  |  20000 |
| CS2024BT0001 | Rahul Roy    |  21 | CSE        |     8 | F330 | F331 | Rajesh Kedia       | CSE  |  40000 |
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| CS2024BT0002 | Sachin Patil |  22 | CSE        |     9 | F330 | F330 | Dr. Shirshendu Das | CSE  |  20000 |
| CS2024BT0002 | Sachin Patil |  22 | CSE        |     9 | F330 | F331 | Rajesh Kedia       | CSE  |  40000 |
| CS2024BT0002 | Sachin Patil |  22 | CSE        |     9 | F330 | F332 | Ashish Mishra      | CSE  |  50000 |
| CS2024BT0003 | Sanjay Vaid  |  23 | CSE        |     7 | F331 | F330 | Dr. Shirshendu Das | CSE  |  20000 |
| CS2024BT0007 | Rohit Roy    |  22 | CSE        |     7 | F332 | F330 | Dr. Shirshendu Das | CSE  |  20000 |
| CS2024BT0007 | Rohit Roy    |  22 | CSE        |     7 | F332 | F331 | Rajesh Kedia       | CSE  |  40000 |
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+--------------+--------------+-----+------------+-------+------+------+--------------------+------+--------+
```

```
+--------------+--------------+-----+------------+-------+------+------+--------------------+------+--------+
| roll         | name         | age | department | grade | m_ID | ID   | name               | dept | salary |
+--------------+--------------+-----+------------+-------+------+------+--------------------+------+--------+
| CS2024BT0001 | Rahul Roy    |  21 | CSE        |     8 | F330 | F330 | Dr. Shirshendu Das | CSE  |  20000 |
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| CS2024BT0007 | Rohit Roy    |  22 | CSE        |     7 | F332 | F332 | Ashish Mishra      | CSE  |  50000 |
+--------------+--------------+-----+------------+-------+------+------+--------------------+------+--------+
```

where m_ID = ID;

to do this in C program, you essentially move through cartesian product

MySQL may not filter the result in a similar manner

rename

```
select roll, name as student_name, name as mentor_name
from students, faculties
where m_ID = ID
```

