Programming Test **Description** with **Adaptor** and **Single** Patterns and **Mediator** Patterns: Part 1

We will be more specific with the description at the next class hour.

Try to make a design and basic implementation.

Probably you will have a program test on **April 14th, Friday**.

Description

- Simulate a hybrid car which is driven both by a conventional fuel engine and also electric motors;
- Your code is based on three design patterns -- **adaptor, singleton,** and **mediator** pattern.
- Depending on the **charging status** **of its** **main battery**, the car changes its driving mode among **fuel** mode, **hybrid** mode, and **electric** mode;
- **Charging status** of the **main battery** is determined by a **random number generator** with the range of **1~100**.
- In **fuel** mode with a **low main-battery level**, the car is driven only by **gas/fuel** engine while **charging the battery by a electric generator** run by the gas/fuel engine;
- In fuel mode, there are two situations - one with battery **low level**, another **with almost empty** battery level. In both situations, the vehicle is **in fuel mode**. When the battery is almost **empty**, the **backup battery** will be used. The charging status of the **backup** battery is made by a random number generator with the range of **50~100**,
- In **hybrid** mode with a **medium main-battery level**, the car is powered by both **gas/fuel engine and an electric motor** while **charging battery** both by **conventional electric generator** and **regenerative braking system**;
- In **electric** mode with a **high main-battery level**, the car is driven only by **electricity without using gas/fuel** while **charging battery only by the regenerative braking system**;
- Mode transitions are traced by the system;
- In **electric** mode, both the **front and rear motors** are driven, while in **hybrid** mode, **only front motor** is driven along **with fuel engine**; and
- In a loop statement of your program, run **at least 8 times** for generating 3 modes randomly.

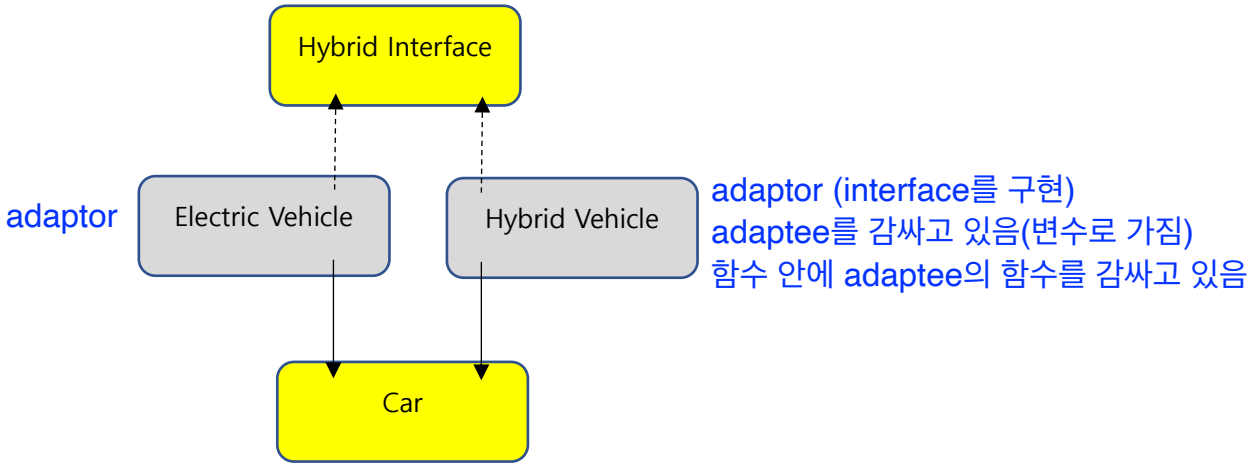
The actions related to **singleton** object will be **notified soon**.

singleton과 mediator는 금요일 당일에 자세하게 알려줄 것임
미리 준비해온 코드에 add 하면 됨

The **mediator** is currently responsible for the action related to the **backup battery** system.

random number
- main battery 1~100
  (4 case - 25, 50, 75, 100)
- backup battery 50~100

The diagram below depicts the class hierarchy of the three classes – Car, Electric, and Hybrid Vehicles.



public class **HybridCar** extends **Car** implements **HybridInterface** {…}

public class **ElectricVehicle** extends **Car** implements **HybridInterface** {…}

```
public interface HybridInterface {
        void startMotor();
        void stopMotor();
        void electricToFrontMotor();
        void generateElectricPower();
        void stopMoving();
        void speedoMeter();
}
```

