# 09. C++ OOP Pure Virtual Members and Multiple Inheritance

Write C++ code for solving the tasks on the following pages.

Submit your solutions here: <https://judge.softuni.bg/Contests/1281/09-Cpp-OOP-Pure-Virtual-Members-and-Multiple-Inheritance>

Any code files that are part of the task are provided under the folder **Skeleton**.

Please follow the exact instructions on uploading the solutions for each task.

# Task 1 – Filters

You are given code which reads a line from the console, then reads the definition of a filter, applies the filter (which removes some of the symbols from the input) and prints the output. The filter types are:

* A-Z – removes all capital letters
* a-z – removes all non-capital letters
* 0-9 – removes all digits

However the code only defines the main() function and a base Filter class. You task is to implement the specific filter each case.

You should submit a single .zip file for this task, containing ONLY the file(s) YOU created. The Judge system has a copy of the other files and will compile them, along with your file, in the same directory.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| Where Eagles Dare  A-Z | here agles are |
| don't ever go into a ALL CAPS RAAAAGE  a-z | ' ALL CAPS RAAAAGE |
| one 2 three  0-9 | one three |

**Task 2 – IDs**

You are given code which reads information about Company objects from the console, maps and sorts them by id, then prints info about each on the console.

The provided code only contains the implementation, without the declarations for the classes & members. Your task is to study the provided code and create files with the appropriate declarations so that the code compiles and accomplishes the task described.

You should submit a single **.zip** file for this task, containing ONLY the file(s) YOU created. The Judge system has a copy of the other files and will compile them, along with your file, in the same directory.

**Examples**

|  |  |
| --- | --- |
| **Input** | **Output** |
| 42 uni (I.K.,S.N.)  13 joro (G.G.)  end | 13 joro (G.G.)  42 uni (I.K.,S.N.) |
| 188 icyha (B.Q.,H.P.,F.S.)  58 uadel (S.A.,C.H.,L.T.)  end | 58 uadel (S.A.,C.H.,L.T.)  188 icyha (B.Q.,H.P.,F.S.) |
| 13 joro (G.G.)  end | 13 joro (G.G.) |

**Task 3 – Files**

You are given code which reads information **File** and **Directory** objects in a file system, each of which has an id, and each of which has a parent – the object which contains it.

NOTE: For this task, only files will have parents (but similar logic will be used in other tasks in this homework assignment).

Operations with the files and directories are done with reference to their **id**, and there are several types of operations:

* **file** – create a **File** object with a **filename** and **contents** (a sequence of characters, stored in a **string**)
* **directory** – create a Directory object with a name
* **copy** – move a file into a directory, only 1 such operation will be done for any file, and it will always contain a file id to move and a directory id to move to
* **size** – prints the **size in bytes** of a **File** or **Directory**. The size of a **File** is equal to the size (number of characters) of its **contents**. The size of **Directory** is equal to the **sum of the sizes** of the **File** objects in it.
* **path** – prints the path of a **File** or **Directory**. The path is the sequence of parents for the **File**/**Directory**, separated by **"/"**, followed by the name of the **File**/**Directory**. For this task, only **File**s will have parents, meaning that paths for a directory will always be just its name.
* **print** – prints the contents of a **File** – will only be called with ids of already existing **File**s

The provided code is missing the definitions for the **File** and **Directory** classes – you should implement them. Also, you should study the code and see what inheritance hierarchy is used to represent the file system and implement any other necessary classes/interfaces and functions.

You should submit a single **.zip** file for this task, containing ONLY the file(s) YOU created. The Judge system has a copy of the other files and will compile them, along with your file, in the same directory.

**Restrictions**

The input will always contain correct operations – i.e. any object used by an operation will have already been created by the file or directory operations. There will be no invalid ids, no **copy** or **print** operations on **Directory** objects (but the destination of a copy operation will always be a **Directory**).

The provided code handles input/output and operation management – you should focus on implementing the classes it uses.

**Examples**

|  |  |
| --- | --- |
| **Input** | **Output** |
| file 1 example.txt some example bytes as text  file 2 otherFile.txt other text  path 1  directory 3 examples  path 3  copy 1 3  path 1  print 1  path 2  end | example.txt  examples  examples/example.txt  some example bytes as text  otherFile.txt |
| file 1 example.txt some example bytes as text  file 2 otherFile.txt other text  size 1  size 2  directory 3 examples  size 3  copy 1 3  size 3  copy 2 3  size 3  end | 26  10  0  26  36 |

**Task 4 – Tree**

Like in **Task 3**, you are given code which reads information **File** and **Directory** objects in a file system, each of which has an id, and each of which has a parent – the object which contains it.

