

CS213: Programming II

Assignment-1



Cairo University, Faculty of Computers
and Information

Deadline & Submission

1. Exactly one team member shall submit an archived/compressed group solution as zip file containing the source code only **“Don’t include exe(s) inside your submission”**.
submissions with exe(s) will cost your group **1 mark**.
2. Assignment must be done in **group of 2 from the same Lab**, be careful in selecting your partner, **you will have to submit all up-coming assignments together with the same group member**.
3. The deadline for submission on Acadox is **Thursday 15 March, 2018 at 10:00 PM**.

About This Assignment

1. All team members should understand all assignment problems.
2. All code must be standard ANSI C++.
3. Assume any missing details and search for information yourself.

Rules – Very Very Important

1. **Cheating will be punished by giving -2 * assignment mark.**
2. **Cheating is submitting code or report taken from any source that you did not fully write
yourself (from the net, from a book, from a colleague, etc.)**
3. **Giving your code to others is also considered cheating.**
4. **People are encouraged to help others fix their code but cannot give them their own code.**
5. **Do not say we solved it together and we understand it. You can write the algorithm on paper together but each group should implement it alone.**
6. **If you do not follow the delivery style (time and files names), your assignment will be rejected.**



CS213: Programming II

Assignment-1

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Based on Wikipedia definition, In mathematics a Matrix is a rectangular [2D] array of Numbers, Symbols, or Expressions arranged in rows and columns. For Example the dimension of the below matrix are 2 x 3 because there is 2 rows and 3 columns.

$$\begin{bmatrix} 1 & 9 & -13 \\ 20 & 5 & -6 \end{bmatrix}$$

Applications of matrices are found in most scientific fields. In every branch of physics, including classical mechanics, optics, electromagnetism, quantum mechanics, and quantum electrodynamics. In computer graphics, they are used in range of applications from Image processing to genetic analysis, In computer graphics.

it's required to design and implement a Numerical matrix class(s), that can hold numerical types.

The class should abstract matrix of any size and allocate the required memory as needed based on the encapsulated rows and columns.

It should have a destructor to free the used memory at the end of the lifetime of each object.

Matrix class specification/declaration should be defined in a separate header “.h” file.

Overload standard operators and I/O operators to enable Matrix class with addition, subtraction, and multiplication as well as suitable input and output capabilities “cin operator >> and cout operator”.

Your matrix class should implement a method to transpose matrix.

Your Matrix class shall support access to individual element through using [[]], I.e: Matrix m(5,5); // will create matrix with 5 x 5.



CS213: Programming II

Assignment-1

`m[0][1] = 0; // will set 0 inside element @ row-0 and column-1`

You should implement a main with suitable test cases to instantiate objects of your implemented Matrix class and test the whole supported methods and operators.

Extra Credit Bonus

In Image processing domain, Images could be represented as a matrix with rows equal to image height and columns equal to image width as well as matrix contents is pixel values.

Most of image enhancement filters are using what is called convolution Matrix, where convolution is the treatment of image matrix by another matrix which is called a “kernel” have a look on the following link from Gimp image processing tool for more information: <https://docs.gimp.org/en/plugin-convmatrix.html>

it's required to use your previously designed and implemented Matrix class to hold a gray scale “BMP” image loaded from a file and apply a Sharpen filter [kernel] as described in the above link to sharp the input image. You could use the following Library bitmap from GitHub to read and write bmp image from/to the disk: <https://github.com/ArashPartow/bitmap>