Project Report

Course Name: CSC3170-2022Fall
Team name: Database Messing System (DBMS)
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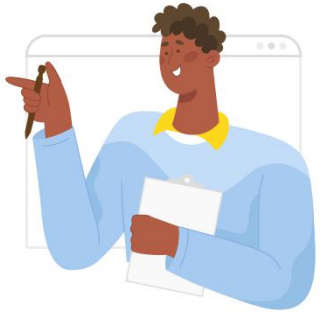
PART ONE

Structure

Project Structure
Database Structure



PART TWO

SQL Sentence

Basic sequence from UCB
Advance sequence

PART THREE

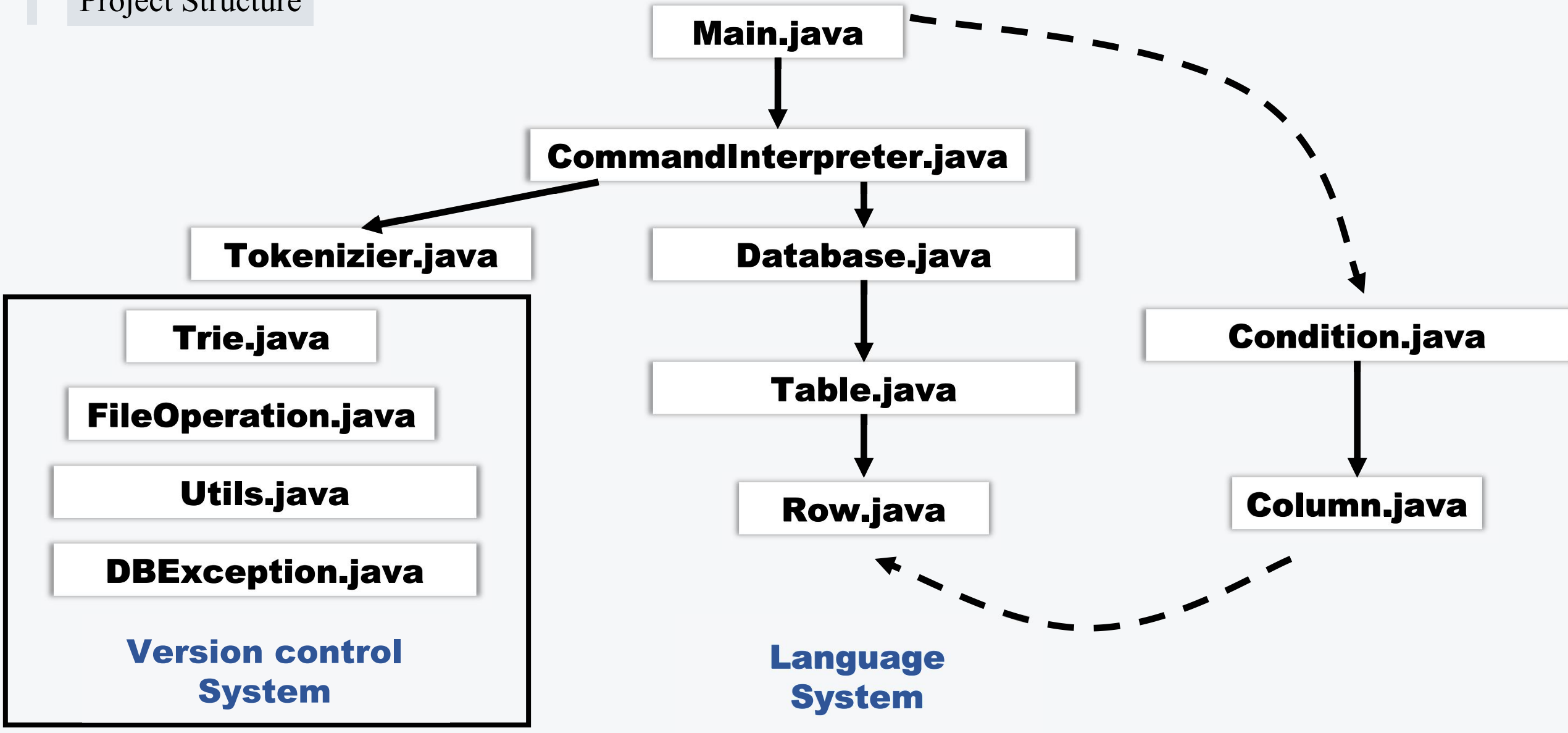
Version Control

PART FOUR

Application

Re-implement
Assignmnet 2

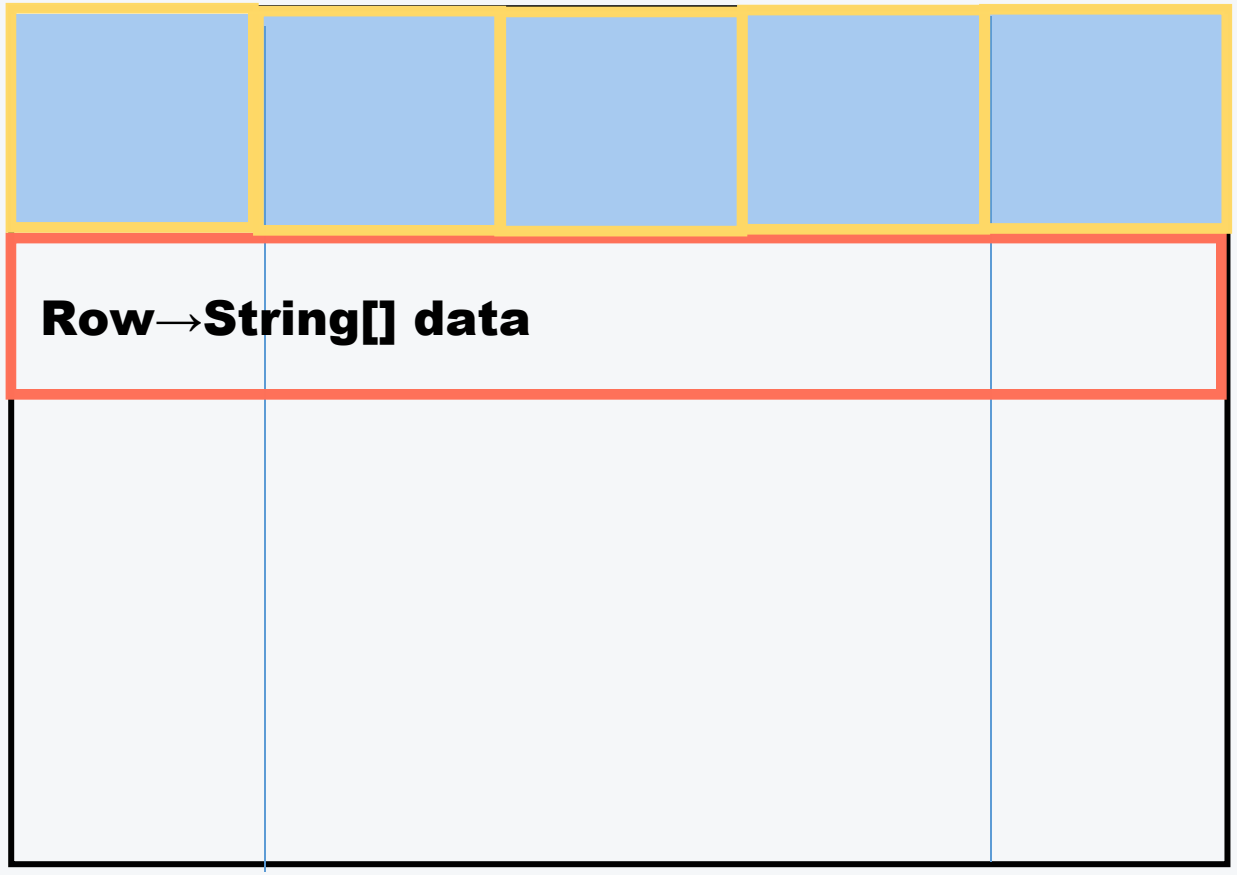
Project Structure



Database Structure

A table contains:
String[] _column_types;
String[] _column_titles;

