# Object-Oriented Programming – Practical Exam

## Furniture

A furniture manufacturer keeps track of their **companies** and **furniture**: **tables** and **chairs**. Each furniture piece has **model**, **material**, **price** in dollars, and **height** in meters. Each table has **length** and **width** in meters. Chairs are three types: **normal**, **adjustable** and **convertible**. Each chair has **number of legs**. Each adjustable chair can **adjust** its height. Each convertible chair can **convert** its state and be easily movable. Each company has **name**, **registration number** and **catalog of furniture**. Companies can **add** or **remove** furniture to their catalogs. Companies can **find** furniture by model. Companies can **show catalogs** of all furniture they offer.

### Design the Class Hierarchy

Your **task** is to **design an object-oriented class hierarchy** to model the furniture manufacturer, companies and all types of furniture **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 a few C# **interfaces** that you should **obligatory** implement and use as a basis of your code:

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| --- |
| namespace FurnitureManufacturer.Interfaces  {  public interface ICompany  {  string Name { get; }  string RegistrationNumber { get; }  ICollection<IFurniture> Furnitures { get; }  void Add(IFurniture furniture);  void Remove(IFurniture furniture);  IFurniture Find(string model);  string Catalog();  }  public interface IFurniture  {  string Model { get; }  string Material { get; }  decimal Price { get; set; }  decimal Height { get; }  }  public interface IChair : IFurniture  {  int NumberOfLegs { get; }  }  public interface ITable : IFurniture  {  decimal Length { get; }  decimal Width { get; }  decimal Area { get; }  }  public interface IAdjustableChair : IChair  {  void SetHeight(decimal height);  }  public interface IConvertibleChair : IChair  {  bool IsConverted { get; }  void Convert();  }  } |

All your furniture should implement **IFurniture**. Tables should implement **ITable**, chairs should implement **IChair**, adjustable chairs should implement **IAdjustableChair** and convertible chairs should implement **IConvertibleChair**. Companies should implement **ICompany**.

**Furniture** validity rules:

* Model cannot be empty, null or with less than 3 symbols.
* Price cannot be less or equal to $0.00.
* Height cannot be less or equal to 0.00 m.

**Table** validity rules:

* Can calculate area by the following formula: length \* width.

**Adjustable chair** validity rules:

* Can change the height to a new valid one.

**Convertible chair** validity rules:

* Has two states: converted and normal.
* States can be changed by converting the chair from one to another
  + When the chair is in normal state is becomes converted.
  + When the chair is in converted state is becomes normal.
* In converted state the height is temporary changed to 0.10.
* In normal state the height returned back to its initial value.
* The initial state is normal.

**Company** validity rules:

* Name cannot be empty, null or with less than 5 symbols.
* Registration number must be exactly 10 symbols and must contain only digits.
* Adding duplicate furniture is allowed.
* Removing furniture removes the first occurrence. If such is not found, nothing happens.
* Finding furniture by model gets the first occurrence. If such is not found, return null. Searching is case insensitive.

Companies should only be created through the **ICompanyFactory** implemented by a class named **CompanyFactory**. Furniture should only be created through the **IFurnitureFactory** implemented by a class named **FurnitureFactory**. Both classes are in the **FurnitureManufacturer.Engine.Factories** namespace.

The company catalog method returns the information about the available furniture in the following form:

|  |
| --- |
| ***(company name)* – *(number of furniture/"no")* *("furniture"/"furnitures")***  **(*information about furniture)***  **(*information about furniture)***  **(*information about furniture)*** |

The listed furniture added to a certain company (through the **Add(…)** method) should be ordered by price then by model. If the company has no furniture added, print **"no furnitures"** (yes, we know "furnitures" is not a valid word, but we do not care, obey the requirements :D ). If the company has 1 piece of furniture, print **"1 furniture"** and show its information on a separate line. If the company has more than 1 piece of furniture, print its number and list each one’s information on a separate line. All decimal type fields should be printed "as is", without any formatting or rounding.

