Praktikum Objektorientierte Programmierung in C++ (WS 2023/2024)

A5 Teil 2/Part 2

Klassenvariable/Class Variable

- Fügen Sie der Klasse **`Consumer`** eine statische private Klassenvariable hinzu. In dieser soll die Anzahl aller erzeugten Objekte, also aller Stromverbraucher insgesamt, gezählt werden. Inkrementieren Sie dazu im Rumpf des Konstruktors der Klasse diese Klassenvariable.
- Definieren Sie weiterhin eine statische öffentliche getter-Funktion dieser Klasse, die den Wert dieser Klassenvariable zurück liefert.
- Ergänzen Sie weiterhin in der Methode **`print_all`** der Klasse **`House`** eine Ausgabe, wieviele Stromverbraucher insgesamt in allen Haushalten im Haus zusammen existieren (siehe Beispiele unten)./

- Add a static private class variable to the class **`Consumer`**. The number of all created objects, i.e. all power consumers in total, should be counted in this variable. To do this, increment this class variable in the body of the constructor of the class.
- Also define a static public getter function in this class that returns the value of this class variable.
- In the **`print_all`** method of the class **`House`**, add an output of the total number of power consumers in all households in the house (see examples below).

Destruktoren/Destructors

Erweitern Sie die Klassen **`Address`**, **`Consumer`**, **`Household`** und **`House`** jeweils um einen Destruktor:

- Der Destruktor von **`Address`** soll im Rumpf die Adressdaten ausgeben, den Wert von **`this`**, und dass dieses Objekt gelöscht wird.
- Der Destruktor von **`Consumer`** soll im Rumpf die Beschreibung ausgeben, den Wert von **`this`**, und dass dieses Objekt gelöscht wird. Weiterhin soll die Anzahl der Objekte der Klasse, also die Klassenvariable, dekrementiert werden.
- Der Destruktor von **`Household`** soll im Rumpf alle Stromverbrauches des Haushalts löschen, den Wert von **`this`** ausgeben, und dass dieses Objekt gelöscht wird.
- Der Destruktor von **`House`** soll im Rumpf alle Haushalte löschen, den Wert von **`this`** ausgeben, und dass dieses Objekt gelöscht wird (siehe Beispiele unten)./

Extend the classes **`Address`**, **`Consumer`**, **`Household`** and **`House`** each with a destructor:

- The destructor of **`Address`** shall output the address data in the body, the value of **`this`**, and that this object is deleted.
- The destructor of **`Consumer`** shall output the description in the body, the value of **`this`**, and that this object is deleted. Furthermore, the number of objects in the class, i.e. the class variable, should be decremented.
  The destructor of **`Household`** shall delete all power consumers of the household in its body, output the value of **`this`**, and that this object is deleted.
- The destructor of **`House`** shall delete all households in its body, output the value of `this`, and that this object is deleted (see examples below).