```
select roll, name, name
from students, faculties
where m_ID = ID
```

→ error, conflicting names

roll → no need of students.roll

long table names

↓

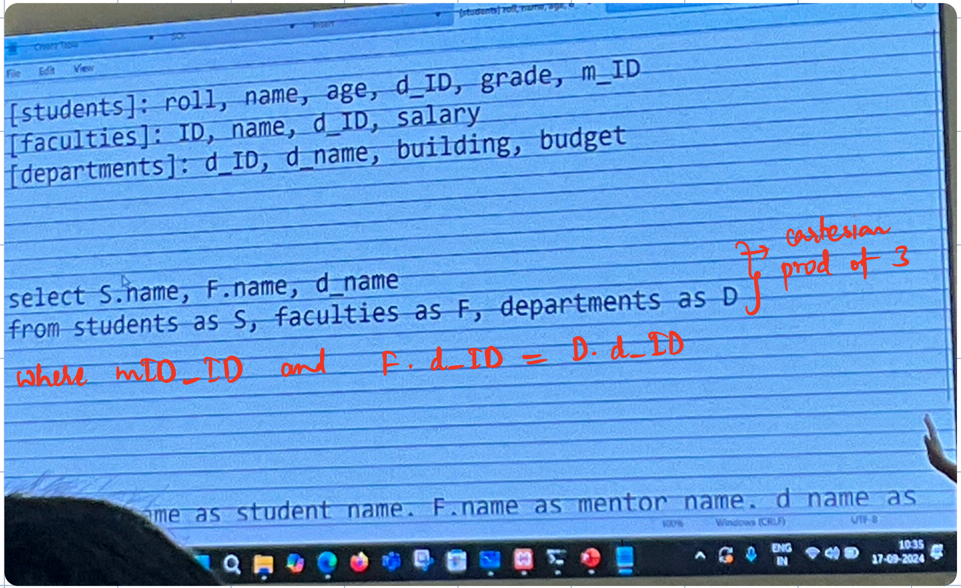
```
select roll, S.name as ohohohoho, F.name as ohohoho
from students as S, faculties as F
where m_ID = ID
```

department_name (column)

→ is an entity, will have a table

→ make d_ID and don't use dept_name directly.

→ combine 3 tables



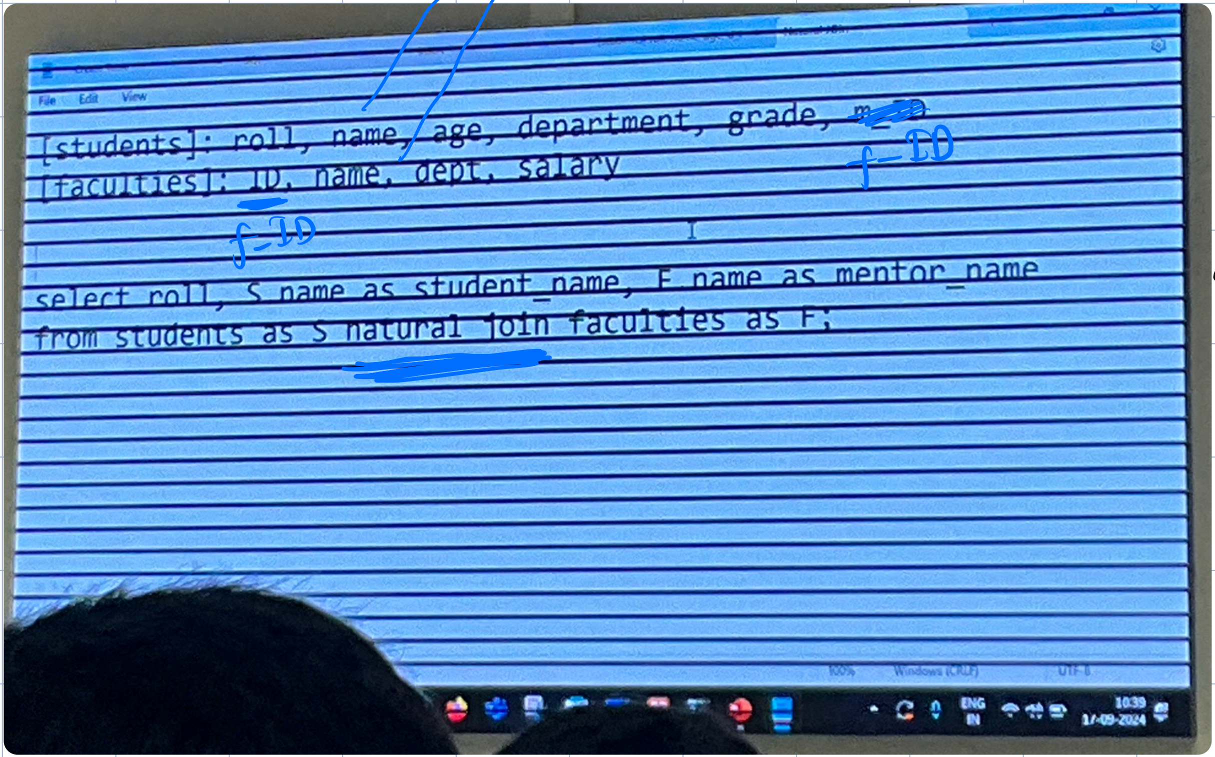
```
[students]: roll, name, age, d_ID, grade, m_ID
[faculties]: ID, name, d_ID, salary
[departments]: d_ID, d_name, building, budget


select S.name, F.name, d_name
from students as S, faculties as F, departments as D
```

} → cartesian prod of 3

where mID_ID and F. d_ID = D. d_ID

