

CS111: Fundamentals of CS

Assignment 1 (4 marks + 1.5 bonus) – Version 1.0



Cairo University, Faculty of Computers
and Information

FACULTY OF COMPUTERS AND INFORMATION, CAIRO UNIVERSITY

CS213: Programming II Year 2018-2019 First Semester

Assignment 1 – Version 1.0

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Revision History

Version 1.0

By Dr Mohammed El-Ramly 10 August 2018 Main Doc

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Objectives

This assignment reviews CS112 (Programming I) concepts and skills.

Instructions

1. These instructions must be followed to get the full marks. يجب اتباع هذه التعليمات بكل دقة.
2. **Deadline is Monday 8th of October 2018 @ 11:59 pm.** Weight is 4 marks + 1.5 bonus marks.
3. Students will form teams of three students **from the same group** whose IDs **do not end with the same digit**. For example, 2017023, 20170433 and 20170124 cannot be in one team because two of them have IDs ending with 3. الفريق من ٣ طلاب لا ينتهي رقم بطاقة الكلية لهم بنفس الرقم.
4. Please submit **only work that you did yourself**. If you copy work from your friend or book or the net **you will fail the course**. تسليم حلول منقولة من أى مصدر يؤدي إلى الرسوب في هذا المقرر. لا تغش الحل أو تنقله من أى مصدر أو أسألني في أى شيء لا تفهمه لكن لا تنقل الحلول من النت أو من زملائك أو أى مكان

Task 0 (0 marks)

1. Review C++ syntax and refresh your C++ knowledge.
2. Review CS112 Programming I and its materials at <http://www.acadox.com/class/51096>
3. Read this quick tutorial <https://www.codesdope.com/cpp-introduction/>

Task 1 (2 marks)

Team members need to calculate the sum of their IDs % 3. Depending on the result, they will solve one of these problems. For example, if the team has student IDs 20170080, 20170082 and 20170089; then the sum of their IDs % 3 = 60510251 % 3 = 2. This group will solve problem 2.

Problem 0

Using structures, 2-D arrays, functions and overloading, the team will develop a set of functions for matrix manipulation. A matrix is represented by the following structure:

```
// A structure to store a matrix
struct matrix
{
    int** data;          // Pointer to 2D array
    int row, col;
};
```

A skeleton code to start the assignment is given in file **CS213-2018-A1-T1-P0.cpp**. It includes the matrix structure, a sample demo program and a function to create new matrices. Your group will implement the following functions. Each team member will do some of them according to his ID.

Student #1 with the smallest ID (e.g., 20170080)

```
// All these operations return a new matrix with the calculation result
matrix operator+ (matrix mat1, matrix mat2); // Add if same dimensions
matrix operator- (matrix mat1, matrix mat2); // Sub if same dimensions
matrix operator* (matrix mat1, matrix mat2); // Multi if col1 == row2
matrix operator+ (matrix mat1, int scalar); // Add a scalar
matrix operator- (matrix mat1, int scalar); // Subtract a scalar
matrix operator* (matrix mat1, int scalar); // Multiple by scalar
```

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Student #2 with the middle ID (e.g., 20170082)

```
// The last operator >> takes an istream and a matrix and return the
// the same istream so it is possible to cascade input like
// cin >> matrix1 >> matrix2 << endl;

matrix operator+= (matrix& mat1, matrix mat2); // mat1 changes & return
// new matrix with the sum
matrix operator-= (matrix& mat1, matrix mat2); // mat1 changes+ return new
// matrix with difference
matrix operator+= (matrix& mat, int scalar); // change mat & return new
matrix operator-= (matrix& mat, int scalar); // change mat & return new
void operator++ (matrix& mat); // Add 1 to each element ++mat
void operator-- (matrix& mat); // Sub 1 from each element --mat
istream& operator>> (istream& in, matrix& mat);
// Input matrix like this (dim 2 x 3) cin >> 2 3 4 6 8 9 12 123
// and return istream to allow cascading input
```

Student #3 with the biggest ID (e.g., 20170089)

```
// The first operator << takes an ostream and a matrix and return the
// the same ostream so it is possible to cascade output like
// cout << matrix1 << matrix2 << endl;

ostream& operator<< (ostream& out, matrix mat);
// Print matrix as follows (2 x 3)          4      6      8
// and return ostream to cascade printing    9      12     123
bool operator== (matrix mat1, matrix mat2); // True if identical
bool operator!= (matrix mat1, matrix mat2); // True if not same
bool isSquare (matrix mat); // True if square matrix
bool isSymetric (matrix mat); // True if square and symmetric
bool isIdentity (matrix mat); // True if square and identity
matrix transpose(matrix mat); // Return new matrix with the transpose
```

The team should integrate the different functions in one program and **write a demo program to demonstrate the use of these functions.**

Problem 1

Using structures, 1-D arrays, functions and overloading, the team will develop a set of functions for matrix manipulation. A matrix is represented by the following structure:

```
// A structure to store a matrix
struct matrix
{
    int* data; // Pointer to 1D array in to store the matrix
    int row, col;
};
```

Skeleton code to start the assignment is in file **CS213-2018-A1-T1-P1.cpp**. It includes the matrix structure, a demo and a function to create a matrix. **The rest of the problem is like problem 0.**

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Problem 2

Using structures, **valarrays**, functions and overloading, the team will develop a set of functions for matrix manipulation. A matrix is represented by the following structure:

```
// A structure to store a matrix
struct matrix
{
    valarray<int> data; // valarray<int> used stores matrix content
    int row, col;
};
```

Skeleton code to start the assignment is in file **CS213-2018-A1-T1-P2.cpp**. It includes the matrix structure, a demo and a function to create a matrix. **The rest of the problem is like problem 0.**

Task 2 (1 marks)

0. Team should help each other and support in each.
1. Team should integrate the work of Task 1 together and submit one working program.
2. Team should test the entire program and make sure that it works correctly in full.
3. All team members **must fully understand all parts of the program.**

Task 3 (1 marks)

1. Each team member will solve one of the following problems according to their ID.
2. Problems are taken from this book:
Problem Solving with C++, ninth edition.
3. Each student **must solve the correct problem** according to the following.