Column Titles



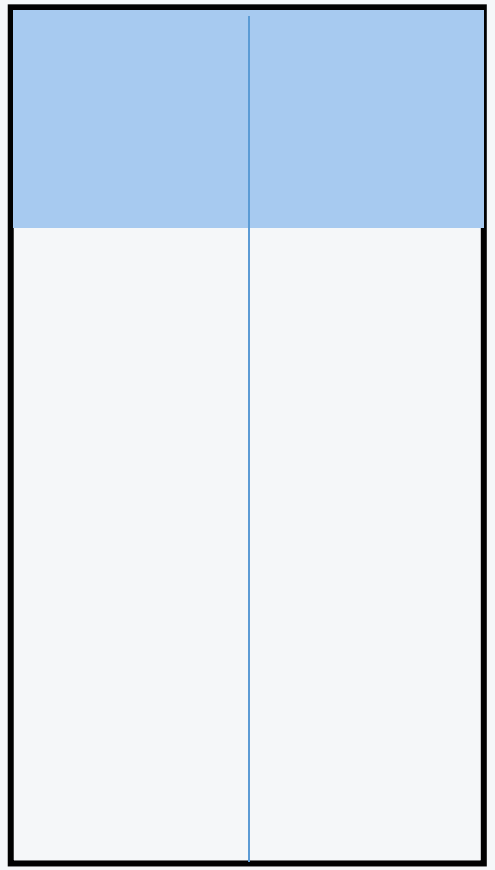


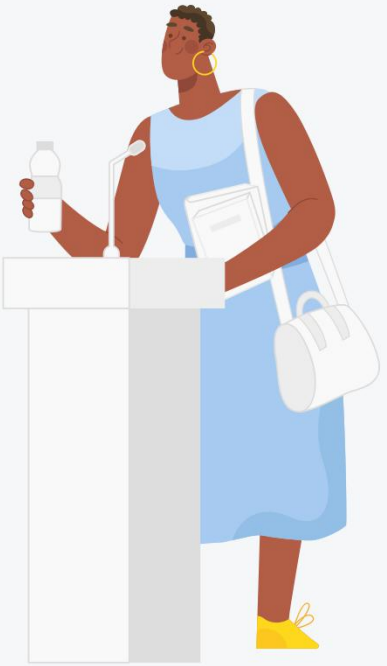
TABLE1→HashSet<Row>

TABLE2→HashSet<Row>

DATABASE→HashMap<string, table>

Basic grammar from UCB

- **<create statement>** ::= create table <name > <table definition > ;
- **<table definition>** ::= (<column name>$^{+}$,) | as <select clause>
- **<print statement>** ::= print <table name> ;
- **<insert statement>** ::= insert into <table name> values <literal>$^{+}$,;
- **<load statement>** ::= load <name> ;
- **<store statement>** ::= store <file name (no suffix)> <table name> ;
- **<exit statement>** ::= quit ; | exit ;
- **<select statement>** ::= <select clause>;
- **<select clause>** ::= select <column name>$^{+}$, from <tables> <condition clause>;
- **Operator in select clause**: =, <, <=, >, >=



Advanced grammar

About data type, we support:

3 data types: string, int and double

- Set data type for each column when creating table.
- Type validation when using functions.
  - Different data type supports different functions

About input, we support:

- Special symbol '*' representing all records.
- Rename the columns that are selected.

About output, we support:

- Organized output format of tables.
  - Format like MySQL.
- Clear exception message.

About integrity constraints, we support:

- Primary key.

```
> create table students(name string, stu_id int, score int);
> insert into students values('TYZ', '123456', '90');
> insert into students values('AZH', '234567', '91');
> insert into students values('HTC', '345678', '92');
```

```
> select * from students
...where score = '92';
Search results:
+----+------+-----+
|name|stu_id|score|
+----+------+-----+
| HTC|345678|   92|
+----+------+-----+
```

```
> select stu_id 'ID', score 'SCORE'
...from students where score = '92'
Search results:
+------+-----+
|    ID|SCORE|
+------+-----+
|345678|   92|
+------+-----+
```

```
> print students;
Table students:
+----+------+-----+
|name|stu_id|score|
+----+------+-----+
| HTC|345678|   92|
| AZH|234567|   91|
| XYY|123456|   91|
| ZYQ|123456|   89|
| TYZ|123456|   90|
+----+------+-----+
```

Advanced grammar

About functions, we support:

- **Aggregated functions:** avg, max, min, count, sum

  Syntax: select <function> <column name>+, from <table name>;

