C# OOP Demo Exam - 04 August 2019

Motocross World Championship MXGP

1. Overview

The FIM (Fédération Internationale de Motocyclisme) Motocross World Championship (MXGP) is the one of the biggest motocross champoinship ever. You love to ride motorcycles and you are the biggest fan on MXGP and for that reason, MXGP hired you to create platform for storing information about riders, motorcycles and races.

2. Setup

- Upload only the MXGP package in every problem except Unit Tests
- Do not modify the classes, interfaces or their packages
- Use strong cohesion and loose coupling
- Use inheritance and the provided interfaces wherever possible
 - This includes constructors, method parameters and return types
- Do not violate your interface implementations by adding more public methods in the concrete class than the interface has defined
- Make sure you have no public fields anywhere

3. Task 1: Structure (50 points)

You are given 8 interfaces, and you have to implement their functionality in the correct classes.

It is not required to implement your structure with Engine, CommandHandler, ConsoleReader, ConsoleWriter and enc. It's good practice but it's not required.

There are 3 types of entities and 3 repositories in the application: Motorcycle, Rider, Race and Repository:

Motorcycle

Motorcycle is a base class for any type of motorcycle and it should not be able to be instantiated.

Data

- Model string
 - o If the model is null, whitespace or less than 4 symbols, throw an ArgumentException with message "Model {model} cannot be less than 4 symbols."
 - All models are unique
- HorsePower int
 - Every type of motorcycle has different range of valid horsepower. If the horsepower is not in the valid range, throw an ArgumentException with message "Invalid horse power: {horsepower}."
- CubicCentimeters double
 - Every type of motorcycle has different cubic centimeters.

Behavior

double CalculateRacePoints(int laps)

The CalculateRacePoints calculates the race points in the concrete race with this formula:



















cubic centimeters / horsepower * laps

Constructor

A **Motorcycle** should take the following values upon initialization:

string model, int horsePower, double cubicCentimeters

Child Classes

There are several concrete types of **Motorcycles**:

PowerMotorcycle

The cubic centimeters for this type of motorcycle are 450. Minimum horsepower is 70 and maximum horsepower is **100**.

If you receive horsepower which is not in the given range throw ArgumentException with message "Invalid horse power: {horsepower}.".

SpeedMotorcycle

The cubic centimeters for this type of motorcycle are 125. Minimum horsepower is 50 and maximum horsepower is **69**.

If you receive horsepower which is not in the given range throw ArgumentException with message "Invalid horse power: {horsepower}.".

Rider

Data

- Name string
 - If the name is null, empty or less than 5 symbols throw an ArgumentException with message "Name {name} cannot be less than 5 symbols."
 - All names are unique
- Motorcycle Motorcycle
- NumberOfWins int
- CanParticipate bool
 - Default behaviour is false
 - Rider can participate in race, **ONLY** if he has motorcycle (motorcycle is not **null**)

Behavior

void AddMotorcycle(Motorcycle motorcycle)

This method adds a motorcycle to the rider. If the motorcycle null, throw ArgumentNullException with message "Motorcycle cannot be null.".

If motorcycle is not null, save it and after that rider can participate to race.

void WinRace()

When rider win race, number of wins should be increased.

Constructor

A **Rider** should take the following values upon initialization:

string name



















Race

Data

- Name string
 - If the name is null, empty or less than 5 symbols throw an ArgumentException with message "Name {name} cannot be less than 5 symbols."
 - All names are unique
- Laps int
 - Throws ArgumentException with message "Laps cannot be less than 1.", if the laps are less than 1.
- Riders A collection of riders

Behavior

void AddRider(Rider rider)

This method adds a rider to the race if the rider is valid. If a rider is not valid, throw an exception with the appropriate message.

Exceptions are:

- If a rider is null throw an ArgumentNullException with message "Rider cannot be null."
- If a rider cannot participate in the race (the rider doesn't own a motorcycle) throw an ArgumentException with message "Rider {rider name} could not participate in race."
- If the rider already exists in the race throw an **ArgumentNullException** with message: "Rider {rider name} is already added in {race name} race."

Repository

The repository holds information about the entity.

Data

Models – A collection of T (entity)

Behavior

void Add(T model)

Adds an entity in the collection.

bool Remove(T model)

Removes an entity from the collection.

