

Programming Design Homework Assignment S10-11

Due: 2022/5/21 23:00

⚠Notice:

1. Please follow the rules for homework assignments announced on the course website.
2. The standard template library and unrelated macros are not permitted in this assignment.

There are two questions in this assignment, question 1 is programming, and question 2 is short answer question.

PART I Programming (80% in total)

- Programming formats : (16%)
 1. The structure of your program (4%)
 2. Clear and readable code layout (4%)
 3. Clear comments for understanding your program (4%)
 4. The copyright and short description of each question (4%)
- Question 1: (64%)

For this assignment, we are going to rewrite question 1 in HWS8 with two self-defined structures. The first structure is MyMatrix which consist of a double pointer which point to a dynamic 2-dimensional array and the rows and columns of the matrix. The second structure is MyValue that record a value of element in the matrix. Also, record the position of the value and which matrix it belonging to.

```

struct MyMatrix
{
    float **Matrix;
    unsigned int rows;
    unsigned int columns;
};

struct MyValue
{
    float Data;
    MyMatrix* matrix;
    unsigned int row;
    unsigned int column;
};

```

Please create two matrices with `struct MyMatrix`. The First matrix A is an $m \times n$ matrix and the second matrix B is a $p \times q$ matrix. The value of m , n , p and q are integer between 2 to 6 by random function. Use dynamic memory allocation to generate the space to store elements. The elements in the two matrices are also generated by random function (between -11.8 and +5.1). Finish the function below.

1. Functions that generate the members of MyMatrix. Please overload this function.
 - I. The first one is a `void function` and has `one input parameter`. Call the random function to get the rows and columns, then create 2-dimensional array.

- II. The second function is also a `void function` and has `three input parameters`. The rows and columns are given in main function. Generate the 2-dimensional array in the function directly.
2. A template function that generate a number randomly. `Input upper and lower bond, and return a random number`. This function may use to get the floating and integer number randomly.
3. Fill in elements of a matrix. Student shall deign the input parameters.
4. Do the Kronecker product of two matrices ($A \otimes B$). This function can only have `three input parameters at most`. There is `no limitation for return argument`.
5. Find the minimum element and its subscript of a matrix. The result shall store in an object of `struct MyValue` and return back to main function. Student shall deign the input parameters.
6. Create the output function that print an object of `MyMatrix` orderly. This function is a `void function` and has `one input parameter`.
7. Create the output function that print the information of an object of `MyValue`. This function is a `void function` and has `one input parameter`.
8. Release a block of memory that you've allocated previously using the operator `new`. This function is a `void function` and has `one input parameter`.

In main function, you shall call the above function to calculate and output the following information on the console window.

1. The two original matrices.
2. The matrix after Kronecker product of two matrices ($A \otimes B$).
3. Output the minimum element and its subscript of the above three matrices.

The subscript is marked with 1. Ex: the minimum value is at the position of `[2][2]`, it should be showed as `(3,3)`.

DO NOT revise the parameters or return type of functions if it already specified. **DO NOT** create any other member in each structure. **DO NOT** create any other function in your program. Use "const" to protect reassignment of variables and parameters. Only the main function and function #6 and #7 can print the informations on the console window.

PART II Short answer question (20% in total)

For short answer question, please answer the question in your words as detailed as possible. Submit as text file named by the question number, such as "HWS10-11-Q2.txt".

● Question 2: (20%)

The short program is shown below. Please answer the following question.

1. There are two different way to include the header file, such as #1 and #2, what is different between them?
2. In HWS9-2, you declare the overloading functions "plus()". However, if you wrote #3 in the program, the function calling would become ambiguous. Why? And what is your solution?
3. In this program, #2 and #3 are necessary. Can you explain how are they working?

```
#include "stdafx.h"           // #1
#include <iostream>           // #2
using namespace std;        // #3

void main()
{
    cout << "Hello world!";
    return 0;
}
```