```
ame as student name. F.name as mentor name. d name as
```

should be different

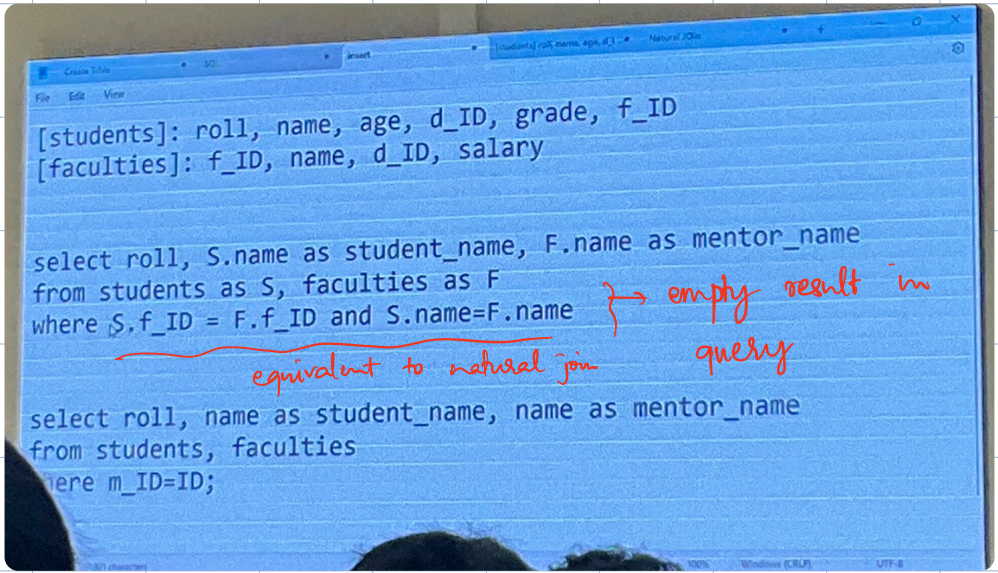


```
[students]: roll, name, age, department, grade, ~~m_ID~~ f_ID
[faculties]: ID, name, dept, salary
             f_ID

select roll, S.name as student_name, F.name as mentor_name
from students as S natural join faculties as F;
```

Join → one of the most common operations in SQL

← Natural Join

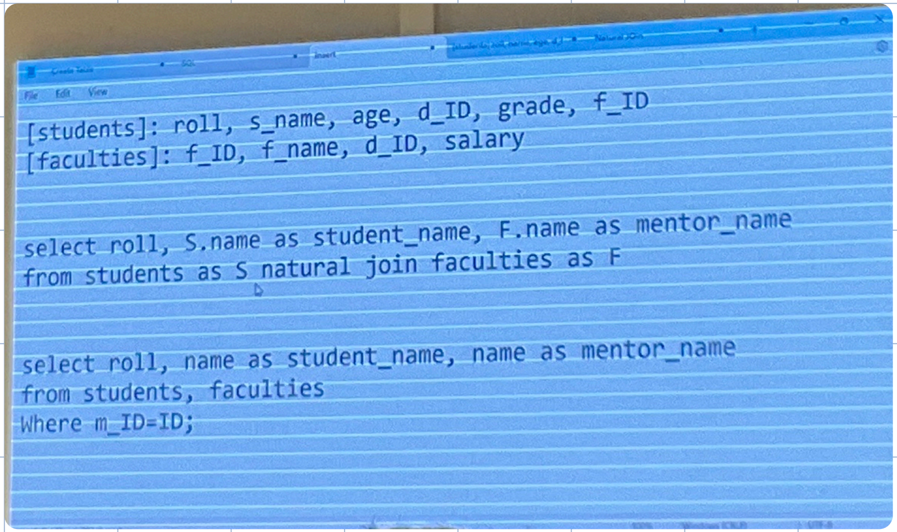
common attributes