T GetByName(string name)

Returns an entity with that name.

Collection<T> GetAll()

Returns all entities (unmodifiable)

Child Classes

Create MotorcycleRepository, RiderRepository and RaceRepository repositories.



















4. Task 2: Business Logic (150 points)

The Controller Class

The business logic of the program should be concentrated around several commands. You are given interfaces, which you have to implement in the correct classes.

Note: The ChampionshipController class SHOULD NOT handle exceptions! The tests are designed to expect exceptions, not messages!

Note: The ChampionshipController class SHOULD HAVE empty constructor!

The first interface is IChampionshipController. You must implement a ChampionshipController class, which implements the interface and implements all of its methods. The given methods should have the following logic:

Commands

There are several commands, which control the business logic of the application. They are stated below.

CreateRider Command

Parameters

• riderName - string

Functionality

Creates a rider with the given name and adds it to the appropriate repository.

The method should **return** the following message:

```
"Rider {name} is created."
```

If a rider with the given name already exists in the rider repository, throw an ArgumentException with message "Rider {name} is already created."

CreateMotorcycle Command

Parameters

- type string
- model string
- horsePower int

Functionality

Create a motorcycle with the provided model and horsepower and add it to the repository. There are two types of motorcycles: "SpeedMotorcycle" and "PowerMotorcycle".

If the motorcycle already exists in the appropriate repository throw an ArgumentException with following message:

"Motorcycle {model} is already created."

If the motorcycle is successfully created, the method should return the following message:

"{"SpeedMotorcycle"/ "PowerMotorcycle"} {model} is created."

AddMotorcycleToRider Command

Parameters

riderName - String



















motorcycleModel - String

Functionality

Gives the motorcycle with given name to the rider with given name (if exists).

If the rider does not exist in rider repository, throw InvalidOperationException with message

"Rider {name} could not be found."

If the motorcycle does not exist in motorcycle repository, throw InvalidOperationException with message

"Motorcycle {name} could not be found."

If everything is successful you should add the motorcycle to the rider and return the following message:

"Rider {rider name} received motorcycle {motorcycle name}."

AddRiderToRace Command

Parameters

- raceName string
- riderName string

Functionality

Adds a rider to the race.

If the race **does not exist** in the race repository, throw an **InvalidOperationException** with message:

• "Race {name} could not be found."

If the rider does not exist in the rider repository, throw an InvalidOperationException with message:

"Rider {name} could not be found."

If everything is successful, you should add the rider to the race and return the following message:

"Rider {rider name} added in {race name} race."

CreateRace Command

Parameters

- name string
- laps int

Functionality

Creates a race with the given name and laps and adds it to the race repository.

If the race with the given name already exists, throw an InvalidOperationException with message:

"Race {name} is already created."

If everything is successful you should return the following message:

"Race {name} is created."

StartRace Command

Parameters

raceName - string













Functionality

This method is the biggest deal. If everything is valid, you should arrange all riders and then return the three fastest riders. To do this you should sort all riders in **descending** order by the result of **CalculateRacePoints** method in the motorcycle object. At the end, if everything is valid **remove** this race from race repository.

If the race does not exist in race repository, throw an InvalidOperationException with message:

"Race {name} could not be found."

If the participants in the race are less than **3**, throw an **InvalidOperationException** with message:

"Race {race name} cannot start with less than 3 participants."

If everything is successful, you should return the following message:

```
"Rider {first rider name} wins {race name} race."
"Rider {second rider name} is second in {race name} race."
"Rider {third rider name} is third in {race name} race."
```

End Command

Exit the program.

Input / Output

You are provided with one interface, which will help with the correct execution process of your program. The interface is **IEngine** and the class implementing this interface should read the input and when the program finishes, this class should print the output.

Input

Below, you can see the **format** in which **each command** will be given in the input:

- CreateRider {name}
- CreateMotorcycle {motorcycle type} {model} {horsepower}
- AddMotorcycleToRider {rider name} {motorcycle name}
- AddRiderToRace {race name} {rider name}
- CreateRace {name} {laps}
- StartRace {race name}
- End

Output

Print the output from each command when issued. If an exception is thrown during any of the commands' execution, print the exception message.