You may use the following for reference:

|  |
| --- |
| **"{0} - {1} - {2} {3}",**  **this.Name, this.RegistrationNumber,**  **this.Furnitures.Count != 0 ? this.Furnitures.Count.ToString() : "no",**  **this.Furnitures.Count != 1 ? "furnitures" : "furniture"** |

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

The **table** information should be in the following form:

|  |
| --- |
| **"Type: {0}, Model: {1}, Material: {2}, Price: {3}, Height: {4}, Length: {5}, Width: {6}, Area: {7}", this.GetType().Name, this.Model, this.Material, this.Price, this.Height, this.Length, this.Width, this.Area** |

The **normal** and **adjustable chair** information should be in the following form:

|  |
| --- |
| **"Type: {0}, Model: {1}, Material: {2}, Price: {3}, Height: {4}, Legs: {5}", this.GetType().Name, this.Model, this.Material, this.Price, this.Height, this.NumberOfLegs** |

The **convertible chair** information should be in the following form:

|  |
| --- |
| **"Type: {0}, Model: {1}, Material: {2}, Price: {3}, Height: {4}, Legs: {5}, State: {6}", this.GetType().Name, this.Model, this.Material, this.Price, this.Height, this.NumberOfLegs, this.IsConverted ? "Converted" : "Normal"** |

The Type is either "**Table**", or "**Chair**", or "**AdjustableChair**" or "**ConvertibleChair**". The convertible chair state is either "**Converted**" or "**Normal**". All decimal 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, you should use **defensive programming** to prevent unwanted results.

### Additional Notes

To simplify your work you are given an engine that executes a sequence of commands read from the console using the classes and interfaces in your project. Please put your classes in namespace **FurnitureManufacturer.Models**. Implement the **CompanyFactory** and **FurnitureFactory** class in the namespace **FurnitureManufacturer.Engine.Factories**.

You are only **allowed to write classes in the FurnitureManufacturer.Models namespace**. You are **not allowed to modify the existing interfaces and classes except the CompanyFactory and FurnitureFactory classes**. You may delete the **DeleteMe.cs** file. ☺

Current implemented commands the engine supports are:

* **CreateCompany (name) (registration number)** – adds a company with given name and registration number. Duplicate names are not allowed. As a result the command returns "**Company (name) created**".
* **AddFurnitureToCompany (company name) (furniture model)** – searches for furniture and adds it to an existing company’s catalog. As a result the command returns "**Furniture (furniture model) added to company (company name)**".
* **RemoveFurnitureFromCompany (company name) (furniture model)** – searches for furniture and removes it from an existing company’s catalog. As a result the command returns "**Furniture (furniture model) removed from company (company name)**".
* **FindFurnitureFromCompany (company name) (furniture model)** – searches for furniture in an existing company’s catalog. If found the engine prints the furniture’s ToString() method.
* **ShowCompanyCatalog (company name)** – searches for a company and invokes it’s Catalog() method.
* **CreateTable (model) (material) (price) (height) (length) (width)** – creates a table with given model, material, price, height, length and width. Duplicate models are not allowed. As a result the command returns "**Table (model) created**".
* **CreateChair (model) (material) (price) (height) (legs) (type)** – creates a chair by given model, material, price, height, legs and type. Type can be "**Normal**", "**Adjustable**" and "**Convertible**". Duplicate models are not allowed. As a result the command returns "**Chair (model) created**".
* **SetChairHeight (model) (height)** – searches for a chair by model and sets its height, if the chair is adjustable. As a result the command returns "**Chair (model) adjusted to height (height)**".
* **ConvertChair (model)** – searches for a chair by model and converts its state, if the chair is convertible. As a result the command returns "**Chair (model) converted**".

In case of an invalid operation or error, the engine returns appropriate text messages.