Beispiel Programmlauf 1/Example Program Run 1

```
CALCULATION OF AVERAGE POWER COSTS FOR A HOUSE - CLASS VERSION
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> h
how many households does the house have? 1
what is the street name? Lotharstrasse
what is house number? 123
what is zip code? 47057
what is the city name? Duisburg
Address Lotharstrasse 123, 47057 Duisburg at address 0x62fd30 deleted
Address Lotharstrasse 123, 47057 Duisburg at address 0x62fb80 deleted
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> a
========================================================================
                              H O U S E
========================================================================
                            (this: 0xdf1a10)
                          address: Lotharstrasse 123, 47057 Duisburg
              number of households: 1
      total number of all consumers: 0
========================================================================
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> n
number of household? 0
how many square metres does the household have? 100
how many persons live in this household? 4
is hot water heated using electricity? (y(es) or n(o)) y
what is the price for one kWh in EUR? 0.39
who is the power supplier? Stadtwerke Duisburg
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> a
========================================================================
                              H O U S E
========================================================================
                            (this: 0xdf1a10)
                          address: Lotharstrasse 123, 47057 Duisburg
              number of households: 1
```

```
     total number of all consumers: 0
H O U S E H O L D   N O   0   P O W E R   C O N S U M P T I O N
------------------------------------------------------------------------
                           (this: 0xdf17b0)
                price for one kWh: 39.00 ct/kWh
                   power supplier: Stadtwerke Duisburg
                    square metres: 100.00 qm
                          persons: 4
    water heated using electricity: yes
                list of consumers
------------------------------------------------------------------------
------------------------------------------------------------------------
   power consumption square meters: 900.0 kWh
     power consumption all persons: 2200.0 kWh
    total annual power consumption: 3100.0 kWh
          total annual power costs: 1209.00 EUR
========================================================================
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> i
number of household? 0
what is the description of the power consumer? Notebook
how many watt it will have? 90
how many watt standby it will have? 0
how often it will be used?
daily  (d)
mo_fr  (m)
once   (o)
sa_su  (s)
weekly (w)? d
how many hours it will be operating then? 1
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> a
========================================================================
                             H O U S E
========================================================================
                           (this: 0xdf1a10)
                         address: Lotharstrasse 123, 47057 Duisburg
             number of households: 1
     total number of all consumers: 1
H O U S E H O L D   N O   0   P O W E R   C O N S U M P T I O N
------------------------------------------------------------------------
                           (this: 0xdf17b0)
                price for one kWh: 39.00 ct/kWh
                   power supplier: Stadtwerke Duisburg
                    square metres: 100.00 qm
                          persons: 4
    water heated using electricity: yes
                list of consumers
------------------------------------------------------------------------
                              1: Notebook
                           (this: 0xdf5d40)
                power consumption: 90.00 W
         power consumption standby: 0.00 W
               annual hours of use: 365.00 h
             annual hours of standby: 8395.00 h
                  annual consumption: 32.9 kWh
```

```
                      annual costs: 12.81 EUR
----------------------------------------------------------------------
    power consumption square meters: 900.0 kWh
      power consumption all persons: 2200.0 kWh
     total annual power consumption: 3132.8 kWh
           total annual power costs: 1221.81 EUR
======================================================================
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> w
input file name: h0.csv
input separator character: |
output file "h0.csv" opened...
output file "h0.csv" closed
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> d
Consumer Notebook at address 0xdf5d40 deleted
Household at address 0xdf17b0 deleted
House at address 0xdf1a10 deleted
Address Lotharstrasse 123, 47057 Duisburg at address 0xdf1a10 deleted
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> q
```

