Programming II (spring 2022)

Test 2, variant C

Task 1 (10p):

Write a function, that takes a name of a text file as one of the parameters, creates a dynamic structure in the memory, fills that structure with data from the file and finally returns the structure to main function. Data exchange between main function and this function must be done using function parameters, pointers and `return` values only. No global variables!
You can pick the parameters and return type as you see fit. Also describe the `struct` that fits this task the best.
The file has the following data: records consisting of an integer id and binary map geometry data stored as hex string owners and their vehicles. Each field is on separate line. The number of records is not known beforehand and must be determined based on the contents of the file. Map data can be extremely long, so the corresponding field must be dynamic.
For example, if the file has:

```
123
0101000000000000050B92341000000006B9D5841
125
0103000000100000066000000098A1FE394201D4136AB3E3F71D55841516B
9A3794201D4196B20CB170D5584145D8F03492201D416E34802370D5584166
8863DD8E201D41713D0A976FD55841857CD0338A201D417B832F0C6FD55841
DDB5843C84201D414A7B83836ED5584197FF90FE7C201D414C3789FD6DD558
41C05B20
```

then your data structure should have 2 records.

Task 2 (6p):

Write a function that frees all memory that has been allocated to a dynamic structure.
The structure consists of substructrures defined as follows:

```
typedef struct cell{
     int is_valid;
     char *value;
} cell_t;
typedef struct row{
     int col_count;
     cell_t *cells;
} row_t;
typedef struct table{
     int row_count;
     row_t *rows;
} table_t;
```

This is a table with dynamic number of rows and each row with a dynamic number of columns. If a cell is empty then `value` is NULL. The function is passed the `table_t` type element.

Task 3 (6p):

Let there be the following tables in the database:

observer	**object**	**observation**
id (PK)	id (PK)	id (PK)
name	name	observer_id (FK)
phone	description	object_id (FK)
email	location	obs_date
		grade

There is a list of protected natural objects and these objects are observed every once in a while to take stock of their condition. The condition is graded from 0 to 5.
Write a query that would list the number of observations and average grade per each observer during last 5 years.
Use interval operator: https://www.postgresql.org/docs/10/functions-datetime.html

Task 4 (3p):

We have the following block of code:

```
C[0] = 0;
for(i = 1; i < n; i++)
     C[i] = C[i] + A[i - 1] * B[i - 1]
```

Can this code be made to run in parallel? Explain why or why not. If it can be turned parallel, then what would be the maximum theoretical gain?

Task 5 (3p):

An optimal data structure is needed for speeding up search of products by id. Id is a product code in format xx-xxx-xxx, where x is a digit. There are approximately one thousand products. How would you solve this? Don't write any code, explain in a couple of sentences.