### Sample Input

|  |
| --- |
| CreateCompany DivansLtd 1234567890  CreateCompany UniPlus 0987654321  ShowCompanyCatalog DivansLtd  CreateTable MyTable wooden 123.4 0.50 0.45 0.65  CreateChair MyChair leather 99.99 1.20 5 Normal  CreateChair TroyanDivan leather 111.56 0.80 4 Adjustable  CreateChair PlovdivStool plastic 80.00 1.00 3 Convertible  CreateChair ZZComfortableChair leather 111.56 0.80 4 Normal  ShowCompanyCatalog UniPlus  AddFurnitureToCompany UniPlus MyTable  AddFurnitureToCompany UniPlus ZZComfortableChair  AddFurnitureToCompany UniPlus MyTable  AddFurnitureToCompany UniPlus TroyanDivan  ShowCompanyCatalog UniPlus  ShowCompanyCatalog DivansLtd  AddFurnitureToCompany DivansLtd MyTable  AddFurnitureToCompany DivansLtd MyChair  AddFurnitureToCompany DivansLtd PlovdivStool  AddFurnitureToCompany DivansLtd TroyanDivan  ShowCompanyCatalog DivansLtd  ShowCompanyCatalog UniPlus  RemoveFurnitureFromCompany UniPlus MyTable  ShowCompanyCatalog UniPlus  FindFurnitureFromCompany UniPlus MyTable  FindFurnitureFromCompany UniPlus TroyanDivan  RemoveFurnitureFromCompany DivansLtd TroyanDivan  RemoveFurnitureFromCompany DivansLtd TroyanDivan  ShowCompanyCatalog DivansLtd  FindFurnitureFromCompany DivansLtd TroyanDivan  FindFurnitureFromCompany DivansLtd PlovdivStool  FindFurnitureFromCompany DivansLtd MyChair  CreateCompany FurnitureEverywhere 6677889900  CreateChair PeterChair plastic 0.99 0.67 4 Adjustable  AddFurnitureToCompany FurnitureEverywhere PeterChair  SetChairHeight PeterChair 1.11  FindFurnitureFromCompany FurnitureEverywhere PeterChair  CreateChair GeorgeChair wooden 1.99 0.95 1 Convertible  AddFurnitureToCompany FurnitureEverywhere GeorgeChair  ConvertChair GeorgeChair  FindFurnitureFromCompany FurnitureEverywhere GeorgeChair  ConvertChair GeorgeChair  FindFurnitureFromCompany FurnitureEverywhere GeorgeChair  ConvertChair GeorgeChair  ShowCompanyCatalog FurnitureEverywhere |