  Example:

```
> select avg score , max age, min age, count * from students, team;
Search results:
+-----------------+--------+--------+--------+
|       AVG(score)|MAX(age)|MIN(age)|COUNT(*)|
+-----------------+--------+--------+--------+
|62.333333333333336|    99.0|     3.0|       6|
+-----------------+--------+--------+--------+
```

- **Round function:**

  Syntax: select round <column name> <operator> <operand> reserve <number of bits reserved> from <table name>;

  Operator: plus, minus, times, divided_by

  Example:

```
> select round score times 3 reserve 3, stu_id from students;
Search results:
+-------------+----------+
|ROUND(score*3)|    stu_id|
+-------------+----------+
|          234|   XYYTXDY|
|          264| Aurora233|
|          174|  19260817|
|          180| TYZZZZZZZ|
|          255|1145141919|
|           15| 121090001|
+-------------+----------+
```

Advanced grammar

About Conditions, we support:

- in

  Syntax: select <column name>+, from <table name> where <column name> in <select clause>;

```
> select stu_id from students
...where stu_id in
...select * from students where gender = 'M';
Search results:
+----------+
|    stu_id|
+----------+
|   XYYTXDY|
|1145141919|
| 121090001|
+----------+
```

- order by

  Syntax: select <column name>+, from <table name> order by (asc/desc) <column name>+,;

```
> select * from students
...order by 'gender', 'score' desc;
Search results:
+----------+------+----+-----+
|    stu_id|gender|rank|score|
+----------+------+----+-----+
| Aurora233|     F|   A| 88.5|
| TYZZZZZZZ|     F|   A| 60.5|
|  19260817|     F|   A| 58.5|
|1145141919|     M|   A| 85.5|
|   XYYTXDY|     M|   A| 78.5|
| 121090001|     M|   A|  5.5|
+----------+------+----+-----+
```

Advanced grammar

About Conditions, we support:

- group by

  Syntax: select <column name>+, <function> <column name> from <table name>
  group by <column name>+,;

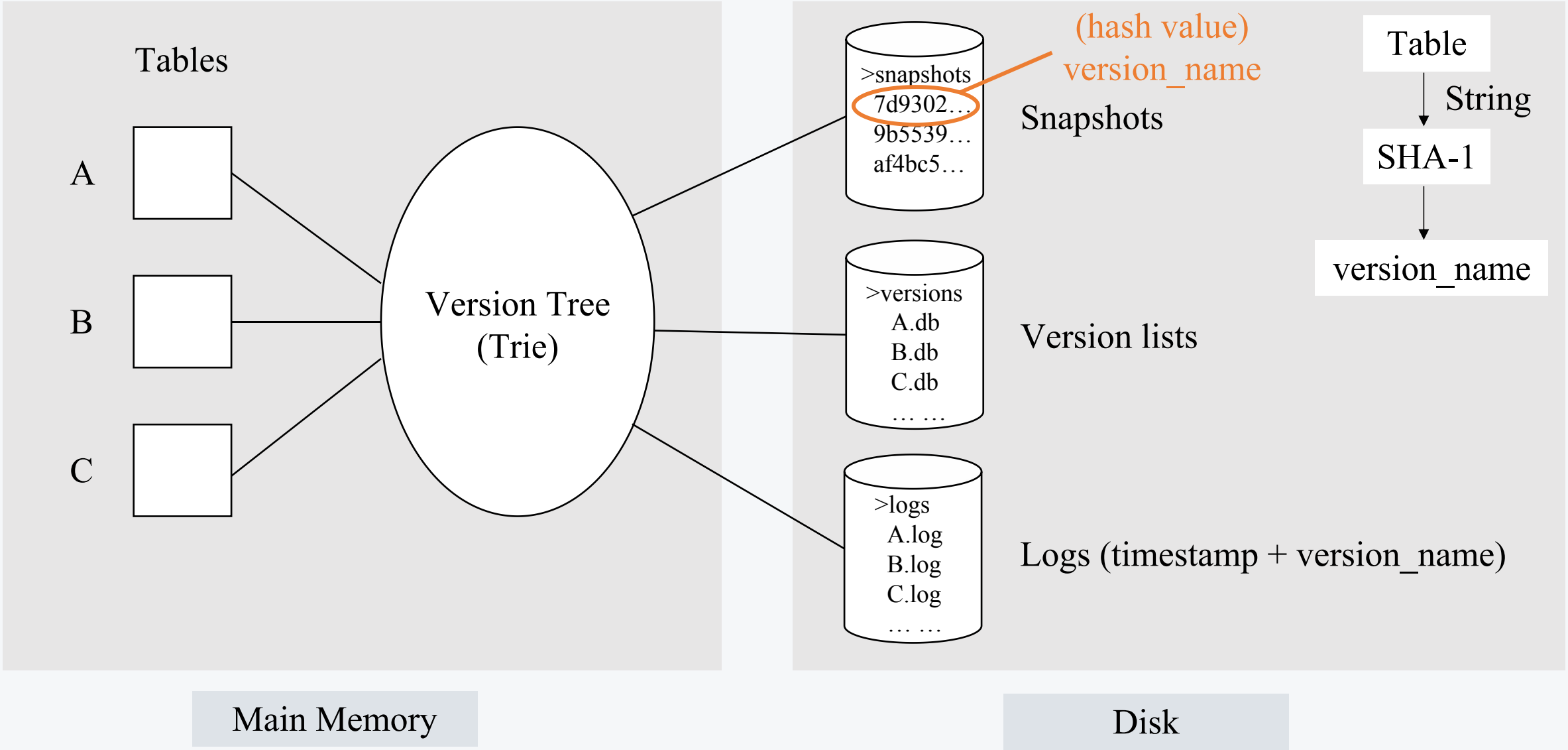
```
> select gender, count stu_id
...from students group by gender;
Search results:
+------+-------------+
|gender|COUNT(stu_id)|
+------+-------------+
|     M|            3|
|     F|            3|
+------+-------------+
```

