# Object-Oriented Programming – Practical Exam

## Problem 1 – Cosmetics Shop

Enough with these silly games – StarCraft, MarCraft...! This ain’t nerd academy! Let’s do something for the girls! We need to create an online cosmetics shop! And by “we”, I mean “ you”! :D

In the shop there are currently two types of **products**: **shampoos** and **toothpastes**. Each **product** has **name**, **brand**, **price** and **gender** (men, women, unisex). Each **shampoo** has **quantity** (in milliliters) and **usage** (every day or medical). All shampoos’ price is per milliliter. Toothpastes have **ingredients**. There are **categories** of products. Each **category** has **name** and products can be **added** or **removed**. The same product can be added to a category more than once. There is also a **shopping cart**. Products can be **added** or **removed** from it. The same product can be added to the shopping cart more than once. The shopping cart can calculate the **total price** of all products in it.

### Design the Class Hierarchy

Your **task** is to **design an object-oriented class hierarchy** to model the cosmetics shop, **using the best practices for object-oriented design (OOD) and object-oriented programming (OOP)**. Avoid duplicated code though abstraction, inheritance, and polymorphism and encapsulate correctly all fields.

You are given few C# **interfaces** that you should **obligatory** implement and use as a basis of your code:

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| --- |
| namespace Cosmetics.Contracts  {  public interface ICategory  {  string Name { get; }  void AddCosmetics(IProduct cosmetics);  void RemoveCosmetics(IProduct cosmetics);  string Print();  }  public interface ICosmeticsFactory  {  ICategory CreateCategory(string name);  IShampoo CreateShampoo(string name, string brand, decimal price, GenderType gender,  uint milliliters, UsageType usage);  IToothpaste CreateToothpaste(string name, string brand, decimal price,  GenderType gender, IList<string> ingredients);  IShoppingCart ShoppingCart();  }  public interface IProduct  {  string Name { get; }  string Brand { get; }  decimal Price { get; }  GenderType Gender { get; }  string Print();  }  public interface IShampoo : IProduct  {  uint Milliliters { get; }  UsageType Usage { get; }  }  public interface IToothpaste : IProduct  {  string Ingredients { get; }  }  public interface IShoppingCart  {  void AddProduct(IProduct product);  void RemoveProduct(IProduct product);  bool ContainsProduct(IProduct product);  decimal TotalPrice();  }  } |

Categories should implement **ICategory**. Adding the same product to one category more than once is allowed.

Minimum category name’s length length is 2 symbols and maximum is 15 symbols. The error message should be "Category name must be between {min} and {max} symbols long!".

Products in category should be sorted by brand in ascending order and then by price in descending order.

When removing product from category, if the product is not found, the error message should be "Product {product name} does not exist in category {category name}!".

Category’s print method should return text in the following format:

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| --- |
| ***{category name} category – {number of products} products/product in total***  ***- {product brand} – {product name}:***  ***\* Price: ${product price}***  ***\* For gender: Men/Women/Unisex***  ***\* Ingredients: {product ingredients, separated by “, “}* (when applicable)**  ***- {product brand} – {product name}:***  ***\* Price: ${product price}***  ***\* For gender: {product gender}***  ***\* Quantity: {product quantity} ml* (when applicable)**  ***\* Usage: EveryDay/Medical* (when applicable)** |

All products should implement the **IProduct** interface.

Minimum product name’s length is 3 symbols and maximum is 10 symbols. The error message should be "Product name must be between {min} and {max} symbols long!".

Minimum brand name’s length is 2 symbols and maximum is 10 symbols. The error message should be "Product brand must be between {min} and {max} symbols long!".

Gender type can be “Men”, “Women” or “Unisex”.

All shampoos should implement the **IShampoo** interface. **Shampoo’s price is given per milliliter.** Usage type can be “EveryDay” or “Medical”.

All toothpastes should implement the **IToothpaste** interface. Ingredients should be represented as text, joined in their order of addition, separated by “, “ (comma and space). Each ingredient name’s length should be between 4 and 12 symbols, inclusive. The error message should be "Each ingredient must be between {min} and {max} symbols long!".

Shopping cart should implement the **IShoppingCart** interface. Adding the same product more than once is allowed. Do not check if the product exists, when removing it from the shopping cart.

Look into the example below to get better understanding of the printing format.

All number type fields should be printed “**as is**”, without any formatting or rounding.

All properties in the above interfaces are mandatory (cannot be null or empty).

If a null value is passed to some mandatory property, your program should throw a proper exception.