```
[students]: roll, name, age, d_ID, grade, f_ID
[faculties]: f_ID, name, d_ID, salary


select roll, S.name as student_name, F.name as mentor_name
from students as S, faculties as F
where S.f_ID = F.f_ID and S.name=F.name

select roll, name as student_name, name as mentor_name
from students, faculties
here m_ID=ID;
```

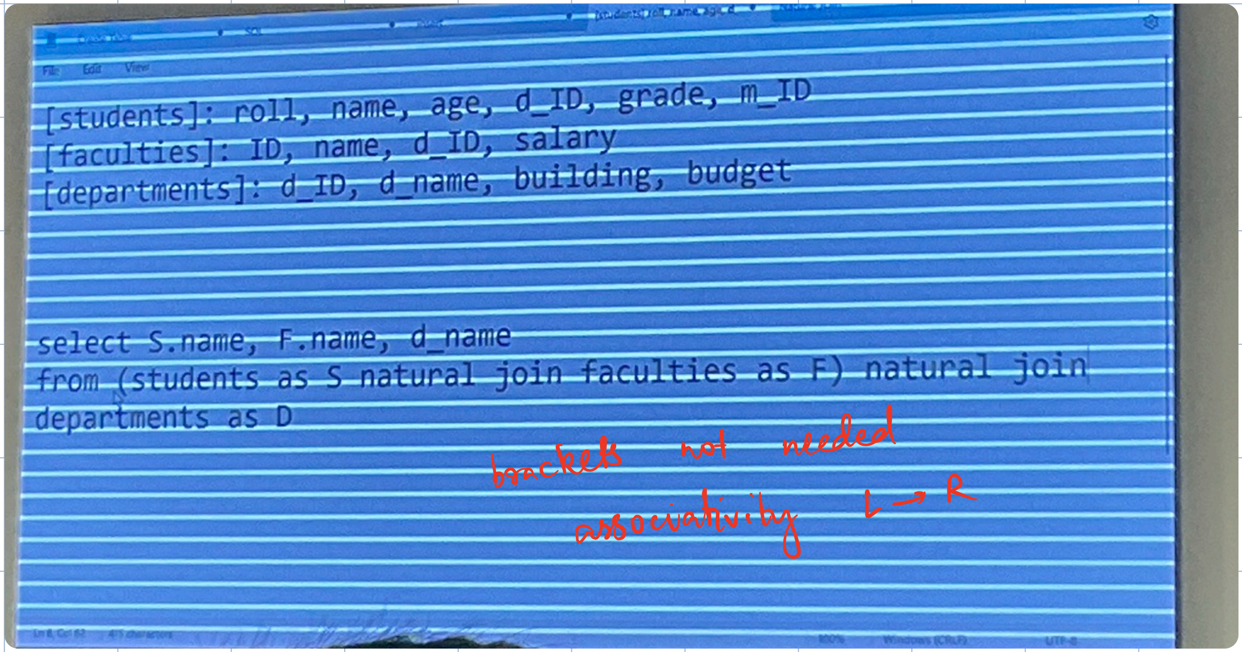
} → empty result in query

equivalent to natural join



```
[students]: roll, s_name, age, d_ID, grade, f_ID
[faculties]: f_ID, f_name, d_ID, salary


select roll, S.name as student_name, F.name as mentor_name
from students as S natural join faculties as F


select roll, name as student_name, name as mentor_name
from students, faculties
Where m_ID=ID;
```

Natural join of more than 1 tables:



```
[students]: roll, name, age, d_ID, grade, m_ID
[faculties]: ID, name, d_ID, salary
[departments]: d_ID, d_name, building, budget


select S.name, F.name, d_name
from (students as S natural join faculties as F) natural join
departments as D
```

brackets not needed

associativity L → R

Simple join

left outer join

right outer join

⋮

Figure ⟶ database design

3.2.3 Queries on multiple relations

3.3.3 Natural join

Strings

Intro % ⟶ string starts with "Intro"

% comp % ⟶ can start or end with anything, "comp" is present in it.

```
where   building like '% Watson %';
where   faculty.name  Like '% Das';
```

Read upto 3.4.5

2024/09/19

Union & intersect

→ Read book

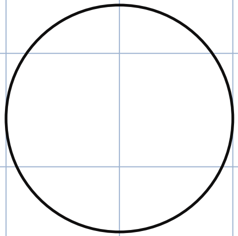
* except

```
(select ...