0. Problem 10 on page 373 (use baby names on file <https://github.com/YC1001/C-Plus-Plus-HW-2016/blob/master/babynames2012.txt>)
1. Problem 11 on page 374 (save your file a your_name.svg and open it in a browser)
2. Problem 14 on page 376. Use the words at this file
<https://raw.githubusercontent.com/dwyl/english-words/master/words.txt>
3. Problem 16 on page 448
4. Problem 12 on page 503
5. Problem 14 on page 504
6. Problem 15 on page 505
7. Problem 16 on page 505 (Exclude the last paragraph)
8. Problem 6 page 536
9. Problem 8 page 538

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Group Bonus 1: Task 4 (1 mark) – Starting a Business

Computer programming is an exciting job. But it is even more exciting to have your own software business. Instead of working for others, they work for you. To build a software business, you need a lot of skills beside programming skills. You need to know:

- 1- How to innovate and develop new ideas that are needed in the society.
- 2- How to develop a business plan to develop this idea into a product and sell it.
- 3- How to get money to support your project in the early stages before it makes profit.
- 4- How to manage the project and resources you have to implement and sell the product.
- 5- How to market the product to potential customers.

To develop your business skills, in this project you will invest a small amount of money in developing an idea of your choice and marketing it. You will set your sales target and work on selling your product to achieve this target.

Instructions

- 1- Each group who like to do this bonus, will visit the professor in his office and take an envelop with an amount of money between 20 and 100 L.E.
- 2- The team will think of an idea or a product to invest this money and increase it.
- 3- Team will set a financial target that could multiple times the given money.
- 4- Each team will make a plan to implement their idea or product and market it.
- 5- Each team will implement their plan and make profits or losses.
- 6- Each team will write a report about what they did, the positives, the negatives and obstacles.
- 7- Team will put the report and money in the envelop and **set a meeting time with the doctor.**

- ١- سيحصل الفريق المشارك في البونس على مظروف من الدكتور فيه مبلغ يتراوح بين ٢٠ إلى ١٠٠ جنيهًا.
- ٢- سيقوم الفريق بالتفكير في طريقة أو منتج لاستثمار هذا المبلغ و تنميته.
- ٣- سيضع الفريق مستهدفا ماليا لتحقيقه مثلا عدة أضعاف المبلغ المعطى.
- ٤- سيضع الفريق خطة عمل لتنفيذ الفكرة أو المنتج و الحصول عليه و من ثم تسويقه و بيعه.
- ٥- سينفذ الفريق الخطة و يحقق أرباحا أو خسائر.
- ٦- سيدرس الفريق تجربته و يكتب عنها تقريرا يشرح ماذا تم و النتيجة و السلبيات و الإيجابيات و العقبات و فرص التحسين.
- ٧- سيضع التقرير مع المبلغ في المظروف و يلتقى مع الدكتور لمناقشته.

Individual Bonus 2: Task 5 (0.5 mark) – Writing Good Quality Code

No program stays the same. It will need to change to fix bugs, add new features, etc. So, it is very important to write high quality readable code so that you or other developers are able to review and modify this code in the future.

In this task, you will:

- 1- Add a header to your program saying who the author is, the purpose of the program, etc.
- 2- Add a header for every function explaining what it does, what parameters it takes and what value it returns.
- 3- Write the code following C++ coding style. <http://geosoft.no/development/cppstyle.html>
- 4- Add comments to any part that is difficult to understand.

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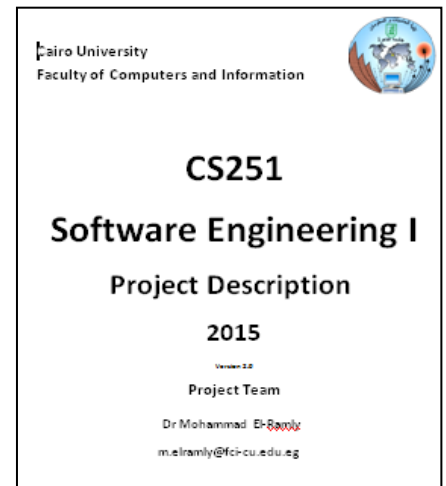
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Submission Instructions

1. **Team will submit into [acadox](#) the following:**
 - A zip file with a pdf document with their names and IDs.
 - The document should have a cover page like this.
 - The source code of each program in a separate folder.
 - A screen shot for every [GitHub](#) account.
2. Team will create a project in [GitHub](#) to upload code there.
3. Each team member will work individually on his part. **But the team must provide ONE integrated and working program.**
4. Team members are expected to help each other but not do work of others.
5. **All team members must understand the details** of all programs and be able to explain it or even modify it if needed.
6. Team members are responsible of testing all the programs and making sure they work.
7. TA can ask any team member about any of the programs developed and its code.
8. **Ask your TA** about the discussion time of your work.
9. **Bonus 1** will be submitted to professor and discussed with him,



Marking Criterion

1. 2.0 for developing your part in the group assignment correctly.
2. 1.0 for integrating the code and developing one working program.
3. 1.0 for developing a solution for the individual assignment.
4. -0.5 for not putting the code in a project in GitHub.
5. 1 **Group Bonus** for successfully starting your business.
6. 0.5 **Individual Bonus** for writing enough comments and following coding style.