Additional Interface method definitions are up to you.

```
//////////////////////////////////////////////////
        public class Car {
…
        public Car(String car_string) {
                this.string = car_string;
        }
        public void igniteEngine() { …  }
        public void keepRunningEngine() { … }
        public void stopEngine() { … }
        public void measureSpeed() { …}
        public void keepRunningEngine() {
                System.out.println("Fuel engine keeps running.");
                System.out.println("Electric Generator is charging battery.");
        }
        ….
//////////////////////////////////////////////////
```

```
public class HybridCar extends Car implements HybridInterface {
…
public void startMotor(){
                        igniteEngine();
        }

public void generateElectricPower(){
          keepRunningEngine();
        …
        }
////////////////////////////////////////////////////////////////
import java.util.ArrayList;
import java.util.Random;
public class Mediator { …
…
        public int requestBackupBattery(){
                …
        }
        public void setUsingBackUpBattery(){
                …
        }
        public void OffUsingBackUpBattery(){
                …
        }
        public Boolean UseOfBackUpBattery(){
                …
        }
```

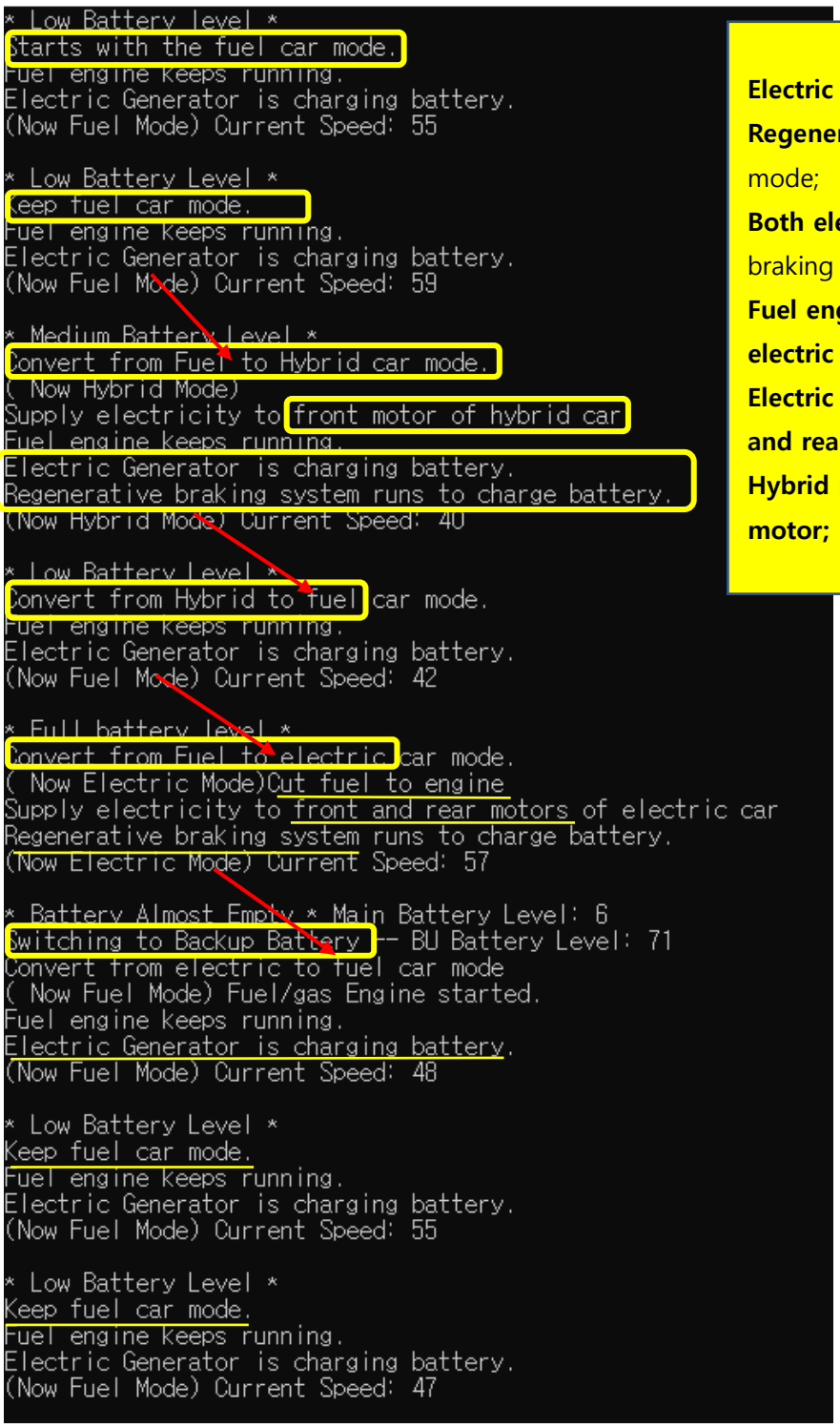
Backup Battery Level Checking

Setter: Use of Backup Battery: TRUE

Setter: Use of Backup Battery: FALSE

Getter: Use of Backup Battery

Simulation of a Hybrid Car with Adaptor, Singleton, Mediator Patterns



Electric generator by **fuel** engine;
Regenerative braking system by **electric** mode;
Both electric generator and **regenerative** braking system by **hybrid** mode;
Fuel engine starts when **converting from electric mode to fuel mod**e;
Electric mode sends electricity to **both front and rear motor,** and **cut fuel** to fuel engine**;**
Hybrid mode sends electricity **to only front motor;**

```
* Low Battery level *
Starts with the fuel car mode.
Fuel engine keeps running.
Electric Generator is charging battery.
(Now Fuel Mode) Current Speed: 53

* Full battery level *
Convert from Fuel to electric car mode.
( Now Electric Mode)Cut fuel to engine
Supply electricity to front and rear motors of electric car
Regenerative braking system runs to charge battery.
(Now Electric Mode) Current Speed: 51

* Full battery level *
Keep electric car mode
( Now Electric Mode)Cut fuel to engine
Supply electricity to front and rear motors of electric car
Regenerative braking system runs to charge battery.
(Now Electric Mode) Current Speed: 51

* Low Battery Level *
Convert from Electric to Fuel car mode
( Now Fuel Mode) Fuel/gas Engine started.
Fuel engine keeps running.
Electric Generator is charging battery.
(Now Fuel Mode) Current Speed: 45

* Full battery level *
Convert from Fuel to electric car mode.
( Now Electric Mode)Cut fuel to engine
Supply electricity to front and rear motors of electric car
Regenerative braking system runs to charge battery.
(Now Electric Mode) Current Speed: 45

* Medium Battery Level *
Convert from Electric to Hybrid car mode.
( Now Hybrid Mode) Fuel/gas Engine started.
Supply electricity to front motor of hybrid car
Fuel engine keeps running.
Electric Generator is charging battery.
