

# Lab 5 in TND002

Mark Eric Dieckmann

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## 1 Summary

The purpose of this lab is to use an abstract superclass and method, the interface **Comparable<T>**, and an interface you wrote yourself. We use these to develop a code framework with which an estate agent can store and sort buildings, which are for sale. We distinguish between apartments, villas, and cottages. All three building types share the abstract superclass **Building**, which implements the interface **Comparable<T>**. Apartments and Villas also implement the interface **CityProperty**. The class **EstateAgent** maintains a dynamic array with all the buildings that are for sale and can sort and list them.

## 2 Task: Implement *Building* and its subclass *Cottage*

<i>Building</i>
-address : String
-price : double
#squareMeters : int
# <u>selection</u> : int
+Building(String, double, int)
+ <i>maintenance()</i> : double
+compareTo(Building) : int
+toString() : String

The values of *address*, *price*, and *squareMeters* are initialized with the constructor arguments. *selection* is initialized to 1 when we declare it.

*maintenance()* has no code body and is implemented in the subclasses.

*compareTo(arg)* is inherited from the interface **Comparable<T>** and implemented here for instances of **Building**. It should return the values 0, -1, or 1, depending on how the value of the calling instance compares to that of *arg*.

This method should compare the values of *price* if *selection* = 1 and otherwise the values of *squareMeters*.

*toString()* should return the formatted string "Address:" followed by the value of *address* on 16 characters space, followed by "Living area:" followed by the integer value of *squareMeters* on 4 characters, followed by "Price:" followed by the float value of *price* on 10 characters space, 2 after the ',' followed by "Maintenance (per month):" followed

by the return value of *maintenance()* on 7 float characters (2 after the ',') (See also console output). We will expand the return value by a second line in a later task.

The class **Cottage** is the simplest subclass of *Building*.

Cottage
-electricity : double
+Cottage(String, double, int, double)
+maintenance() : double

The only monthly cost for a cottage is the value of *electricity*.

The constructor calls that of the super-class with the first three arguments and initializes *electricity* with its fourth.

*maintenance()* returns the value of *electricity*.

Uncomment the first two lines of **Lab5**. You should get the console output:

```
Address: Vildmarkvägen 1, Living area: 100, Price: 850000,00, Maintenance (per month): 100,00
```

### 3 Task: Implement the interface CityProperty, and Apartment + Villa

The interface *CityProperty* has the abstract method *computePropertyTax()*, which returns a double. Owners of villas and apartments need to pay property tax and, hence, the corresponding classes must implement this interface. The classes **Villa** and **Apartment** are also subclasses of *Building*.

Apartment
-monthlyFee: double
-bedrooms : int
+Apartment(String, double, int, double, int)
+getBedrooms() : int
+computePropertyTax() : double
+maintenance() : double

The constructor calls that of the super-class with the first three arguments. It initializes the values of *monthlyFee* and *bedrooms* with the last two.

*getBedrooms()* returns *bedrooms*.

*maintenance()* returns *monthlyFee*.

*computePropertyTax()* returns (10 \* squareMeters + 50 \* bedrooms).

Villa
-electricity, heating : double
-bedrooms : int
+Villa(String, double, int, double, double, int)
+getBedrooms() : int
+maintenance() : double
+computePropertyTax() : double

The constructor calls that of the super-class with the first three arguments. It initializes *electricity*, *heating*, and *bedrooms* with the last three.

*getBedrooms()* returns *bedrooms*.

*maintenance()* returns the sum (*electricity* + *heating*).

*computePropertyTax()* returns (20 \* squareMeters + 100 \* bedrooms).

Once you implemented both subclasses of *Building*, you can expand its *toString()* method. If the object you are in is an instance of **CityProperty**, then it should add

the line "Property tax: " followed by the return value of *computePropertyTax()* to the return string. If the object you are in is an instance of **Cottage**, you should attach a blank line.

