

CSE443 - Object Oriented Analysis and Design  
Fall 2018-2019

## Homework 2 – v1

**Rule 1:** no plagiarism (from colleagues or other sources). Detected cases of plagiarism will lead to a significant penalty of your course grade at the end of the semester.

**Rule 2:** no late submissions! Even if it is late by one minute, it will be ignored. Learning to plan your schedule according to deadlines is part of your education and an invaluable professional asset.

**What to submit: a) the source code of your project fully documented (with javadoc), b) a nicely formatted pdf report of your design decision explanations and class diagrams and c) an executable demo that fully illustrates your program's capabilities whenever code is requested.**

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**Question 1:** You have implemented the Singleton design pattern as a class named (very originally) "Singleton".

1. What happens if someone tries to clone a Singleton object using the `clone()` method inherited from `Object`? Does it lead to the creation of a second distinct Singleton object? Justify your answer. **(5 points)**
2. Cloning Singletons should not be allowed. How can you prevent the cloning of a Singleton object? **(5 points)**
3. Let's assume the class Singleton is a subclass of class Parent, that fully implements the Cloneable interface. How would you answer questions 1 and 2 in this case? **(10 points)**

**Question 2 (30 points):** You are now employed by ZırhSan A.Ş. A private company specializing in the design and production of exoskeleton armored suits for military personnel, equipped with various custom weapons.



There are 3 basic types of suits: **dec** (500k TL, 25kg), **ora** (1500k TL, 30kg) and **tor** (5000k TL, 50kg).

**Each of these suits can be equipped with the following accessories:**

- Flamethrower (50k TL per item, 2kg)
- AutoRifle (30k TL per item, 1.5kg)
- RocketLauncher (150k TL per item, 7.5kg)
- Laser (200k TL per item, 5.5kg)

A customer can demand any custom combination of accessories: such as a dec suit with 1 flamethrower, 2 automatic rifles and 1 rocket launcher.

Your task is to develop a piece of software in Java *able to calculate the total cost and weight of an equipped suit* (total price = basic suit price + prices of the accessories). The user of the software should be able to designate any combination of accessories *dynamically* at runtime. Your design should be flexible and easy to accommodate new accessories and suit types.

**Question 3:** You quit your job at ZırhSan, as the schedules were hectic (initially advertised as a “esnek çalışma saatlerine sahip pozisyon, bıdı bıdı”) and you are now employed by Turkish Aerospace Industries (TAI). TAI is about to launch the new series TPX series of passenger planes, consisting of 3 models.

Model	Purpose	Skeleton	Engine	Seating
TPX 100	Domestic flights	Aluminum alloy	Single jet engine	50 seats
TPX 200	Domestic and short international flights	Nickel alloy	Twin jet engines	100 seats
TPX 300	Transatlantic flights	Titanium alloy	Quadro jet engines	250 seats

The production of a plane is conducted in the following order:

1) `constructSkeleton()`  
2) `placeEngines()`  
and 3) `placeSeats()`

Use the Factory Method design pattern to develop a Java program simulating the production of TPX planes. **(20 points)**

Business is booming. TAI is now exporting planes to the international market. And the models are customized according to local needs.

Market	Engine injection type	Seating cover	
Domestic	Turbojet	Velvet	
Eurasia	Turbofan	Linen	
Other	Geared turbofan	Leather	

Redesign and re-implement your Java program simulating the production of TPX planes for all 3 markets, using this time the Abstract Factory design pattern **(30 points)**.