



National University of Sciences and Technology (NUST)
School of Electrical Engineering and Computer Science

Department of Computing

CS 212: Object Oriented Programming

Class: BSCS-6ABC

Lab 06: Object Oriented Design

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Instructors:

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Learning Objectives

The learning objective of this lab is to understand and practice Object Oriented Design for a real life scenario. The key concepts include inheritance, composition, associations and aggregations. Here are some links that will help you in understanding these concepts.

<http://aviadezra.blogspot.com/2009/05/uml-association-aggregation-composition.html>

<http://beginnersbook.com/2013/05/association/>

<http://beginnersbook.com/2013/05/aggregation/>

<https://bellekens.com/2010/12/20/uml-composition-vs-aggregation-vs-association/>

A few slides on UML have also been uploaded on LMS for your reference.

Lab Tasks

Ancient Chinese were the first to develop rockets, but the father of modern rocketry is Robert Goddard developer of the very first liquid fueled rocket in the 1920s. It is evident that there would not have been space exploration without rockets.

Last week, Elon Musk's SpaceX successfully relaunched and landed a recycled rocket, which is quite a historic step in the field of rocket re-usability. In view of this development, your task in this lab is to first read more about Rockets on Wikipedia (<https://en.wikipedia.org/wiki/Rocket>). Once you have skimmed through the article, you must have developed a conceptual model of the problem domain, in this case about rockets.

A conceptual model is just a composition of concepts to help people know, understand and learn about a subject area/domain. The concepts/subsystems are illustrated as a collection of connected rectangular blocks. Once you have developed the hierarchy of concepts/subsystems, the objects in the system are identified and their details are designed. Here, the emphasis shifts from domain concepts to computer concepts; that is, the objects identified are etched up for implementation. The process is called object oriented design.

Some of the basic steps that can be used for this task are:

- 1) **Object identification.** The objects identified in the analysis phase are grouped into classes and refined so that they are suitable for actual implementation.
- 2) **Design of Relationships.** The main relationships that are addressed comprise of associations, aggregations, and inheritances.
- 3) **Object Representation.** Once the classes are identified, they need to be represented using object modeling techniques. This stage essentially involves constructing UML diagrams.



4) **Classification of Operations.** In this step, the operation to be performed on objects are defined.

5) **Algorithm Design.** The operations in the objects are defined using algorithms.

Your task in this lab assignment is to follow the aforementioned steps to come with an object oriented design and its corresponding Java classes. Lastly create a test class to demonstrate your proposed object oriented design.

Hand in

Hand in the source code from this lab at the appropriate location on the LMS system. You should hand in a single compressed/archived file named Lab_6_<Your CMS_ID. Your_NAME>.zip (without angle brackets) that contains ONLY the following files.

- 1) A word document containing the class diagrams for all the objects identified for this lab. The class diagram should show the relationship between classes as well as the instance variables and methods within these classes.
- 2) All completed java source files representing the work accomplished for this lab. The files should contain author in the comments at the top.

To Receive Credit

1. By showing up on time for lab, working on the lab solution, and staying to the end of the class period, only then you can receive full credit for the lab assignment.
2. Comment your programs heavily. Intelligent comments and a clean, readable formatting of your code account for 20% of your grade.
3. The lab time is not intended as free time for working on your programming/other assignments. Only if you have completely solved the lab assignment, including all challenges, and have had your work checked off for completeness by your TA/Lab Engineer should you begin the programming/other assignments.