### Additional Notes

To simplify your work you are given an already built execution engine that executes a sequence of commands read from the console using the classes and interfaces in your project (see the Cosmetics-Skeleton folder). Please, put your classes in namespace **Cosmetics.Products**. Implement the **CosmeticsFactory** class in the namespace **Cosmetics.Engine**.

You are only **allowed to write classes**. You are **not allowed to modify the existing interfaces and classes except the CosmeticsFactory class**.

Current implemented commands the engine supports are:

* **CreateCategory (name)** – adds a category with given name. Duplicate names are not allowed
* **AddToCategory (categoryName) (productName)** – adds a product to a category, if both are already created in the program
* **RemoveFromCategory (categoryName) (productName)** – removes a product from a category, if both are already created in the program
* **ShowCategory (categoryName)** – prints the category and all products in it
* **CreateShampoo (name) (brand) (price) (gender) (milliliters) (usage)** – parses the input and creates shampoo. Duplicate names are not allowed
* **CreateToothpaste (name) (brand) (price) (gender) (ingredients) –** parses the input and creates toothpaste. Ingredients are comma separated. Duplicate names are not allowed
* **AddToShoppingCart (productName) –** adds a product to the shopping cart, if the product is already created
* **RemoveFromShoppingCart (productName) –** removes a product from the shopping cart, if the product is created and is already in the shopping cart
* **TotalPrice –** return the total price of all products in the shopping cart

All commands return appropriate success messages. In case of invalid operation or error, the engine returns appropriate error messages.

### Sample Input

|  |
| --- |
| **CreateCategory ForMale**  **ShowCategory ForMale**  **CreateCategory a**  **CreateCategory qwertyuiopasdfghjklzxcvbnm**  **CreateCategory ForMale**  **CreateToothpaste White+ Colgate 15.50 men fluor,bqla,golqma**  **CreateToothpaste W Colgate 15.50 men fluor,bqla,golqma**  **CreateToothpaste White+White+White+White+White+ Colgate 15.50 men fluor,bqla,golqma**  **CreateToothpaste White+ Colgate 15.50 men fluor,bqla,golqma**  **CreateToothpaste White+++ C 15.50 men fluor,bqla,golqma**  **CreateToothpaste White++++ ColgateColgateColgateColgate 15.50 men fluor,bqla,golqma**  **CreateCategory ForMale**  **ShowCategory ForMale**  **CreateShampoo Cool Nivea 0.50 men 500 everyday**  **CreateToothpaste White+ Colgate 15.50 men fluor,bqla,golqma**  **AddToCategory ForMale Cool**  **ShowCategory ForMale**  **AddToCategory ForMale White+**  **ShowCategory ForMale**  **CreateToothpaste White- Colgate 19.50 men fluor,bqla,golqma**  **AddToCategory ForMale White-**  **ShowCategory ForMale**  **RemoveFromCategory ForMale Cool**  **ShowCategory ForMale**  **RemoveFromCategory ForMale White+**  **ShowCategory ForMale**  **CreateCategory ForMale**  **ShowCategory ForMale**  **CreateShampoo Cool Nivea 0.50 men 500 everyday**  **CreateToothpaste White+ Colgate 15.50 men fluor,bqla,golqma**  **AddToCategory ForMale Cool**  **ShowCategory ForMale**  **AddToCategory ForMale White+**  **ShowCategory ForMale**  **CreateToothpaste White- Colgate 19.50 men fluor,bqla,golqma**  **AddToCategory ForMale White-**  **ShowCategory ForMale**  **CreateToothpaste White+ Colgate 15.50 men fluor,bqla,golqma**  **AddToShoppingCart White+**  **CreateShampoo Cool Nivea 0.50 men 500 everyday**  **AddToShoppingCart Cool**  **CreateToothpaste White+ Colgate 15.50 men fluor,bqla,golqma**  **AddToShoppingCart White+**  **CreateShampoo Cool Nivea 0.50 men 500 everyday**  **RemoveFromShoppingCart Cool**  **RemoveFromShoppingCart White+**  **CreateToothpaste White+ Colgate 15.50 men fluor,bqla,golqma**  **AddToShoppingCart White+**  **CreateShampoo Cool Nivea 0.50 men 500 everyday**  **AddToShoppingCart Cool**  **TotalPrice** |

