



C++ Pool - d07

C++ templates

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Abstract: This document contains the subject for day 07 of 42's C++ pool.

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Chapter I

General rules

- Any function implemented in a header (except in the case of templates), and any unprotected header, means 0 to the exercise.
- Every output goes to the standard output, and will be ended by a newline, unless specified otherwise.
- The imposed filenames must be followed to the letter, as well as class names, function names and method names.
- Remember: You are coding in C++ now, not in C anymore. Therefore:
 - The following functions are FORBIDDEN, and their use will be punished by a -42, no questions asked: `*alloc`, `*printf` and `free`.
 - You are allowed to use basically everything in the standard library. HOWEVER, it would be smart to try and use the C++-ish versions of the functions you are used to in C, instead of just keeping to what you know, this is a new language after all. And NO, you are not allowed to use the STL until you actually are supposed to (that is, until d08). That means no vectors/lists/maps/etc... or anything that requires an include `<algorithm>` until then.
- Actually, the use of any explicitly forbidden function or mechanic will be punished by a -42, no questions asked.
- Also note that unless otherwise stated, the C++ keywords `"using namespace"` and `"friend"` are forbidden. Their use will be punished by a -42, no questions asked.
- Files associated with a class will always be `ClassName.hpp` and `ClassName.cpp`, unless specified otherwise.
- Turn-in directories are `ex00/`, `ex01/`, ..., `exn/`.
- You must read the examples thoroughly. They can contain requirements that are not obvious in the exercise's description. If something seems ambiguous, you don't understand C++ enough.

- Since you are allowed to use the C++ tools you learned about since the beginning of the pool, you are not allowed to use any external library. And before you ask, that also means no C++11 and derivatives, nor Boost or anything your awesomely skilled friend told you C++ can't exist without.
- You may be required to turn in an important number of classes. This can seem tedious, unless you're able to script your favorite text editor.
- Read each exercise FULLY before starting it ! Really, do it.
- The compiler to use is `clang++`.
- Your code has to be compiled with the following flags : `-Wall -Wextra -Werror`.
- Each of your includes must be able to be included independently from others. Includes must contain every other includes they are depending on, obviously.
- The subject can be modified up to 4h before the final turn-in time.
- In case you're wondering, no coding style is enforced during the C++ pool. You can use any style you like, no restrictions. But remember that a code your peer-evaluator can't read is a code she or he can't grade.
- Important stuff now : You will NOT be graded by a program, unless explicitly stated in the subject. Therefore, you are afforded a certain amount of freedom in how you choose to do the exercises. However, be mindful of the constraints of each exercise, and DO NOT be lazy, you would miss a LOT of what they have to offer !
- It's not a problem to have some extraneous files in what you turn in, you may choose to separate your code in more files than what's asked of you. Feel free, as long as the day is not graded by a program.
- Even if the subject of an exercise is short, it's worth spending some time on it to be absolutely sure you understand what's expected of you, and that you did it in the best possible way.
- By Odin, by Thor ! Use your brain !!!

Chapter II

Foreword

Here is a poem written by Victor Hugo that I like:


A une femme

Enfant ! si j'etais roi, je donnerais l'empire,
Et mon char, et mon sceptre, et mon peuple a genoux
Et ma couronne d'or, et mes bains de porphyre,
Et mes flottes, a qui la mer ne peut suffire,
Pour un regard de vous !

Si j'etais Dieu, la terre et l'air avec les ondes,
Les anges, les demons courbes devant ma loi,
Et le profond chaos aux entrailles fecondes,
L'eternite, l'espace, et les cieux, et les mondes,
Pour un baiser de toi !

Chapter III

Exercise 00: A few functions

	Exercise 00
Exercise 00: A few functions	
Turn-in directory : <i>ex00/</i>	
Files to turn in : whatever.cpp and a Makefile	
Allowed functions : None	
Remarks : n/a	

Write the following function templates:

- **swap** : Swaps the values of two arguments. Does not return anything.
- **min** : Compares the two arguments and returns the smallest one. If the two arguments are equal, then it returns the second one.
- **max** : Compares the two arguments and returns the biggest one. If the two arguments are equal, then it returns the second one.

These functions can be called with any type of argument, with the condition that the two arguments have the same type and supports all comparison operators. Provide enough code to compile an executable that proves that everything works as intended.

The following code :

```
int main( void ) {

    int a = 2;
    int b = 3;

    ::swap( a, b );
    std::cout << "a = " << a << ", b = " << b << std::endl;
    std::cout << "min( a, b ) = " << ::min( a, b ) << std::endl;
    std::cout << "max( a, b ) = " << ::max( a, b ) << std::endl;

    std::string c = "chaine1";
    std::string d = "chaine2";

    ::swap(c, d);
    std::cout << "c = " << c << ", d = " << d << std::endl;
    std::cout << "min( c, d ) = " << ::min( c, d ) << std::endl;
    std::cout << "max( c, d ) = " << ::max( c, d ) << std::endl;


    return 0;
}
```

Should output the following if you did well:

```
a = 3, b = 2
min(a, b) = 2
max(a, b) = 3
c = chaine2, d = chaine1
min(c, d) = chaine1
max(c, d) = chaine2
```

Chapter IV

Exercise 01: Iter


	Exercise 01
Exercise 01: Iter	
Turn-in directory : <i>ex01/</i>	
Files to turn in : iter.cpp and a Makefile	
Allowed functions : None	
Remarks : n/a	

Write a function template `iter` that take 3 parameters and returns nothing. The first parameter is the address of an array, the second one is the length of the array and the third one is a function that is called on each element of the array.

Wrap your work in an executable that proves that your function template `iter` works with any type of array and/or with an instantiated function template as a third parameter.

Chapter V

Exercise 02: Array

	Exercise 02
Exercise 02: Array	
Turn-in directory : <i>ex02/</i>	
Files to turn in : <code>Array.hpp</code> , or <code>Array.hpp</code> , or <code>Array.h</code> , or anything that makes sense, plus anything necessary to build an executable, and a Makefile	
Allowed functions : None	
Remarks : n/a	

Write a class template `Array` that contains elements of type `T` and that allows the following behaviors:

- Construction with no parameter: creates an empty array.
- Construction with an `unsigned int n` as a parameter: creates an array of `n` elements, initialized by default. (Tip: try to compile `int * a = new int();`, then display `*a`.)
- Construction by copy and assignment operator. In both cases, modifying one of the two arrays after copy/assignment won't affect anything in the other array.
- You MUST use the operator `new[]` for your allocation. You must not do preventive allocation. Your code must never access non allocated memory.
- Elements are accessible through the operator `[]`.
- When accessing an element with the operator `[]`, if this element is out of the limits, a `std::exception` is thrown.
- A member function `size` that returns the number of elements in the array. This member function takes no parameter and does not modify the current instance in any way.

Wrap your work into an executable that proves that your class template works as intended.