Regenerative braking system runs to charge battery.
(Now Hybrid Mode) Current Speed: 45

* Battery Almost Empty * Main Battery Level: 2
Switching to Backup Battery -- BU Battery Level: 95
Convert from hybrid to fuel car mode.
Fuel engine keeps running.
Electric Generator is charging battery.
(Now Fuel Mode) Current Speed: 56

* Low Battery Level *
Keep fuel car mode.
Fuel engine keeps running.
Electric Generator is charging battery.
(Now Fuel Mode) Current Speed: 41
```

```
* Medium Battery Level *
Starts with the hybrid car mode.
Fuel engine keeps running.
Electric Generator is charging battery.
Regenerative braking system runs to charge battery.
(Now Hybrid Mode) Current Speed: 53

* Battery Almost Empty * Main Battery Level: 5
Switching to Backup Battery -- BU Battery Level: 83
Convert from hybrid to fuel car mode.
Fuel engine keeps running.
Electric Generator is charging battery.
(Now Fuel Mode) Current Speed: 50

* Medium Battery Level *
Convert from Fuel to Hybrid car mode.
( Now Hybrid Mode)
Supply electricity to "front" motor of hybrid car
Fuel engine keeps running.
Electric Generator is charging battery.
Regenerative braking system runs to charge battery.
(Now Hybrid Mode) Current Speed: 56

* Medium Battery Level *
Keep hybrid car mode
( Now Hybrid Mode)
Supply electricity to front motor of hybrid car
Fuel engine keeps running.
Electric Generator is charging battery.
Regenerative braking system runs to charge battery.
(Now Hybrid Mode) Current Speed: 49

* Medium Battery Level *
Keep hybrid car mode
( Now Hybrid Mode)
Supply electricity to front motor of hybrid car
Fuel engine keeps running.
Electric Generator is charging battery.
Regenerative braking system runs to charge battery.
(Now Hybrid Mode) Current Speed: 51

* Full battery level *
Convert from Hybrid to electric car mode.
( Now Electric Mode)Cut fuel to engine
Supply electricity to front and rear motors of electric car
Regenerative braking system runs to charge battery.
(Now Electric Mode) Current Speed: 42

* Full battery level *
Keep electric car mode
( Now Electric Mode)Cut fuel to engine
Supply electricity to front and rear motors of electric car
Regenerative braking system runs to charge battery.
(Now Electric Mode) Current Speed: 40

* Medium Battery Level *
Convert from Electric to Hybrid car mode.
( Now Hybrid Mode) Fuel/gas Engine started.
Supply electricity to front motor of hybrid car
Fuel engine keeps running.
Electric Generator is charging battery.
Regenerative braking system runs to charge battery.
(Now Hybrid Mode) Current Speed: 51
```

```
* Low Battery level *
Starts with the fuel car mode.
Fuel engine keeps running.
Electric Generator is charging battery.
(Now Fuel Mode) Current Speed: 49

* Medium Battery Level *
Convert from Fuel to Hybrid car mode.
( Now Hybrid Mode)
Supply electricity to front motor of hybrid car
Fuel engine keeps running.
Electric Generator is charging battery.
Regenerative braking system runs to charge battery.
(Now Hybrid Mode) Current Speed: 50

* Full battery level *
Convert from Hybrid to electric car mode.
( Now Electric Mode)Cut fuel to engine
Supply electricity to front and rear motors of electric car
Regenerative braking system runs to charge battery.
(Now Electric Mode) Current Speed: 47

* Medium Battery Level *