   ...
   ...)
except
(select
   ...
   ...)
```

* null → unknown

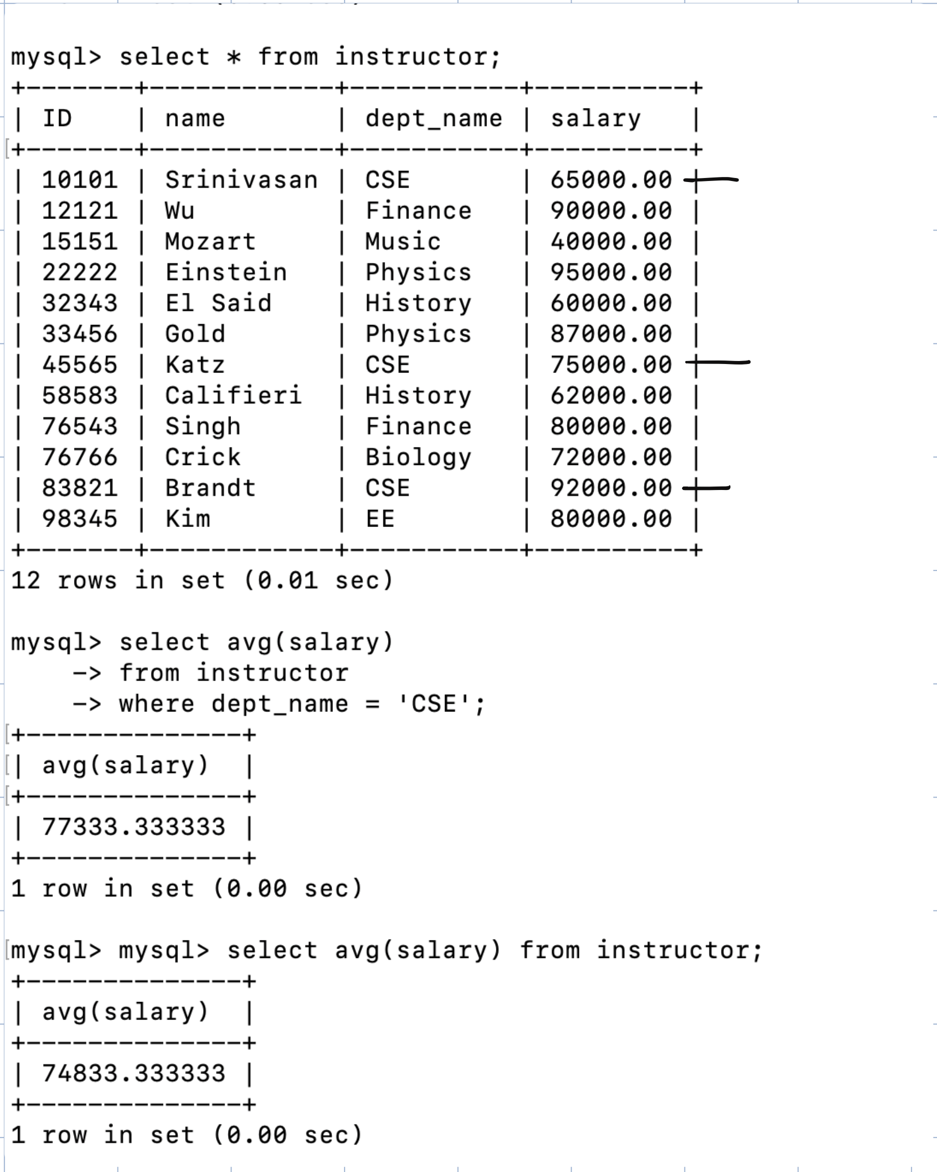
```
select name
from instructor
where salary is null        (is not null)
```

don't use = null



Aggregate functions

avg , min , max , sum , count



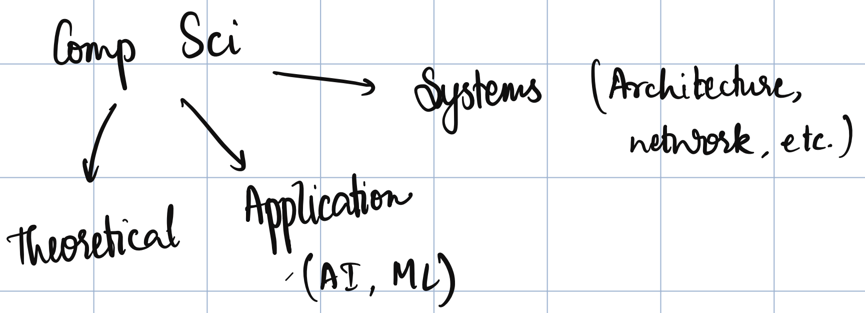
```
mysql> select * from instructor;
+-------+------------+------------+----------+
| ID    | name       | dept_name  | salary   |
+-------+------------+------------+----------+
| 10101 | Srinivasan | CSE        | 65000.00 |
| 12121 | Wu         | Finance    | 90000.00 |
| 15151 | Mozart     | Music      | 40000.00 |
| 22222 | Einstein   | Physics    | 95000.00 |
| 32343 | El Said    | History    | 60000.00 |
| 33456 | Gold       | Physics    | 87000.00 |
| 45565 | Katz       | CSE        | 75000.00 |
| 58583 | Califieri  | History    | 62000.00 |
| 76543 | Singh      | Finance    | 80000.00 |
| 76766 | Crick      | Biology    | 72000.00 |
| 83821 | Brandt     | CSE        | 92000.00 |
| 98345 | Kim        | EE         | 80000.00 |
+-------+------------+------------+----------+
12 rows in set (0.01 sec)