If you uncomment the related diagnostics in **Lab5**, you should get the console output:

```
Address: Vildmarkvägen 1, Living area: 100, Price: 850000,00, Maintenance (per month): 100,00

Address:   Kungsgatan 7, Living area: 115, Price:2500000,00, Maintenance (per month):6400,00
Property tax: 1300.0

Address:   Villavägen 13, Living area: 180, Price:6700000,00, Maintenance (per month):3500,00
Property tax: 4000.0
```

## 4 Task: Implement EstateAgent

EstateAgent
<u>+ALLBUILDINGS, CITYBUILDINGS, COTTAGES : int</u> +NAME : String -theBuildings : ArrayList<Building> -theCityBuildings : ArrayList<CityProperty> -theCottages : ArrayList<Cottage>
+EstateAgent(String) +addBuilding(Building) : String +sort(int) : String +updateLists() : void +updateLists(int) : void +toString() : String

This class has the class constants *ALLBUILDINGS*, *CITYBUILDINGS*, and *COTTAGES* with the values 1, 2, 3.

The 3 dynamic arrays are initialized when you declare them.

The constant *NAME* is initialized with the constructor's argument.

*addBuilding(arg)* adds *arg* to *theBuildings*. Depending on if *arg* is a cottage or a city building, it is also added to the appropriate dynamic array. It should return either "Added city building" or "Added cottage".

*sort(arg)* should ask you with a pop-up window if you want to sort by price or area asking "Sorting by price (1) or area (2)?". It should set the value of the class variable of *Building* to this value (if it is 1 or 2).

If the value of *arg* is *ALLBUILDINGS*, then it should sort *theBuildings* and call the method *updateLists()*.

If the value of *arg* is *COTTAGES*, then *sort(arg)* should sort *theCottages* and call *updateLists(COTTAGES)*.

If the value of *arg* is *CITYBUILDINGS*, then *sort(arg)* should sort *theCityBuildings* and call *updateLists(CITYBUILDINGS)*. You will not be able to sort *theCityBuildings* because you cannot apply *Collections.sort()* to arrays of interfaces. You need to deep-copy it to an array of **Building**, sort it, and deep-copy it back after that.

*sort(arg)* should return "Sorted by price", "Sorted by area" or "Not sorted" followed by a line break, depending on the value you entered in the pop-up window.

*updateLists()* should update the order of the cottages and city buildings in the arrays *theCottages* and *theCityBuildings* such that they match that in *theBuildings*.

*updateLists(arg)* changes the ordering of the cottages in *theBuildings* based on the ordering in *theCottages* if *arg* is *COTTAGES*. If *arg* is *CITYBUILDINGS*, then it changes the ordering of the city buildings in *theBuildings* based on that in *theCityBuildings*.

*toString()* should return "Estate agent: " followed by the value of *NAME* and a line break. Then you attach the string "All buildings" followed by a line break followed by the return values of all elements of *theBuildings*. Note that each of these return strings has two lines. Cottages have a second blank line so that we can distinguish them from villas and apartments.

Then you attach "Cottages" preceded and followed by line breaks. This string is followed by the return values of the *toString()* methods of all elements of *theCottages*.

Finally, you attach the string "Villas and apartments" preceded and followed by a line break and followed by the return values of the *toString()* methods of all elements of *theCityBuildings*.

The section in **Lab5** labeled "Diagnostics for the estate agent" should give you the output on the next page. The sorting methods (sort by price) should give you the outputs on the follow-up pages (test also sort by area).

Estate agent: Watson Property

#### All buildings

Address: Kungsgatan 7, Living area: 115, Price:2500000,00, Maintenance (per month):6400,00  
Property tax: 1300.0

Address: Villavägen 13, Living area: 180, Price:6700000,00, Maintenance (per month):3500,00  
Property tax: 4000.0

Address: Vildmarkvägen 1, Living area: 100, Price: 850000,00, Maintenance (per month): 100,00

Address: Ektorpgatan 28, Living area: 92, Price:2000000,00, Maintenance (per month):5300,00  
Property tax: 1070.0

Address: Hagavägen, Living area: 62, Price:1600000,00, Maintenance (per month):4500,00  
Property tax: 670.0

Address: Kneippgatan 3, Living area: 210, Price:7900000,00, Maintenance (per month):3600,00  
Property tax: 4700.0

Address: Vätternsgatan 18, Living area: 190, Price:9000000,00, Maintenance (per month):3100,00  
Property tax: 4500.0

Address: Rydgatan 4, Living area: 80, Price: 500000,00, Maintenance (per month): 200,00

Address: Sjövägen 22, Living area: 70, Price: 620000,00, Maintenance (per month): 400,00

Address: Lindövägen 18, Living area: 80, Price: 950000,00, Maintenance (per month): 200,00

