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

A4 Teil 2: Präsenzaufgabe/Part 2: Presence Task

Im bisherigen Programm wird jeweils zu Beginn des Programms der Strompreis für eine Kilowattstunde für alle Haushalte in einem Haus gleich angegeben. In der Praxis schließt allerdings jeder Haushalt einen eigenen Strom-Liefervertrag mit einem der Stromlieferanten ab. Ändern und erweitern Sie Ihren C++-Kode aus A4 Teil 1 folgendermassen:/
In the current program, the power price for one kilowatt hour is given same for all households in a house at the start of the program. In practice, however, each household has its own power supply contract with one of the power suppliers. Change and extend your C++ code from A4 part 1 as follows:

1. Fügen Sie der Struktur **`household`** als weitere Komponenten eine Gleitpunktzahl für einen Strompreis hinzu sowie eine C++-Zeichenkette für den Stromlieferanten./
   Add a floating point number for a power price and a C++ string for the power supplier as further components to structure **`household`**.
2. Löschen Sie in der Funktion **`main`** die Variable zur Speicherung des Strompreises und die Eingabe eines Wertes für diesen. Fügen Sie stattdessen bei der Eingabe eines Haushalts eine Strompreiseingabe und eine Eingabe des Stromlieferanten hinzu./
   In function **`main`**, delete the variable for storing the power price and the input of a value for it. Instead add a power price input and an input for a power supplier when inputting a household.
3. Löschen Sie in allen Funktionen und Funktionsaufrufen den Parameter mit dem Strompreis, ändern und ergänzen die Ausgabe eines Haushalts auf die Ausgabe des Strompreises und des Stromlieferanten aus den beiden neuen Komponentendaten der Struktur, und ändern Sie auch alle Preisberechnungen auf den Strompreis aus der Komponente des Haushalts./
   Delete the parameter with the power price in all functions and function calls, change/add the output of a household to output the power price and the power supplier from the two new component data of the structure, and also change all price calculations using the power price from the household component.
4. Löschen Sie in der Funktion zum Schreiben aller Daten in eine Datei den Strompreis-Parameter und die Ausgabe des Strompreises in der ersten Zeile der Datei. Fügen Sie dafür beim Schreiben der Haushalte je zwei weitere Werte für den Strompreis und den Stromlieferanten am Ende der jeweiligen Zeile in der Datei ein./
   In the function for writing all data to a file, delete the power price parameter and the output of the power price into the first line of the file. Add two more values for the power price and the power supplier at the end of the respective lines in the file for writing the households.
5. Löschen Sie in der Funktion zum Lesen aller Daten aus einer Datei den Strompreis-Parameter und das Einlesen des Strompreises aus der ersten Zeile der Datei. Fügen Sie stattdessen beim Einlesen der Daten der einzelnen Haushalte das Einlesen des Strompreises und des Stromlieferanten mit ein./
   In the function for reading all data from a file, delete the power price parameter and the reading of the power price out of the first line of the file. Instead, when reading in the data of the individual households, include the reading in of the power price and the power supplier.

Beispiel Datei `house42.csv` (zusätzliche Werte in roter Farbe)/Example File `house42.csv` (additional values in red colour)

```
A4#5#Bergisch Gladbach
household#2#Bergisch Gladbach#true#5#200#0.3#Yello Strom
consumer#Washing Machine#2#weekly#2000#0
consumer#Office PC#8.5#Monday to Friday#200#0.5
consumer#Router#24#daily#10#0
household#3#Bergisch Gladbach#false#2#100#0.4#Stadtwerke
consumer#Dish Washer#3.5#daily#250#0
consumer#LED TV#2#Saturday and Sunday#70#0.5
```