### Sample Output

|  |
| --- |
| **Category with name ForMale was created!**  **ForMale category - 0 products in total**  **Category name must be between 2 and 15 symbols long!**  **Category name must be between 2 and 15 symbols long!**  **Category with name ForMale already exists!**  **Toothpaste with name White+ was created!**  **Product name must be between 3 and 10 symbols long!**  **Product name must be between 3 and 10 symbols long!**  **Toothpaste with name White+ already exists!**  **Product brand must be between 2 and 10 symbols long!**  **Product brand must be between 2 and 10 symbols long!**  **Category with name ForMale already exists!**  **ForMale category - 0 products in total**  **Shampoo with name Cool was created!**  **Toothpaste with name White+ already exists!**  **Product Cool added to category ForMale!**  **ForMale category - 1 product in total**  **- Nivea - Cool:**  **\* Price: $250.00**  **\* For gender: Men**  **\* Quantity: 500 ml**  **\* Usage: EveryDay**  **Product White+ added to category ForMale!**  **ForMale category - 2 products in total**  **- Colgate - White+:**  **\* Price: $15.50**  **\* For gender: Men**  **\* Ingredients: fluor, bqla, golqma**  **- Nivea - Cool:**  **\* Price: $250.00**  **\* For gender: Men**  **\* Quantity: 500 ml**  **\* Usage: EveryDay**  **Toothpaste with name White- was created!**  **Product White- added to category ForMale!**  **ForMale category - 3 products in total**  **- Colgate - White-:**  **\* Price: $19.50**  **\* For gender: Men**  **\* Ingredients: fluor, bqla, golqma**  **- Colgate - White+:**  **\* Price: $15.50**  **\* For gender: Men**  **\* Ingredients: fluor, bqla, golqma**  **- Nivea - Cool:**  **\* Price: $250.00**  **\* For gender: Men**  **\* Quantity: 500 ml**  **\* Usage: EveryDay**  **Product Cool removed from category ForMale!**  **ForMale category - 2 products in total**  **- Colgate - White-:**  **\* Price: $19.50**  **\* For gender: Men**  **\* Ingredients: fluor, bqla, golqma**  **- Colgate - White+:**  **\* Price: $15.50**  **\* For gender: Men**  **\* Ingredients: fluor, bqla, golqma**  **Product White+ removed from category ForMale!**  **ForMale category - 1 product in total**  **- Colgate - White-:**  **\* Price: $19.50**  **\* For gender: Men**  **\* Ingredients: fluor, bqla, golqma**  **Category with name ForMale already exists!**  **ForMale category - 1 product in total**  **- Colgate - White-:**  **\* Price: $19.50**  **\* For gender: Men**  **\* Ingredients: fluor, bqla, golqma**  **Shampoo with name Cool already exists!**  **Toothpaste with name White+ already exists!**  **Product Cool added to category ForMale!**  **ForMale category - 2 products in total**  **- Colgate - White-:**  **\* Price: $19.50**  **\* For gender: Men**  **\* Ingredients: fluor, bqla, golqma**  **- Nivea - Cool:**  **\* Price: $250.00**  **\* For gender: Men**  **\* Quantity: 500 ml**  **\* Usage: EveryDay**  **Product White+ added to category ForMale!**  **ForMale category - 3 products in total**  **- Colgate - White-:**  **\* Price: $19.50**  **\* For gender: Men**  **\* Ingredients: fluor, bqla, golqma**  **- Colgate - White+:**  **\* Price: $15.50**  **\* For gender: Men**  **\* Ingredients: fluor, bqla, golqma**  **- Nivea - Cool:**  **\* Price: $250.00**  **\* For gender: Men**  **\* Quantity: 500 ml**  **\* Usage: EveryDay**  **Toothpaste with name White- already exists!**  **Product White- added to category ForMale!**  **ForMale category - 4 products in total**  **- Colgate - White-:**  **\* Price: $19.50**  **\* For gender: Men**  **\* Ingredients: fluor, bqla, golqma**  **- Colgate - White-:**  **\* Price: $19.50**  **\* For gender: Men**  **\* Ingredients: fluor, bqla, golqma**  **- Colgate - White+:**  **\* Price: $15.50**  **\* For gender: Men**  **\* Ingredients: fluor, bqla, golqma**  **- Nivea - Cool:**  **\* Price: $250.00**  **\* For gender: Men**  **\* Quantity: 500 ml**  **\* Usage: EveryDay**  **Toothpaste with name White+ already exists!**  **Product White+ was added to the shopping cart!**  **Shampoo with name Cool already exists!**  **Product Cool was added to the shopping cart!**  **Toothpaste with name White+ already exists!**  **Product White+ was added to the shopping cart!**  **Shampoo with name Cool already exists!**  **Product Cool was removed from the shopping cart!**  **Product White+ was removed from the shopping cart!**  **Toothpaste with name White+ already exists!**  **Product White+ was added to the shopping cart!**  **Shampoo with name Cool already exists!**  **Product Cool was added to the shopping cart!**  **$546.50 total price currently in the shopping cart!** |