mysql> select avg(salary)
    -> from instructor
    -> where dept_name = 'CSE';
+--------------+
| avg(salary)  |
+--------------+
| 77333.333333 |
+--------------+
1 row in set (0.00 sec)

mysql> mysql> select avg(salary) from instructor;
+--------------+
| avg(salary)  |
+--------------+
| 74833.333333 |
+--------------+
1 row in set (0.00 sec)
```

* Show avg salary for each department?

```
select dept_name, avg(salary)
from instructor
group by dept_name ;
```

Suppose ID is not a primary key:

```
select count (distinct ID)
from teaches
where semester = 'Spring' and year = 2010;
```



Show avg salary by area

```
select avg (salary)
from instructor
where dept_name = 'CSE'
group by area;
```

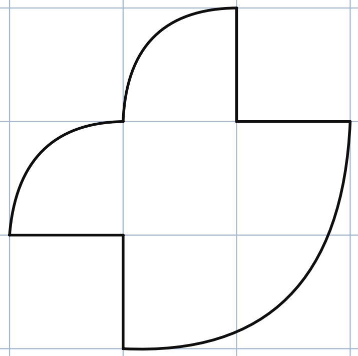
group after where

Having clause:

→ after group

- applied on each group and not each row.

```
select dept_name, avg(salary) as avg_salary
from instructor
group by dept_name
having avg(salary) > 40000;
```



Set membership

→ * nested queries

intersection

some

all

↳ < all , <= all, >= all , <> all

* Read upto 3.8.5

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join

```
select *
from student join takes
on student.id = takes.id
```

→ not much different from using where clause

