



394661-FS2020-0 - C++ Programming I

EXERCISE-04

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1 Introduction

This exercise of 394661-FS2020-0 will focus on classes and objects in C++ . In particular, your writing your own classes using constructors to guarantee data consistency and encapsulation where necessary.

You will learn the following topics when completing this exercise:

- ▶ Classes and constructors
- ▶ Objects and usage
- ▶ Data integrity
- ▶ Data encapsulation
- ▶ Standard strings and algorithms

2 Exercises

Create CMake-Projects with C++ 11 compiler support and Debug/Release build options for the exercise. Add additional files manually to the project to gain full control over the included project files. Separate class declaration and implementation in header and source file, respectively.

2.1 Library, Books and ISBN

The International Standard Book Number (ISBN) is a unique numeric commercial book identifier. The ISBN-10 number for example is valid if consisting out of 9 digits and a 10th digit, the so called check digit. The check digit is calculated as follows:

$$z_{10} = \left(\sum_{i=1}^9 i \cdot \text{digit} \right) \mod 11 \quad (1)$$

For example:

0-7897-5774-?

$$z_{10} = (1*0 + 2*7 + 3*8 + 4*9 + 5*7 + 6*5 + 7*7 + 8*7 + 9*4) \mod 11 = 5$$

and hence: 0-7897-5774-5

Therefore, to check the validity of the ISBN the following condition can be used:

$$\sum_{i=1}^{10} i \cdot \text{digit} = 0 \quad (\mod 11) \quad (2)$$

1. **Write a class Book** holding the book title, the name of the author and the ISBN number. You have to guarantee that only books with known title, author name and ISBN-10 can be created, i.e. are marked as valid books, respectively! Implement the following functionality:

- ▶ Private member variables holding the book details
- ▶ A private member function checking the existence of title and author, i.e. no empty strings allowed
- ▶ A private member function checking the validity of ISBN-10 (number of digits and check sum (see Eq.(2)) during construction.

Tips:

- a) Use "erase" from <algorithm> to get rid off the hyphen ("-") if any.

Example:

```
string isbn("0-7897-5774-5");  
isbn.erase(std::remove(isbn.begin(), isbn.end(), '-' ), isbn.end());
```

- b) Use string to int conversion "stoi" to convert the digits. For example to access the third digit:

```
int i = std::stoi(isbn.substr(2,1)); -> i = 8
```

- ▶ A private boolean member holding the validity status of book: e.g isValid. If one or more book descriptions aren't correct the book is marked as non-valid
- ▶ A public member function to request the validity status of the book
- ▶ A public member function printing out the book information, i.e. title, author, ISBN and validity status

2. **Write a second class Library** storing all the books internally in a "safe", private list with the following functionality:

- ▶ A private vector storing all the books
- ▶ A public member function to add new books
- ▶ A private member function to delete books
- ▶ A public member function to clean up the library, i.e. to remove invalid book entries, using the above delete book function
- ▶ A public member function to print the inventory, i.e. complete number, number of valid and number non-valid books

3. **Test your classes** with the following or similar program:

```
1 // You have a bag of books
2 Book book1("Sams Teach Yourself C++", "Siddharta Rao", "0-7897-5774-5");
3 Book book2("C++ Primer", "Stanley B. Lippman", "0321714113");
4 Book book3("The C++ Programming Language", "Bjarne Stroustrup", "0321563840");
5 Book book4("Programming Python", "Mark Lutz", "0-596-15810-2");
6 Book book5("TIBITS AT HOME", "Betty Bossy", "1-234-567-8");
7 Book book6("Thinking in Java", "", "9780596009205");
8 Book book7("Multiple View Geometry in Computer Vision", "", "1139449141");
9 Book book8("", "Paul Kimmel", "0-321-99278-4");
10
11 // Bring all the books to the library
12 Library lib; // Create instance of library
13 lib.addBook(book1);
14 lib.addBook(book2);
15 ...
16 ..
17 .
18 lib.addBook(book8);
19
20 // Give an overview
21 lib.printInventory();
22
23 // Clean non-valid book
24 lib.cleanup();
25
26 // Overview again
27 lib.printInventory();
28
29 // Now only C++ books are left in the library
```

3 Submission

Submit your source code (as a zip-file) to Ilias EXERCISE-04 **before the deadline** specified in Ilias.