Examples

Input

CreateRider Michael CreateRider Peter

CreateMotorcycle Speed Honda 60

CreateMotorcycle Power Suziki 80





















CreateMotorcycle Power Yamaha 70

CreateRace Loket 2

AddMotorcycleToRider Michael Honda

AddMotorcycleToRider Peter Suziki

AddMotorcycleToRider Michael Yamaha

StartRace Loket

AddRiderToRace Loket Michael

AddRiderToRace Loket Peter

StartRace Loket

CreateRider Brian

AddRiderToRace Loket Brian

CreateMotorcycle Speed KTM-SX 55

AddMotorcycleToRider Brian KTM-SX

AddRiderToRace Loket Brian

StartRace Loket

End

Output

Rider Michael is created.

Rider Peter is created.

SpeedMotorcycle Honda is created.

PowerMotorcycle Suziki is created.

PowerMotorcycle Yamaha is created.

Race Loket is created.

Rider Michael received motorcycle Honda.

Rider Peter received motorcycle Suziki.

Rider Michael received motorcycle Yamaha.

Race Loket cannot start with less than 3 participants.

Rider Michael added in Loket race.

Rider Peter added in Loket race.

Race Loket cannot start with less than 3 participants.

Rider Brian is created.

Rider Brian could not participate in race.

SpeedMotorcycle KTM-SX is created.

Rider Brian received motorcycle KTM-SX.

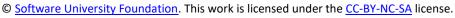
Rider Brian added in Loket race.

Rider Michael wins Loket race.

Rider Peter is second in Loket race.

Rider Brian is third in Loket race.

















Input

CreateRider Kevin

CreateRider Kevin

CreateRider Jose

CreateMotorcycle Speed KTM-SX-F 100

CreateMotorcycle Power KTM 100

CreateMotorcycle Power KTM-SX-F 100

CreateMotorcycle Power KTM-SX-F 100

StartRace Imola

CreateRace Imola 4

AddRiderToRace Lommel Kevin

AddRiderToRace Imola Jose

AddRiderToRace Imola Kevin

AddMotorcycleToRider Kevin KTM-SX-F

AddRiderToRace Imola Kevin

CreateMotorcycle Speed Honda 60

CreateMotorcycle Power Suziki 80

CreateMotorcycle Power Yamaha 70

CreateRace Loket 2

CreateRider Michael

CreateRider Peter

AddMotorcycleToRider Michael Honda

AddMotorcycleToRider Peter Suziki

AddRiderToRace Imola Michael

AddRiderToRace Imola Peter

StartRace Imola

End

Output

Rider Kevin is created.

Rider Kevin is already created.

Name Jose cannot be less than 5 symbols.

Invalid horse power: 100.

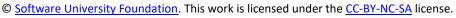
Model KTM cannot be less than 4 symbols.

PowerMotorcycle KTM-SX-F is created.

Motorcycle KTM-SX-F is already created.

Race Imola could not be found.



















Race Imola is created.

Race Lommel could not be found.

Rider Jose could not be found.

Rider Kevin could not participate in race.

Rider Kevin received motorcycle KTM-SX-F.

Rider Kevin added in Imola race.

SpeedMotorcycle Honda is created.

PowerMotorcycle Suziki is created.

PowerMotorcycle Yamaha is created.

Race Loket is created.

Rider Michael is created.

Rider Peter is created.

Rider Michael received motorcycle Honda.

Rider Peter received motorcycle Suziki.

Rider Michael added in Imola race.

Rider Peter added in Imola race.

Rider Peter wins Imola race.

Rider Kevin is second in Imola race.

Rider Michael is third in Imola race.

5. Task 3: Unit Tests (100 points)

You will receive a skeleton with RaceEntry, UnitMotorcycle and UnitRider classes inside. The class will have some methods, properties, fields and one constructor, which are working properly. You are NOT ALLOWED to change any class. Cover the whole class (RaceEntry) with unit tests to make sure that the class is working as intended.

You are provided with a unit test project in the project skeleton. DO NOT modify its NuGet packages.

Note: The **TheRace** you need to test is in the **global namespace**, so **remove any using statements**, pointing towards the namespace **TheRace**.

Do **NOT** use **Mocking** in your unit tests!

