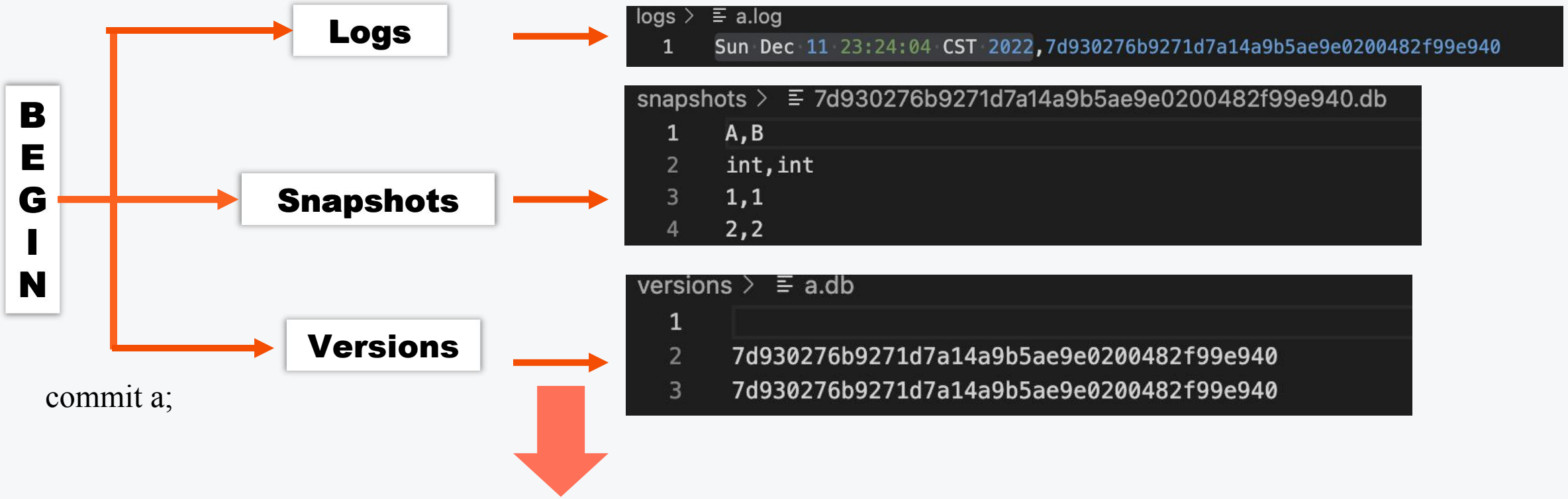
- between

  Syntax: select <column name>+, from <table name>
  where <column name> between <operand A> and <operand B>;

