CSE 344 - System Programming

Final

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1 How did I solve this problem?

Server:

Firstly, i created a daemon process with fork().
In the daemon process, first, i check the errors. If the number of arguments is not equal to 9, i print an error and exit.
After that, i handle the command line arguments. First, i check whether it is incompatible or not every flag.

After that, i read the csv file and store its data in the Linked List. Its columns and rows are stored in separate linked lists. I implemented custom methods for optimization in linked list. In this way, the running time of the program is reduced.

After reading the csv file I open a socket to accept the data. The socket uses TCP(Transmission Control Protocol).

After opening the socket I create as many threads as the number of pool size in the command line.

The threads waits a connection and a query. After coming a query, firstly, the query is parsed. And if the query type is SELECT, server_reader() function is called. If the query type is UPDATE server_writer() function is called. There is a reader-writer paradigm in here.

I use condition variables and a mutex in order to solve reader-writer problem.

I keep time before server_reader() or server_writer() function and after server_reader()

or server_writer() function. In this way, i find the time between them. This gives the runtime of query.

If the query type is SELECT i create the message which is sent to client in a separate function. If the query type is UPDATE i create the message in server_writer() function.

After creating the message, the message is sent to relevant client. And the thread waits a new query after it sleep 0.5 seconds.

Client:

In the client, first, i check the errors in the same way. If the number of arguments is not equal to 9, i print an error and exit. After that i check the flags and its arguments.

After checking the errors and stored its arguments in a struct, i open a socket and i connect to a socket. And the query is sent to the socket.

The server gets the query and creates a message. The message is sent to the client. The client prints it to the console.

This is repeated until the queries are finished.

2 My Design Decisions

I create a 'ServerArguments' struct so that i store server's command line arguments.

I create a 'ClientArguments' struct so that i store clients' command line arguments.

I create a 'Query' struct so that i store the query's data.

I create a 'Message' struct so that server sends to client.

I create a 'QueryType' enum for 'Query' struct.

I use some global variables to solve some issues.

I use linked lists to store data in the csv file.
Why?
Because the data is appended to the linked list only constant(O(1)) time.

3 Requirements I achieved and which I have failed

I think I achieved almost all the requirements. However, I may not have been able to achieve some requirements.

4 My Files

serverMain.c ⇒ The Server Main C File
serverFunctions.c ⇒ The Server Functions
serverFunctions.h ⇒ The Server Functions' Headers
clientMain.c ⇒ The Client Main C File
clientFunctions.c ⇒ The Client Functions
clientFunctions.h ⇒ The Client Functions' Headers
linkedList.c ⇒ Linked List Functions
linkedList.h ⇒ Linked List Functions' Headers
helper.c ⇒ Helper Functions
helper.h ⇒ Helper Functions' Headers
171044014_report.pdf ⇒ The Report PDF
171044014_report.tex ⇒ The Report Latex file
Makefile ⇒ The Makefile

5 Some screenshots from the program

```
harunalbayrak@harunalbayrak:~/Desktop/system/final$ ./server -p 1236 -o path -l 2 -d files/annual*
harunalbayrak@harunalbayrak:~/Desktop/system/final$
```

Figure 1: The server

```
harunalbayrak@harunalbayrak:~/Desktop/system/final$ ./client -i 2 -a 127.0.0.1 -p 1236 -o files/queryFile
Client-2 connecting to 127.0.0.1:1236
Client-2 connected and sending query 'UPDATE TABLE SET year='2030', variable='Deneme' WHERE year='2011''
Server's response to Client-2 is 0 records, and arrived in 0.00 seconds.

year                            variable
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
2030                            Deneme
Updating is completed successfully.
Maximum Number of Columns Shown : 20

A total of 1 query were executed, client-2 is terminating.
```

Figure 2: Client 2

```
harunalbayrak@harunalbayrak:~/Desktop/system/final$ ./client -i 1 -a 127.0.0.1 -p 1236 -o files/queryFile
Client-1 connecting to 127.0.0.1:1236
Client-1 connected and sending query 'SELECT year, unit FROM TABLE;'
Server's response to Client-1 is 0 records, and arrived in 0.00 seconds.


year                            unit
2030                            COUNT
2030                            COUNT
2030                            DOLLARS(millions)
2030                            DOLLARS(millions)
2030                            DOLLARS(millions)
2030                            DOLLARS(millions)
2030                            DOLLARS(millions)
2030                            DOLLARS(millions)
2030                            DOLLARS(millions)
2030                            COUNT
2030                            COUNT
2030                            DOLLARS(millions)
2030                            DOLLARS(millions)
2030                            DOLLARS(millions)
2030                            DOLLARS(millions)
2030                            DOLLARS(millions)
2030                            DOLLARS(millions)
2030                            DOLLARS(millions)
2030                            COUNT
2030                            COUNT
Maximum Number of Columns Shown : 20

A total of 1 query were executed, client-1 is terminating.
```

Figure 3: Client 1

```
harunalbayrak@harunalbayrak:~/Desktop/system/final$ ./deneme.sh
Client-1 connecting to 127.0.0.1:1237
Client-1 connected and sending query 'SELECT DISTINCT year,rme_size_grp FROM TABLE;
'
Server's response to Client-1 is 0 records, and arrived in 0.00 seconds.


year                            rme_size_grp
2011                            a_0
2012                            b_1-5
2013                            c_6-9
2014                            d_10-19
2015                            e_20-49
2016                            f_50-99
2017                            g_100-199
2018                            h_200+
2019                            i_Industry_Total
                                j_Grand_Total
                                                        Maximum Number of Columns Shown : 20

A total of 1 query were executed, client-1 is terminating.
Client-2 connecting to 127.0.0.1:1237
Client-2 connected and sending query 'SELECT year, unit, columnName3 FROM TABLE;
'
Server's response to Client-2 is 0 records, and arrived in 0.00 seconds.


year                            unit
2011                            COUNT
2011                            COUNT
2011                            DOLLARS(millions)
2011                            DOLLARS(millions)
2011                            DOLLARS(millions)
2011                            DOLLARS(millions)
2011                            DOLLARS(millions)
2011                            DOLLARS(millions)
2011                            DOLLARS(millions)
2011                            COUNT
2011                            COUNT
2011                            DOLLARS(millions)
2011                            DOLLARS(millions)
2011                            DOLLARS(millions)
2011                            DOLLARS(millions)
2011                            DOLLARS(millions)
2011                            DOLLARS(millions)
2011                            DOLLARS(millions)
2011                            COUNT
2011                            COUNT
Maximum Number of Columns Shown : 20
```

Figure 4: Client 2

```
A total of 1 query were executed, client-2 is terminating.
Client-3 connecting to 127.0.0.1:1237
Client-3 connected and sending query 'UPDATE TABLE SET year=’2050’, industry_code_ANZSIC=’ASD’ WHERE year=’2011’'
Server's response to Client-3 is 0 records, and arrived in 0.00 seconds.

year                            industry_code_ANZSIC
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
2050                            ASD
Updating is completed successfully.
Maximum Number of Columns Shown : 20

A total of 1 query were executed, client-3 is terminating.
```

Figure 5: Client 1