### Sample Output

|  |
| --- |
| Company DivansLtd created  Company UniPlus created  DivansLtd - 1234567890 - no furnitures  Table MyTable created  Chair MyChair created  Chair TroyanDivan created  Chair PlovdivStool created  Chair ZZComfortableChair created  UniPlus - 0987654321 - no furnitures  Furniture MyTable added to company UniPlus  Furniture ZZComfortableChair added to company UniPlus  Furniture MyTable added to company UniPlus  Furniture TroyanDivan added to company UniPlus  UniPlus - 0987654321 - 4 furnitures  Type: AdjustableChair, Model: TroyanDivan, Material: Leather, Price: 111.56, Height: 0.80, Legs: 4  Type: Chair, Model: ZZComfortableChair, Material: Leather, Price: 111.56, Height: 0.80, Legs: 4  Type: Table, Model: MyTable, Material: Wooden, Price: 123.4, Height: 0.50, Length: 0.45, Width: 0.65, Area: 0.2925  Type: Table, Model: MyTable, Material: Wooden, Price: 123.4, Height: 0.50, Length: 0.45, Width: 0.65, Area: 0.2925  DivansLtd - 1234567890 - no furnitures  Furniture MyTable added to company DivansLtd  Furniture MyChair added to company DivansLtd  Furniture PlovdivStool added to company DivansLtd  Furniture TroyanDivan added to company DivansLtd  DivansLtd - 1234567890 - 4 furnitures  Type: ConvertibleChair, Model: PlovdivStool, Material: Plastic, Price: 80.00, Height: 1.00, Legs: 3, State: Normal  Type: Chair, Model: MyChair, Material: Leather, Price: 99.99, Height: 1.20, Legs: 5  Type: AdjustableChair, Model: TroyanDivan, Material: Leather, Price: 111.56, Height: 0.80, Legs: 4  Type: Table, Model: MyTable, Material: Wooden, Price: 123.4, Height: 0.50, Length: 0.45, Width: 0.65, Area: 0.2925  UniPlus - 0987654321 - 4 furnitures  Type: AdjustableChair, Model: TroyanDivan, Material: Leather, Price: 111.56, Height: 0.80, Legs: 4  Type: Chair, Model: ZZComfortableChair, Material: Leather, Price: 111.56, Height: 0.80, Legs: 4  Type: Table, Model: MyTable, Material: Wooden, Price: 123.4, Height: 0.50, Length: 0.45, Width: 0.65, Area: 0.2925  Type: Table, Model: MyTable, Material: Wooden, Price: 123.4, Height: 0.50, Length: 0.45, Width: 0.65, Area: 0.2925  Furniture MyTable removed from company UniPlus  UniPlus - 0987654321 - 3 furnitures  Type: AdjustableChair, Model: TroyanDivan, Material: Leather, Price: 111.56, Height: 0.80, Legs: 4  Type: Chair, Model: ZZComfortableChair, Material: Leather, Price: 111.56, Height: 0.80, Legs: 4  Type: Table, Model: MyTable, Material: Wooden, Price: 123.4, Height: 0.50, Length: 0.45, Width: 0.65, Area: 0.2925  Type: Table, Model: MyTable, Material: Wooden, Price: 123.4, Height: 0.50, Length: 0.45, Width: 0.65, Area: 0.2925  Type: AdjustableChair, Model: TroyanDivan, Material: Leather, Price: 111.56, Height: 0.80, Legs: 4  Furniture TroyanDivan removed from company DivansLtd  Furniture TroyanDivan removed from company DivansLtd  DivansLtd - 1234567890 - 3 furnitures  Type: ConvertibleChair, Model: PlovdivStool, Material: Plastic, Price: 80.00, Height: 1.00, Legs: 3, State: Normal  Type: Chair, Model: MyChair, Material: Leather, Price: 99.99, Height: 1.20, Legs: 5  Type: Table, Model: MyTable, Material: Wooden, Price: 123.4, Height: 0.50, Length: 0.45, Width: 0.65, Area: 0.2925  Furniture TroyanDivan not found  Type: ConvertibleChair, Model: PlovdivStool, Material: Plastic, Price: 80.00, Height: 1.00, Legs: 3, State: Normal  Type: Chair, Model: MyChair, Material: Leather, Price: 99.99, Height: 1.20, Legs: 5  Company FurnitureEverywhere created  Chair PeterChair created  Furniture PeterChair added to company FurnitureEverywhere  Chair PeterChair adjusted to height 1.11  Type: AdjustableChair, Model: PeterChair, Material: Plastic, Price: 0.99, Height: 1.11, Legs: 4  Chair GeorgeChair created  Furniture GeorgeChair added to company FurnitureEverywhere  Chair GeorgeChair converted  Type: ConvertibleChair, Model: GeorgeChair, Material: Wooden, Price: 1.99, Height: 0.10, Legs: 1, State: Converted  Chair GeorgeChair converted  Type: ConvertibleChair, Model: GeorgeChair, Material: Wooden, Price: 1.99, Height: 0.95, Legs: 1, State: Normal  Chair GeorgeChair converted  FurnitureEverywhere - 6677889900 - 2 furnitures  Type: AdjustableChair, Model: PeterChair, Material: Plastic, Price: 0.99, Height: 1.11, Legs: 4  Type: ConvertibleChair, Model: GeorgeChair, Material: Wooden, Price: 1.99, Height: 0.10, Legs: 1, State: Converted |