- like

  Syntax: select <column name>+, from <table name>
  where <column name> like <sample value>;
  supported operator: '_', '%'


Tables
A
B
C
Version Tree
(Trie)
>snapshots
7d9302…
9b5539…
af4bc5…
(hash value)
version_name
Snapshots
>versions
A.db
B.db
C.db
… …
Version lists
>logs
A.log
B.log
C.log
… …
Logs (timestamp + version_name)
Table
String
SHA-1
version_name
Main Memory
Disk



Syntax	Example: Table a (a.db)
<commit statement> ::= commit <table name>;	commit a;
<rollback to statement> ::= rollback <table name> to <literal>;	rollback a to '7d93';
<rollback at statement> ::= rollback <table name> at <literal>;	rollback a at 'Sun Dec 11 23:24:04 CST 2022';

```
================================
==   Start assignment2 test    ==
================================
Question 2:
  Passed.
============================
Question 3:
  Passed.
============================
Question 4:
  Passed.
============================
Question 5:
  Passed.
============================
Question 6:
  Passed.
============================
Question 7:
  Passed.
============================
Question 8:
  Passed.
============================
```

```
============================
Question 9:
  Passed.
============================
Question 10:
  Passed.
============================
Question 11:
  Passed.
============================
Question 12:
  Passed.
============================
Question 13:
  Passed.
============================
Question 14:
  Passed.
============================
Question 15:
  Passed.
============================
Question 16:
  Passed.
============================
```

Re-implement result

```
-- Create Table `regions` here

CREATE TABLE  regions(
    REGION_ID       INT(5),
    REGION_NAME     VARCHAR(25)     NOT NULL,
    PRIMARY KEY (REGION_ID)
);
```

```
> create table regions(
...region_id int, region_name string, primary key region_id);
> print regions;
Table regions:
+---------+-----------+
|region_id|region_name|
+---------+-----------+
+---------+-----------+
```

Question 1

```
SELECT FIRST_NAME AS "First Name", LAST_NAME AS "Last Name"
FROM employees
```

```
> select FIRST_NAME 'First Name', LAST_NAME 'Last Name'
...from employees;
Search results:
+----------+-----------+
|First Name|  Last Name|
+----------+-----------+
|   Randall|      Matos|
|      Jack| Livingston|
|    Diana|    Lorentz|
|.
 .
 .
+----------+--------+
```

Question 2

```
SELECT EMPLOYEE_ID, SALARY FROM employees ORDER BY SALARY
```

```
> select EMPLOYEE_ID, SALARY from employees
...order by 'SALARY';
Search results:
+-----------+--------+
|EMPLOYEE_ID|  SALARY|
+-----------+--------+
|        132| 2100.00|
|        136| 2200.00|
|        128| 2200.00|
|        127| 2400.00|
|        135| 2400.00|
 .
 .
 .
+-----------+--------+
```

Question 3

```
SELECT MAX(SALARY), MIN(SALARY) FROM employees
```

```
> select max SALARY, min SALARY from employee;
Search results:
+-----------+-----------+
|MAX(SALARY)|MIN(SALARY)|
+-----------+-----------+
|    24000.0|     2100.0|
+-----------+-----------+
```

Question 4

```
SELECT EMPLOYEE_ID, ROUND(SALARY/12, 2) FROM employees
```

```
> select round SALARY divided_by 12 reserve 2
...from employees;
Search results:
+-----------------+
|ROUND(SALARY/12~2)|
+-----------------+
|             2,000|
|           516.67|
|           291.67|
 .
 .
 .
+----------+-------+
```

Question 5

```
SELECT MANAGER_ID as 'EMPLOYEE_ID' FROM departments
WHERE MANAGER_ID NOT IN (SELECT employees.MANAGER_ID FROM employees);
```

```
> select MANAGER_ID 'EMPLOYEE ID' from departments
...where MANAGER_ID !='NULL'and MANAGER_ID not in
...select MANAGER_ID from employees;
Search results:
+-----------+
|EMPLOYEE ID|
+-----------+
|        200|
|        203|
|        204|
+-----------+
```