Beispiel Programmlauf 2/Example Program Run 2

```
CALCULATION OF AVERAGE POWER COSTS FOR A HOUSE - CLASS VERSION
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> h
how many households does the house have? 1
what is the street name? Lotharstrasse
what is house number? 123
what is zip code? 47057
what is the city name? Duisburg
Address Lotharstrasse 123, 47057 Duisburg at address 0x62fd30 deleted
Address Lotharstrasse 123, 47057 Duisburg at address 0x62fb80 deleted
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> r
input file name: h1.csv
input separator character: ;
input file "h1.csv" opened...
Address Lotharstrasse 65d, 47057 Duisburg Neudorf at address 0x62f730 deleted
Address Lotharstrasse 65d, 47057 Duisburg Neudorf at address 0x62f830 deleted
input file "h1.csv" closed
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> a
======================================================================
                              H O U S E
======================================================================
                           (this: 0xd95fc0)
                        address: Lotharstrasse 65d, 47057 Duisburg Neudorf
              number of households: 6
     total number of all consumers: 5
H O U S E H O L D   N O   2   P O W E R   C O N S U M P T I O N
----------------------------------------------------------------------
                           (this: 0xd960c0)
                price for one kWh: 30.00 ct/kWh
                   power supplier: Yello Strom
                    square metres: 200.00 qm
                          persons: 5
    water heated using electricity: yes
                list of consumers
----------------------------------------------------------------------
                              1: Router
                           (this: 0xd96110)
                power consumption: 10.00 W
          power consumption standby: 0.00 W
                annual hours of use: 8760.00 h
            annual hours of standby: 0.00 h
                 annual consumption: 87.6 kWh
                       annual costs: 26.28 EUR
```

```
                                2: Office PC
                             (this: 0xd96160)
                   power consumption: 200.00 W
           power consumption standby: 0.50 W
                 annual hours of use: 2210.00 h
             annual hours of standby: 6550.00 h
                  annual consumption: 445.3 kWh
                        annual costs: 133.58 EUR
                                3: Washing Machine
                             (this: 0xd961e0)
                   power consumption: 2000.00 W
           power consumption standby: 0.00 W
                 annual hours of use: 104.00 h
             annual hours of standby: 8656.00 h
                  annual consumption: 208.0 kWh
                        annual costs: 62.40 EUR
-------------------------------------------------------------------
    power consumption square meters: 1800.0 kWh
      power consumption all persons: 2750.0 kWh
     total annual power consumption: 5290.9 kWh
           total annual power costs: 1587.26 EUR
H O U S E H O L D   N O   3   P O W E R   C O N S U M P T I O N
-------------------------------------------------------------------
                             (this: 0xd96230)
                   price for one kWh: 40.00 ct/kWh
                      power supplier: Stadtwerke
                       square metres: 100.00 qm
                             persons: 2
    water heated using electricity: no
                   list of consumers
-------------------------------------------------------------------
                                1: Dish Washer
                             (this: 0xd96280)
                   power consumption: 250.00 W
           power consumption standby: 0.00 W
                 annual hours of use: 1277.50 h
             annual hours of standby: 7482.50 h
                  annual consumption: 319.4 kWh
                        annual costs: 127.75 EUR
                                2: LED TV
                             (this: 0xd962d0)
                   power consumption: 70.00 W
           power consumption standby: 0.50 W
                 annual hours of use: 208.00 h
             annual hours of standby: 8552.00 h
                  annual consumption: 18.8 kWh
                        annual costs: 7.53 EUR
-------------------------------------------------------------------
    power consumption square meters: 900.0 kWh
      power consumption all persons: 400.0 kWh
     total annual power consumption: 1638.2 kWh
           total annual power costs: 655.28 EUR
===================================================================
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> n
number of household? 4
how many square metres does the household have? 50
how many persons live in this household? 3
is hot water heated using electricity? (y(es) or n(o)) n
what is the price for one kWh in EUR? 0.5
who is the power supplier? RWE
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
```

```
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> c
number of household from which to copy consumers? 2
number of household to copy to? 4
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> c
number of household from which to copy consumers? 3
number of household to copy to? 4
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> a
========================================================================
                              H O U S E
========================================================================
                            (this: 0xd95fc0)
                          address: Lotharstrasse 65d, 47057 Duisburg Neudorf
              number of households: 6
      total number of all consumers: 10
H O U S E H O L D   N O   2   P O W E R   C O N S U M P T I O N
------------------------------------------------------------------------
                            (this: 0xd960c0)
                 price for one kWh: 30.00 ct/kWh
                    power supplier: Yello Strom
                     square metres: 200.00 qm
                           persons: 5
     water heated using electricity: yes
                 list of consumers
------------------------------------------------------------------------
                               1: Router
                            (this: 0xd96110)
                  power consumption: 10.00 W
          power consumption standby: 0.00 W
                annual hours of use: 8760.00 h