#### Cottages

Address: Vildmarkvägen 1, Living area: 100, Price: 850000,00, Maintenance (per month): 100,00

Address: Rydgatan 4, Living area: 80, Price: 500000,00, Maintenance (per month): 200,00

Address: Sjövägen 22, Living area: 70, Price: 620000,00, Maintenance (per month): 400,00

Address: Lindövägen 18, Living area: 80, Price: 950000,00, Maintenance (per month): 200,00

#### Villas and apartments

Address: Kungsgatan 7, Living area: 115, Price:2500000,00, Maintenance (per month):6400,00  
Property tax: 1300.0

Address: Villavägen 13, Living area: 180, Price:6700000,00, Maintenance (per month):3500,00  
Property tax: 4000.0

Address: Ektorpgatan 28, Living area: 92, Price:2000000,00, Maintenance (per month):5300,00  
Property tax: 1070.0

Address: Hagavägen, Living area: 62, Price:1600000,00, Maintenance (per month):4500,00  
Property tax: 670.0

Address: Kneippgatan 3, Living area: 210, Price:7900000,00, Maintenance (per month):3600,00  
Property tax: 4700.0

Address: Vätternsgatan 18, Living area: 190, Price:9000000,00, Maintenance (per month):3100,00  
Property tax: 4500.0



## Sorted with *ALLBUILDINGS*

Sorted by price

Estate agent: Watson Property

### All buildings

Address: Rydgatan 4, Living area: 80, Price: 500000,00, Maintenance (per month): 200,00

Address: Sjövägen 22, Living area: 70, Price: 620000,00, Maintenance (per month): 400,00

Address: Vildmarkvägen 1, Living area: 100, Price: 850000,00, Maintenance (per month): 100,00

Address: Lindövägen 18, Living area: 80, Price: 950000,00, Maintenance (per month): 200,00

Address: Hagavägen, Living area: 62, Price:1600000,00, Maintenance (per month):4500,00  
Property tax: 670.0

Address: Ektorpgatan 28, Living area: 92, Price:2000000,00, Maintenance (per month):5300,00  
Property tax: 1070.0

Address: Kungsgatan 7, Living area: 115, Price:2500000,00, Maintenance (per month):6400,00  
Property tax: 1300.0

Address: Villavägen 13, Living area: 180, Price:6700000,00, Maintenance (per month):3500,00  
Property tax: 4000.0

Address: Kneippgatan 3, Living area: 210, Price:7900000,00, Maintenance (per month):3600,00  
Property tax: 4700.0

Address: Vätternsgatan 18, Living area: 190, Price:9000000,00, Maintenance (per month):3100,00  
Property tax: 4500.0

### Cottages

Address: Rydgatan 4, Living area: 80, Price: 500000,00, Maintenance (per month): 200,00

Address: Sjövägen 22, Living area: 70, Price: 620000,00, Maintenance (per month): 400,00

Address: Vildmarkvägen 1, Living area: 100, Price: 850000,00, Maintenance (per month): 100,00

Address: Lindövägen 18, Living area: 80, Price: 950000,00, Maintenance (per month): 200,00

### Villas and apartments

Address: Hagavägen, Living area: 62, Price:1600000,00, Maintenance (per month):4500,00  
Property tax: 670.0

Address: Ektorpgatan 28, Living area: 92, Price:2000000,00, Maintenance (per month):5300,00  
Property tax: 1070.0

Address: Kungsgatan 7, Living area: 115, Price:2500000,00, Maintenance (per month):6400,00  
Property tax: 1300.0

Address: Villavägen 13, Living area: 180, Price:6700000,00, Maintenance (per month):3500,00  
Property tax: 4000.0

Address: Kneippgatan 3, Living area: 210, Price:7900000,00, Maintenance (per month):3600,00  
Property tax: 4700.0

Address: Vätternsgatan 18, Living area: 190, Price:9000000,00, Maintenance (per month):3100,00  
Property tax: 4500.0

Sorted with *COTTAGES*

Sorted by price

Estate agent: Watson Property

All buildings

Address: Kungsgatan 7, Living area: 115, Price:2500000,00, Maintenance (per month):6400,00  
Property tax: 1300.0

Address: Villavägen 13, Living area: 180, Price:6700000,00, Maintenance (per month):3500,00  
Property tax: 4000.0