Datei Programmlauf/Example Program Run

```
CALCULATION OF AVERAGE POWER COSTS FOR A HOUSE
how many households does the house have? 6
in which city the house is located? Duisburg
q quit
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: house42.csv
input separator character: #
input file "house42.csv" opened...
input file "house42.csv" closed
q quit
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 H O L D   N O   2   P O W E R   C O N S U M P T I O N
-----------------------------------------------------------------------
                            city: Bergisch Gladbach (at address: 0xf35ec0)
                price for one kWh: 30.00 ct/kWh
                   power supplier: Yello Strom
                    square metres: 200 qm
                          persons: 5
    water heated using electricity: yes
                list of consumers
-----------------------------------------------------------------------
                                1: Washing Machine (at address: 0xf35f60)
                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
                                2: Office PC (at address: 0xf35fb0)
                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: Router (at address: 0xf36030)
                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
-----------------------------------------------------------------------
    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: 1587.3 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
-----------------------------------------------------------------------
                            city: Bergisch Gladbach (at address: 0xf36080)
                price for one kWh: 40.00 ct/kWh
                   power supplier: Stadtwerke
                    square metres: 100 qm
                          persons: 2
    water heated using electricity: no
                list of consumers
-----------------------------------------------------------------------
                                1: Dish Washer (at address: 0xf36120)
                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 (at address: 0xf36170)
                   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: 655.3 EUR

q quit
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? 2
is hot water heated using electricity? (y(es) or n(o)) y
what is the price for one kWh in EUR? 0.5
who is the power supplier? RWE
q quit
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
>> p
number of household? 4
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
------------------------------------------------------------------------
                              city: Bergisch Gladbach (at address: 0xf35cb0)
                 price for one kWh: 50.00 ct/kWh
                    power supplier: RWE
                     square metres: 50 qm
                           persons: 2
     water heated using electricity: yes
                 list of consumers
------------------------------------------------------------------------
------------------------------------------------------------------------
    power consumption square meters: 450.0 kWh
      power consumption all persons: 1100.0 kWh
     total annual power consumption: 1550.0 kWh
           total annual power costs: 775.0 EUR

q quit
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
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
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 H O L D   N O   2   P O W E R   C O N S U M P T I O N
-----------------------------------------------------------------------
                            city: Bergisch Gladbach (at address: 0xf35ec0)
                price for one kWh: 30.00 ct/kWh
                   power supplier: Yello Strom
                    square metres: 200 qm
                          persons: 5
    water heated using electricity: yes
                list of consumers
-----------------------------------------------------------------------
                                1: Washing Machine (at address: 0xf35f60)
                 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
                                2: Office PC (at address: 0xf35fb0)
                 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: Router (at address: 0xf36030)
                 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
-----------------------------------------------------------------------
   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: 1587.3 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
-----------------------------------------------------------------------
                            city: Bergisch Gladbach (at address: 0xf36080)
                price for one kWh: 40.00 ct/kWh
                   power supplier: Stadtwerke
                    square metres: 100 qm
                          persons: 2
    water heated using electricity: no
                list of consumers
-----------------------------------------------------------------------
                                1: Dish Washer (at address: 0xf36120)
                 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 (at address: 0xf36170)
                 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: 655.3 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
-------------------------------------------------------------------
                             city: Bergisch Gladbach (at address: 0xf35cb0)
                 price for one kWh: 50.00 ct/kWh
                    power supplier: RWE
                     square metres: 50 qm
                           persons: 2
    water heated using electricity: yes
                 list of consumers
-------------------------------------------------------------------
                                1: Dish Washer (at address: 0xf35e10)
                 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 (at address: 0xf35e60)
                 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: Washing Machine (at address: 0xf35d20)
                 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
                                4: Office PC (at address: 0xf35d70)
                 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: Router (at address: 0xf35dc0)
                 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
-------------------------------------------------------------------
    power consumption square meters: 450.0 kWh
      power consumption all persons: 1100.0 kWh
     total annual power consumption: 2629.1 kWh
           total annual power costs: 1314.5 EUR

q quit
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: house43.csv
input separator character: |
output file "house43.csv" opened...
output file "house43.csv" closed
q quit
```

```
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
>>
```

Beispiel Datei `house43.csv` (zusätzliche Werte in roter Farbe)/Example File `house43.csv` (additional values in red colour)

```
A4|6|Bergisch Gladbach
household|2|Bergisch Gladbach|true|5|200|0.3|Yello Strom
consumer|Washing Machine|2|weekly|2000|0
consumer|Office PC|8.5|Monday to Friday|200|0.5
consumer|Router|24|daily|10|0
household|3|Bergisch Gladbach|false|2|100|0.4|Stadtwerke
consumer|Dish Washer|3.5|daily|250|0
consumer|LED TV|2|Saturday and Sunday|70|0.5
household|4|Bergisch Gladbach|true|2|50|0.5|RWE
consumer|Dish Washer|3.5|daily|250|0
consumer|LED TV|2|Saturday and Sunday|70|0.5
consumer|Washing Machine|2|weekly|2000|0
consumer|Office PC|8.5|Monday to Friday|200|0.5
consumer|Router|24|daily|10|0
```

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