Implementation of Database Management System

Option 3 UCB CS61B

Outline

1. Introduction
2. Functionalities of our project
3. Code review
4. Real-time execution (the world cup)
5. Utilization from lectures and promotion

Introduction

Introduction

Purpose:

To implement a relational database management system (DBMS) with tables and a query language to manage the relational database which can perform various operations on the data.

Functions (For detail, please go to section 2 “functionalities”):

- Required by CS61B (creation, insertion, selection, etc.)
- Additional works (group by, having, order by, etc.)
- Attractive appearance of tables

Reflection:

Our understanding on the low-level working mechanism of database management system improves.

Functionalities

The basic implementation about DBMS

Required by CS61B

- Implement the Row class.
- Implement the table class.
- Implement the Database class.
- Implement insert and create.
- Implement select.

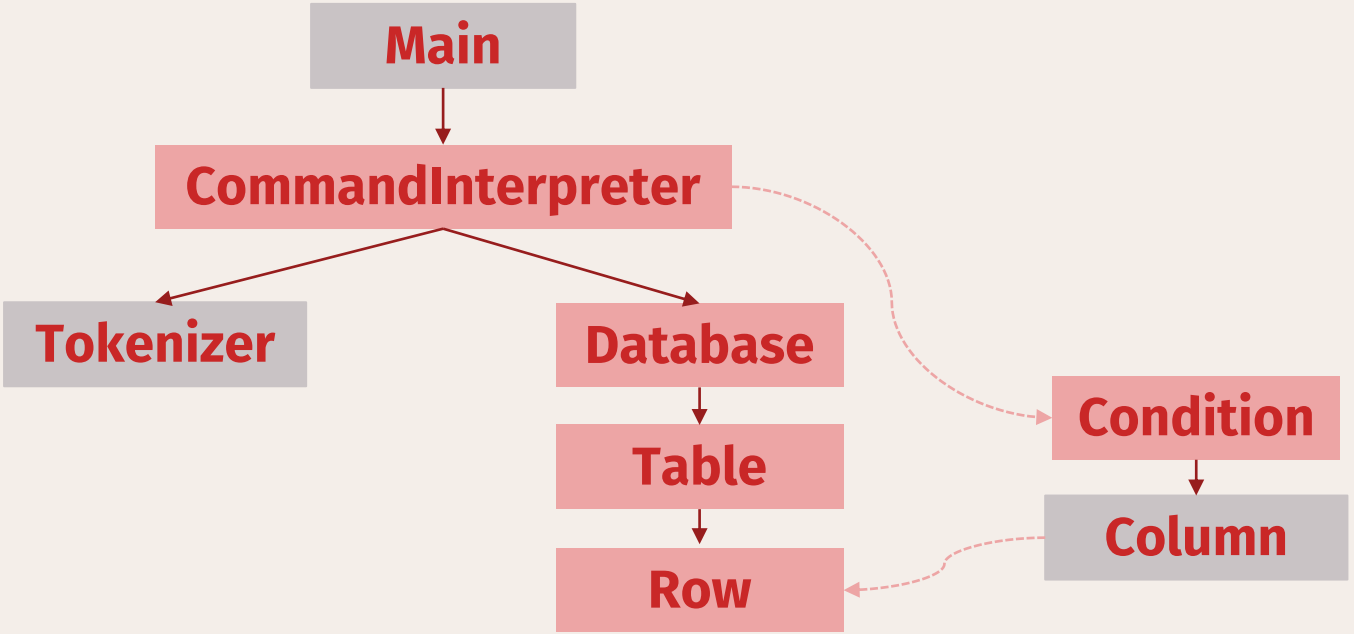
Additional works

Add new features to the program

- Implement DELETE table operation.
- Implement ORDER BY.
- Implement GROUP BY and HAVING.
- Implement aggregate function (SUM, AVG, MAX, MIN, COUNT).
- Implement remove rows.
- Implement column minus and column plus. (our new ideas that MySQL does not support!)
- Improve visualization design of the printed table. (our new ideas that MySQL does not support!)

Code review

Project skeleton adapt the original backbone



Algorithm

1. Read the input
2. Check which type the statement is, and do corresponding operation

   If the first string is “create” :

   if the next string is “as”, let the select result as table return

   else create an empty table with some columns

   else if the first string is “load”: read the corresponding file and insert the read result as a table into the database

   else if the first string is “exit” or “quit”, exit the program

   else if the first string is “insert”, insert one row into a table

   else if the first string is “delete”, delete one table from the database

   else if the first string is “print”, print the table contents (visualization)

   else if the first string is “select”:

   1. read the column names (including aggregate functions)
   2. read the table names (one or two) and deal with where condition if needed
   3. deal with group by if needed
   4. deal with aggregate functions if needed
   5. deal with having condition if needed
   6. deal with order by if needed
   7. print the result (visualization)

   else if the first string is “store”: store the contents of one table into one file

   else if the first string is “column_plus”: plus two column into a new column (one table, data type is number)

   else if the first string is “column_minus”: minus two column into a new column (one table, data type is number)

   else if the first string is “remove_row”: remove some rows that satisfies the condition from one table

   else return error message

3. Go to step 1

Real-time execution

Let’s use the data from the world cup to test out implementation!

Test load statement and print statement

```
load WorldCupGroups;
load Shooters;
print WorldCupGroups;
```

I want to know the countries that participate in the World Cup.

Test select statement with condition, group by, order by, aggregate functions

```
select Country, Continent from WorldCupGroups;
select Continent, max(Goals_For) , avg(Goals_For) from WorldCupGroups group by Continent;
```

I want to know the performance of different continents.

Test select statement with condition and order by

```
select Country, Continent, Wins, Goals_For, Goals_against from WorldCupGroups where Continent = 'Europe';
select Country, Continent, Goals_For from WorldCupGroups where Continent = 'Europe' order by Goals_For desc;
```

I want to know the performance of European countries

Test column_minus statement

column_minus WorldCupGroups: Goals_For and Goals_against to Goals_diff;

I find that the table does not contain goal difference, can we get it?

Test select statement from two tables

```
print Shooters;
select Country, Goals_For, Players, Player_Goals from WorldCupGroups, Shooters
where Country = Country;
```

I know the shooters' list. Can you combine the Top 10 players with their countries?

Test create statement and select statement

```
create table ManyGoalsTeams as select Country, Goals_For from WorldCupGroups where Goals_For >= '4';
select Country, Goals_For from ManyGoalsTeams;
```

I love goals.
Can you show me the countries that have over 4 goals?

Test insert statement and remove_row statement

```
insert into ManyGoalsTeams values 'China', '10';
select Country, Goals_For from ManyGoalsTeams;
remove_row from ManyGoalsTeams where Goals_For <= '9';
select Country, Goals_For from ManyGoalsTeams;
```

I love China!
Why no China??
(Imaginary Time)

Utilization and Promotion

Utilization from Lectures

- Data definition language (DDL): create
- Data query language (DQL): select -- where, group by, having, order by
- Data manipulation language (DML): insert, delete
- Aggregate functions: SUM, AVG, MAX, MIN, COUNT

Future Promotion

- Implement different data types for better performance of the DBMS
- Implement null value to differentiate null value and empty value
- Implement integrity constrains to make the database more accurate and reliable.

Thanks!

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