Address: Rydgatan 4, Living area: 80, Price: 500000,00, Maintenance (per month): 200,00

Address: Ektorgatan 28, Living area: 92, Price:2000000,00, Maintenance (per month):5300,00  
Property tax: 1070.0

Address: Hagavägen, Living area: 62, Price:1600000,00, Maintenance (per month):4500,00  
Property tax: 670.0

Address: Kneippgatan 3, Living area: 210, Price:7900000,00, Maintenance (per month):3600,00  
Property tax: 4700.0

Address: Vätterngatan 18, Living area: 190, Price:9000000,00, Maintenance (per month):3100,00  
Property tax: 4500.0

Address: Sjövägen 22, Living area: 70, Price: 620000,00, Maintenance (per month): 400,00

Address: Vildmarkvägen 1, Living area: 100, Price: 850000,00, Maintenance (per month): 100,00

Address: Lindövägen 18, Living area: 80, Price: 950000,00, Maintenance (per month): 200,00

Cottages

Address: Rydgatan 4, Living area: 80, Price: 500000,00, Maintenance (per month): 200,00

Address: Sjövägen 22, Living area: 70, Price: 620000,00, Maintenance (per month): 400,00

Address: Vildmarkvägen 1, Living area: 100, Price: 850000,00, Maintenance (per month): 100,00

Address: Lindövägen 18, Living area: 80, Price: 950000,00, Maintenance (per month): 200,00

Villas and apartments

Address: Kungsgatan 7, Living area: 115, Price:2500000,00, Maintenance (per month):6400,00  
Property tax: 1300.0

Address: Villavägen 13, Living area: 180, Price:6700000,00, Maintenance (per month):3500,00  
Property tax: 4000.0

Address: Ektorgatan 28, Living area: 92, Price:2000000,00, Maintenance (per month):5300,00  
Property tax: 1070.0

Address: Hagavägen, Living area: 62, Price:1600000,00, Maintenance (per month):4500,00  
Property tax: 670.0

Address: Kneippgatan 3, Living area: 210, Price:7900000,00, Maintenance (per month):3600,00  
Property tax: 4700.0

Address: Vätterngatan 18, Living area: 190, Price:9000000,00, Maintenance (per month):3100,00  
Property tax: 4500.0

## Sorted with *CITYBUILDINGS*

Sorted by price

Estate agent: Watson Property

### All buildings

Address: Hagavägen, Living area: 62, Price:1600000,00, Maintenance (per month):4500,00  
Property tax: 670.0

Address: Ektorpgatan 28, Living area: 92, Price:2000000,00, Maintenance (per month):5300,00  
Property tax: 1070.0

Address: Vildmarkvägen 1, Living area: 100, Price: 850000,00, Maintenance (per month): 100,00

Address: Kungsgatan 7, Living area: 115, Price:2500000,00, Maintenance (per month):6400,00  
Property tax: 1300.0

Address: Villavägen 13, Living area: 180, Price:6700000,00, Maintenance (per month):3500,00  
Property tax: 4000.0

Address: Kneippgatan 3, Living area: 210, Price:7900000,00, Maintenance (per month):3600,00  
Property tax: 4700.0

Address: Vätterngatan 18, Living area: 190, Price:9000000,00, Maintenance (per month):3100,00  
Property tax: 4500.0

Address: Rydgatan 4, Living area: 80, Price: 500000,00, Maintenance (per month): 200,00

Address: Sjövägen 22, Living area: 70, Price: 620000,00, Maintenance (per month): 400,00

Address: Lindövägen 18, Living area: 80, Price: 950000,00, Maintenance (per month): 200,00

### Cottages

Address: Vildmarkvägen 1, Living area: 100, Price: 850000,00, Maintenance (per month): 100,00

Address: Rydgatan 4, Living area: 80, Price: 500000,00, Maintenance (per month): 200,00

Address: Sjövägen 22, Living area: 70, Price: 620000,00, Maintenance (per month): 400,00

Address: Lindövägen 18, Living area: 80, Price: 950000,00, Maintenance (per month): 200,00

### Villas and apartments

Address: Hagavägen, Living area: 62, Price:1600000,00, Maintenance (per month):4500,00  
Property tax: 670.0

Address: Ektorpgatan 28, Living area: 92, Price:2000000,00, Maintenance (per month):5300,00  
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