```
select *
 from student join takes using (ID)
```

2024/09/26

Database design

→ meet the people, understand the requirements

→ conceptual design

→ ER diagram (entity relationship)

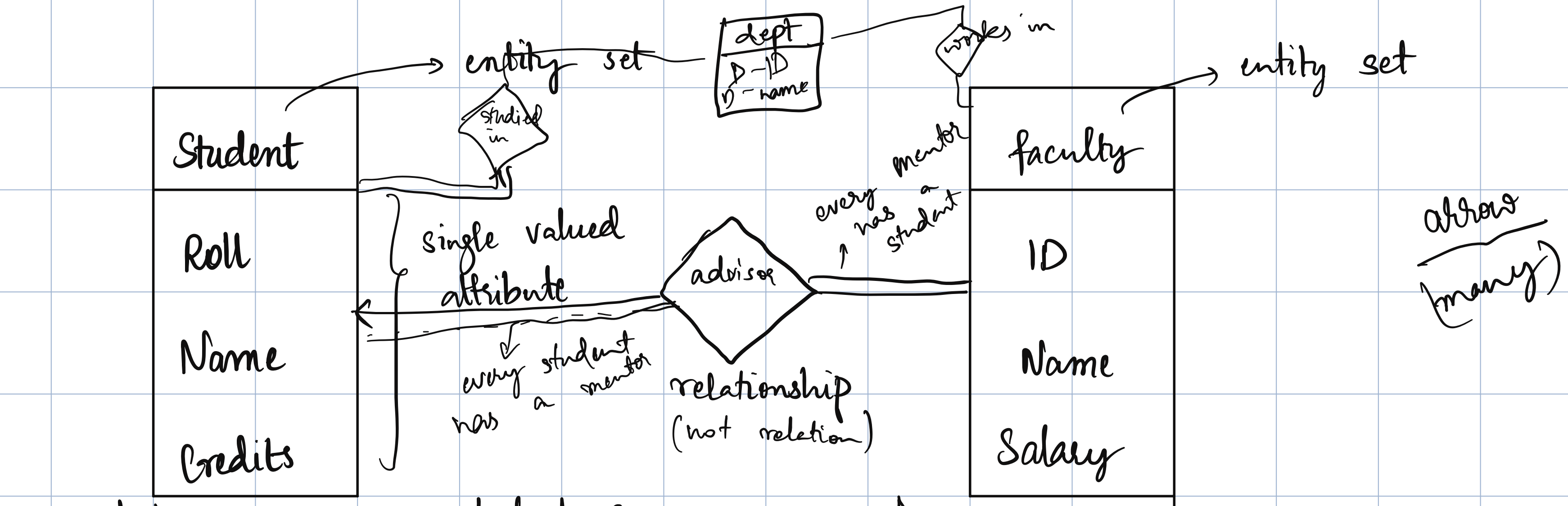
→ logical design

→ physical design

→ There is no unified rule

single

2 different ER diagrams may meet the requirement



Multivalued attribute { Phone } → student can have two phones

address } composite valued

↙ ↓ ↘

Street House Road

DOB → assume single valued

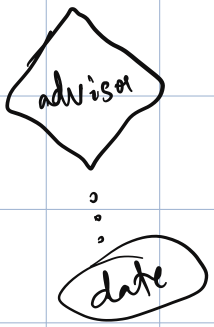
age( ) → derived attribute

both not needed

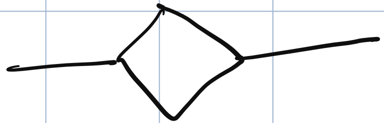
ER diagram

Relation can also have attributes

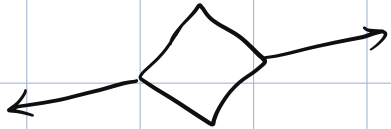
→ descriptive attributes

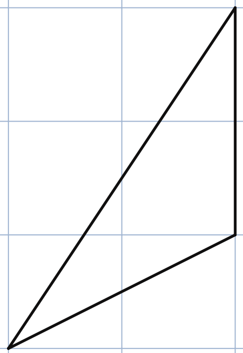


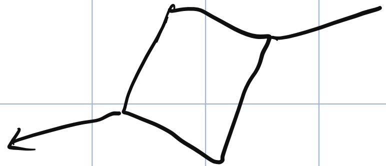
many to many

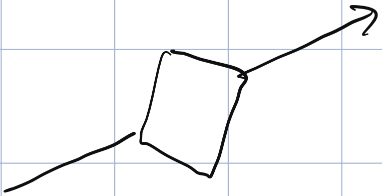


one to one









faculty → mandatory to mentor a student (full participation)

→ not mandatory to mentor a student

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