Question 6

```
SELECT EMPLOYEE_ID, PHONE_NUMBER FROM employees
WHERE DEPARTMENT_ID = 20 OR DEPARTMENT_ID = 100
```

```
> select EMPLOYEE_ID, PHONE_NUMBER from employees
...where DEPARTMENT_ID not in
...select DEPARTMENT_ID from employees
...where DEPARTMENT_ID!='20' and DEPARTMENT_ID !='100';
Search results:
+----------+------------+
|EMPLOYEE_ID|PHONE_NUMBER|
+----------+------------+
|        110|515.124.4269|
|        112|515.124.4469|
|        111|515.124.4369|
|        201|515.123.5555|
|        113|515.124.4567|
|        109|515.124.4169|
|        202|603.123.6666|
|        108|515.124.4569|
+----------+------------+
```

Question 7

```
SELECT FIRST_NAME FROM employees
WHERE FIRST_NAME LIKE '_a%'
```

```
> select FIRST_NAME from employee where FIRST_NAME like '_a%';
Search results:
+----------+
|FIRST_NAME|
+----------+
|     James|
|     Payam|
|    Daniel|
 .
 .
 .
+----------+
```

Question 8

```
SELECT JOB_ID, COUNT(*) FROM employees GROUP BY JOB_ID
```

```
> select JOB_ID, count EMPLOYEE_ID from employees, jobs
...group by JOB_ID;
Search results:
+----------+------------------+
|    JOB_ID|COUNT(EMPLOYEE_ID)|
+----------+------------------+
|  PU_CLERK|                 5|
|    ST_MAN|                 5|
|   IT_PROG|                 5|
|    MK_MAN|                 1|
 .
 .
 .
+----------+--------+
```

Question 9

```
SELECT DEPARTMENT_ID, AVG(SALARY), COUNT(*) FROM employees
GROUP BY DEPARTMENT_ID
HAVING COUNT(*)>10
```

```
> create table tmp as select DEPARTMENT_ID, count EMPLOYEE_ID 'NUMBER'
...from employees group by DEPARTMENT_ID;
> select DEPARTMENT_ID, avg SALARY from employees, tmp
...where NUMBER > '10' group by DEPARTMENT_ID;
Search results:
+-------------+-----------------+
|DEPARTMENT_ID|      AVG(SALARY)|
+-------------+-----------------+
|           80|8969.565217391304|
|           50|           3988.0|
+-------------+-----------------+
```

Question 10

```
SELECT FIRST_NAME, LAST_NAME FROM employees
WHERE MANAGER_ID IN(
    SELECT EMPLOYEE_ID FROM employees
    WHERE DEPARTMENT_ID IN (
        SELECT DEPARTMENT_ID FROM departments
        WHERE LOCATION_ID IN (
            SELECT LOCATION_ID FROM locations
            WHERE COUNTRY_ID = 'US'
        )
    )
)
```

```
> select FIRST_NAME, LAST_NAME from employees
...where MANAGER_ID in
...select EMPLOYEE_ID 'MANAGER_ID' from employees
...where DEPARTMENT_ID in
...select DEPARTMENT_ID from departments
...where LOCATION_ID in
...select LOCATION_ID from locations
...where COUNTRY_ID in
...select COUNTRY_ID from countries
...where COUNTRY_NAME = '"United States of America"';
Search results:
+----------+----------+
|FIRST_NAME| LAST_NAME|
+----------+----------+
|    Matthew|     Weiss|
|    Timothy|     Gates|
|    Randall|     Matos|
 .
 .
+----------+--------+
```

Question 11

```
SELECT EMPLOYEE_ID, SALARY FROM employees
WHERE  SALARY > ALL(
    SELECT AVG(SALARY) FROM employees
    GROUP BY DEPARTMENT_ID
    )
```

```
> create table avgs as
...select DEPARTMENT_ID, avg SALARY 'avg' from employees
...group by DEPARTMENT_ID;
> create table maxavg as
...select max avg 'maxAvg' from avgs;
> select EMPLOYEE_ID, SALARY from employees, maxavg
...where SALARY > maxAvg;
Search results:
+-----------+--------+
|EMPLOYEE_ID|  SALARY|
+-----------+--------+
|        100|24000.00|
+-----------+--------+
```