Convert from Electric to Hybrid car mode.
( Now Hybrid Mode) Fuel/gas Engine started.
Supply electricity to front motor of hybrid car
Fuel engine keeps running.
Electric Generator is charging battery.
Regenerative braking system runs to charge battery.
(Now Hybrid Mode) Current Speed: 46

* Full battery level *
Convert from Hybrid to electric car mode.
( Now Electric Mode)Cut fuel to engine
Supply electricity to front and rear motors of electric car
Regenerative braking system runs to charge battery.
(Now Electric Mode) Current Speed: 54

* Full battery level *
Keep electric car mode
( Now Electric Mode)Cut fuel to engine
Supply electricity to front and rear motors of electric car
Regenerative braking system runs to charge battery.
(Now Electric Mode) Current Speed: 41

* Full battery level *
Keep electric car mode
( Now Electric Mode)Cut fuel to engine
Supply electricity to front and rear motors of electric car
Regenerative braking system runs to charge battery.
(Now Electric Mode) Current Speed: 41

* Medium Battery Level *
Convert from Electric to Hybrid car mode.
( Now Hybrid Mode) Fuel/gas Engine started.
Supply electricity to front motor of hybrid car
Fuel engine keeps running.
Electric Generator is charging battery.
Regenerative braking system runs to charge battery.
(Now Hybrid Mode) Current Speed: 48
```

```
* Full battery level *
Starts with the electric car mode.
( Now Electric Mode)Cut fuel to engine
Supply electricity to front and rear motors of electric car
Regenerative braking system runs to charge battery.
(Now Electric Mode) Current Speed: 54

* Battery Almost Empty * Main Battery Level: 6
Switching to Backup Battery -- BU Battery Level: 77
Convert from electric to fuel car mode
( Now Fuel Mode) Fuel/gas Engine started.
Fuel engine keeps running.
Electric Generator is charging battery.
(Now Fuel Mode) Current Speed: 59

* Full battery level *
Convert from Fuel to electric car mode.
( Now Electric Mode)Cut fuel to engine
Supply electricity to front and rear motors of electric car
Regenerative braking system runs to charge battery.
(Now Electric Mode) Current Speed: 40

* Battery Almost Empty * Main Battery Level: 5
Switching to Backup Battery -- BU Battery Level: 55
Convert from electric to fuel car mode
( Now Fuel Mode) Fuel/gas Engine started.
Fuel engine keeps running.
Electric Generator is charging battery.
(Now Fuel Mode) Current Speed: 58

* Medium Battery Level *
Convert from Fuel to Hybrid car mode.
( Now Hybrid Mode)
Supply electricity to front motor of hybrid car
Fuel engine keeps running.
Electric Generator is charging battery.
Regenerative braking system runs to charge battery.
(Now Hybrid Mode) Current Speed: 52

* Battery Almost Empty * Main Battery Level: 6
Switching to Backup Battery -- BU Battery Level: 75
Convert from hybrid to fuel car mode.
Fuel engine keeps running.
Electric Generator is charging battery.
(Now Fuel Mode) Current Speed: 55

* Battery Still Almost Empty * Main Battery Level: 9
Continue to use Backup Battery -- BU Battery Level: 88
Keep fuel car mode.
Fuel engine keeps running.
Electric Generator is charging battery.
(Now Fuel Mode) Current Speed: 56

* Low Battery Level *
Keep fuel car mode.
Fuel engine keeps running.
Electric Generator is charging battery.
(Now Fuel Mode) Current Speed: 43
```