            annual hours of standby: 0.00 h
                 annual consumption: 87.6 kWh
                       annual costs: 26.28 EUR
                               2: Office PC
                            (this: 0xd96160)
                  power consumption: 200.00 W
          power consumption standby: 0.50 W
                annual hours of use: 2210.00 h
            annual hours of standby: 6550.00 h
                 annual consumption: 445.3 kWh
                       annual costs: 133.58 EUR
                               3: Washing Machine
                            (this: 0xd961e0)
                  power consumption: 2000.00 W
          power consumption standby: 0.00 W
                annual hours of use: 104.00 h
            annual hours of standby: 8656.00 h
                 annual consumption: 208.0 kWh
                       annual costs: 62.40 EUR
```

```
------------------------------------------------------------------------
    power consumption square meters: 1800.0 kWh
      power consumption all persons: 2750.0 kWh
     total annual power consumption: 5290.9 kWh
           total annual power costs: 1587.26 EUR
H O U S E H O L D   N O   3   P O W E R   C O N S U M P T I O N
------------------------------------------------------------------------
                             (this: 0xd96230)
                 price for one kWh: 40.00 ct/kWh
                    power supplier: Stadtwerke
                     square metres: 100.00 qm
                           persons: 2
     water heated using electricity: no
                 list of consumers
------------------------------------------------------------------------
                                1: Dish Washer
                             (this: 0xd96280)
                   power consumption: 250.00 W
           power consumption standby: 0.00 W
                 annual hours of use: 1277.50 h
            annual hours of standby: 7482.50 h
                 annual consumption: 319.4 kWh
                       annual costs: 127.75 EUR
                                2: LED TV
                             (this: 0xd962d0)
                   power consumption: 70.00 W
           power consumption standby: 0.50 W
                 annual hours of use: 208.00 h
            annual hours of standby: 8552.00 h
                 annual consumption: 18.8 kWh
                       annual costs: 7.53 EUR
------------------------------------------------------------------------
    power consumption square meters: 900.0 kWh
      power consumption all persons: 400.0 kWh
     total annual power consumption: 1638.2 kWh
           total annual power costs: 655.28 EUR
H O U S E H O L D   N O   4   P O W E R   C O N S U M P T I O N
------------------------------------------------------------------------
                             (this: 0xd95d10)
                 price for one kWh: 50.00 ct/kWh
                    power supplier: RWE
                     square metres: 50.00 qm
                           persons: 3
     water heated using electricity: no
                 list of consumers
------------------------------------------------------------------------
                                1: Dish Washer
                             (this: 0xd95e50)
                   power consumption: 250.00 W
           power consumption standby: 0.00 W
                 annual hours of use: 1277.50 h
            annual hours of standby: 7482.50 h
                 annual consumption: 319.4 kWh
                       annual costs: 159.69 EUR
                                2: LED TV
                             (this: 0xd95ea0)
                   power consumption: 70.00 W
           power consumption standby: 0.50 W
                 annual hours of use: 208.00 h
            annual hours of standby: 8552.00 h
                 annual consumption: 18.8 kWh
                       annual costs: 9.42 EUR
                                3: Router
                             (this: 0xd95d60)
                   power consumption: 10.00 W
           power consumption standby: 0.00 W
                 annual hours of use: 8760.00 h
            annual hours of standby: 0.00 h
                 annual consumption: 87.6 kWh
                       annual costs: 43.80 EUR
                                4: Office PC
                             (this: 0xd95db0)
                   power consumption: 200.00 W
           power consumption standby: 0.50 W
                 annual hours of use: 2210.00 h
            annual hours of standby: 6550.00 h
```

```
                annual consumption: 445.3 kWh
                      annual costs: 222.64 EUR
                                 5: Washing Machine
                           (this: 0xd95e00)
                 power consumption: 2000.00 W
          power consumption standby: 0.00 W
                annual hours of use: 104.00 h
             annual hours of standby: 8656.00 h
                annual consumption: 208.0 kWh
                      annual costs: 104.00 EUR
----------------------------------------------------------------------
    power consumption square meters: 450.0 kWh
      power consumption all persons: 600.0 kWh
     total annual power consumption: 2129.1 kWh
           total annual power costs: 1064.54 EUR
======================================================================
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> d
Consumer Router at address 0xd96110 deleted
Consumer Office PC at address 0xd96160 deleted
Consumer Washing Machine at address 0xd961e0 deleted
Household at address 0xd960c0 deleted
Consumer Dish Washer at address 0xd96280 deleted
Consumer LED TV at address 0xd962d0 deleted
Household at address 0xd96230 deleted
Consumer Dish Washer at address 0xd95e50 deleted
Consumer LED TV at address 0xd95ea0 deleted
Consumer Router at address 0xd95d60 deleted
Consumer Office PC at address 0xd95db0 deleted
Consumer Washing Machine at address 0xd95e00 deleted
Household at address 0xd95d10 deleted
House at address 0xd95fc0 deleted
Address Lotharstrasse 65d, 47057 Duisburg Neudorf at address 0xd95fc0 deleted
q quit
d delete house
h house initialisation
i input power consumer
u move up power consumer
p print household
a print all households
n new household
c copy all consumers (added to already existing ones)
r read data from file
w write data into file
>> q
```

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◄ A5 Upload Teil 1/Part 1

Direkt zu:

A5 Upload Teil 1+2/Part 1+2 ►

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