Question 12

```
SELECT DISTINCT EMPLOYEE_ID, SALARY
FROM employees e1
WHERE 4 = (SELECT COUNT(DISTINCT SALARY)
FROM employees  e2
WHERE e2.SALARY <= e1.SALARY);
```

```
> create table min1st as
...select min SALARY 'min1st' from employees;
> create table min2nd as
...select min SALARY 'min2nd' from employees, min1st
...where SALARY > min1st;
> create table min3rd as
...select min SALARY 'min3rd' from employees, min2nd
...where SALARY > min2nd;
> create table min4th as
...select min SALARY 'min4th' from employees, min3rd
...where SALARY > min3rd;
> select EMPLOYEE_ID, SALARY from employees, min4th
...where SALARY = min4th;
Search results:
+-----------+-------+
|EMPLOYEE_ID| SALARY|
+-----------+-------+
|        144|2500.00|
|        140|2500.00|
|        131|2500.00|
|        191|2500.00|
|        119|2500.00|
|        182|2500.00|
+-----------+-------+
```

Question 13

```
SELECT employees.EMPLOYEE_ID, employees.JOB_ID,
    employees.DEPARTMENT_ID, departments.DEPARTMENT_NAME
FROM employees JOIN departments ON (departments.DEPARTMENT_ID =
    employees.DEPARTMENT_ID)
WHERE departments.LOCATION_ID IN (
    SELECT LOCATION_ID FROM locations
    WHERE CITY = 'Seattle'
)
```

```
> create table tep as
...select DEPARTMENT_ID, DEPARTMENT_NAME from departments
...where DEPARTMENT_ID in
...select DEPARTMENT_ID from departments
...where LOCATION_ID in
...select LOCATION_ID from locations
...where CITY ='Seattle';
> select EMPLOYEE_ID, JOB_ID, DEPARTMENT_ID, DEPARTMENT_NAME
...from employees, tep;
Search results:
+-----------+----------+-------------+---------------+
|EMPLOYEE_ID|    JOB_ID|DEPARTMENT_ID|DEPARTMENT_NAME|
+-----------+----------+-------------+---------------+
|        102|     AD_VP|           90|      Executive|
|        119|  PU_CLERK|           30|     Purchasing|
|        116|  PU_CLERK|           30|     Purchasing|
|        114|    PU_MAN|           30|     Purchasing|
|        117|  PU_CLERK|           30|     Purchasing|
  .
  .
  .
 +-----------+--------+-------------+---------------+
```

Question 14

```
SELECT d.department_id `Department Name`, COUNT(*) `Number of Employees`
FROM departments d INNER JOIN employees e
ON d.department_id = e.department_id GROUP BY d.department_id
```

```
> select DEPARTMENT_ID 'Department Name', count EMPLOYEE_ID 'Number of Employees'
...from employees group by DEPARTMENT_ID;
Search results:
+---------------+------------------+
|Department Name|Number of Employees|
+---------------+------------------+
|            100|                 6|
|              0|                 1|
|             10|                 1|
  .
  .
 +-----------+--------+
```

Question 15

```
SELECT departments.DEPARTMENT_ID, departments.DEPARTMENT_NAME, employees.FIRST_NAME
FROM (departments JOIN employees ON (departments.MANAGER_ID = employees.EMPLOYEE_ID ))
```

```
> create table tep1 as
...select DEPARTMENT_ID, DEPARTMENT_NAME, MANAGER_ID from departments;
> create table tep2 as
...select EMPLOYEE_ID,FIRST_NAME from employees;
> create table preout as
...select DEPARTMENT_ID, DEPARTMENT_NAME, MANAGER_ID, EMPLOYEE_ID,FIRST_NAME
...from tep1, tep2 where MANAGER_ID = EMPLOYEE_ID;
> select DEPARTMENT_ID, DEPARTMENT_NAME,FIRST_NAME from preout;
Search results:
+-------------+---------------+----------+
|DEPARTMENT_ID| DEPARTMENT_NAME|FIRST_NAME|
+-------------+---------------+----------+
|           90|      Executive|    Steven|
|           50|       Shipping|      Adam|
|           70|Public Relations|   Hermann|
  .
  .
 +-----------+--------+
```

Question 16

Thanks for your Attention!

Database Messing System (DBMS)
Dec 11th, 2022