Operations with the files and directories are done with reference to their **id**, and there are several types of operations:

* **file** – create a **File** object with a **filename** and **contents** (a sequence of characters, stored in a **string**)
* **directory** – create a Directory object with a name
* **move** – move an object (File or Directory) into a Directory
* **shortcut** – creates a “shortcut” to a file or directory. Shortcuts do not move the object (i.e. the object remains in the directory it was originally, but it also appears in the shortcuts)

The provided code is missing the definitions for the **File** and **Directory** classes – you should implement them.

Note: there are some minor changes to the requirements for file system objects (getters and range-based for loop usability for **FileSystemObjectsContainer**).

Your task (in addition to implementing **File** and **Directory**) is to implement a “tree view” for the file system entered on the input.

A tree view is a layered representation of hierarchical objects. Objects on the **first level are printed without indentation**. Objects on the **second level** (i.e. objects contained inside directories from the first level) are printed with **1 level of indentation** after their **parent** objects. And so on – **objects on each following level are printed with an additional level of indentation, compared to their parents**, and are printed **on the line after their parents**. Additionally, objects on **each level** should be **sorted lexicographically** (using **operator<** of the **string** class). The shortcuts are printed as if they were a directory named **[shortcuts]**.

For this task, one level of indentation should be represented by the string **"--->"** (three dashes and a “greater than” sign, i.e. an arrow). See the examples below for more details on how to represent the tree view.

You should submit a single **.zip** file for this task, containing ONLY the file(s) YOU created. The Judge system has a copy of the other files and will compile them, along with your file, in the same directory.

**Restrictions**

The input will always contain correct operations – i.e. any object used by an operation will have already been created by the file or directory operations. There will be no invalid or duplicate ids, no **move**/**shortcut** operations referencing ids not yet created. No object (**File** or **Directory**) will have the same name as another object.

The provided code handles input/output and operation management – you should focus on implementing the classes it uses and on implementing the construction of the tree view.

**Examples**

|  |  |
| --- | --- |
| **Input** | **Output** |
| file 1 example.txt some example bytes as text  file 2 otherFile.txt other text  directory 3 examples  move 1 3  directory 4 nested  move 4 3  move 2 4  file 5 rootFile.txt this file is in the file system root  directory 6 rootDir  end | examples  --->example.txt  --->nested  --->--->otherFile.txt  rootDir  rootFile.txt |
| file 1 example.txt some example bytes as text  file 2 otherFile.txt other text  shortcut 2  directory 3 examples  move 1 3  directory 4 nested  shortcut 4  move 4 3  move 2 4  file 5 rootFile.txt this file is in the file system root  directory 6 rootDir  file 7 noDot can't use name to check if directory or file :)  move 7 4  shortcut 6  end | [shortcuts]  --->nested  --->--->noDot  --->--->otherFile.txt  --->otherFile.txt  --->rootDir  examples  --->example.txt  --->nested  --->--->noDot  --->--->otherFile.txt  rootDir  rootFile.txt |

**Task 5 – Explorer**

Like in **Task 3** and **Task 4** you are given code which reads information **File** and **Directory** objects in a file system, however it uses an **Explorer** class to create, cut & paste, create shortcuts and navigate between them.

You are tasked with implementing the **Explorer** class so that it supports the operations below. After all operations by the explorer are done, the tree view logic from Task 4 is used to print the resulting file system.

The **Explorer** supports the following operations:

* **mf** – create a **File** object with a **filename** and **contents** (a sequence of characters, stored in a **string**), in the current directory
* **md** – create a **Directory** object with a name, in the current directory
* **cut** – prepare and object from the current directory to be moved. Can be called multiple times and each time it adds an object to be moved to a “clipboard”
* **paste** – moves the objects from the clipboard to the current directory. The object is removed from its current parent and placed in the current directory (shortcuts to the object remain unchanged)
* **sc** – creates a “shortcut” to a file or directory. Shortcuts do not move the object (i.e. the object remains in the directory it was originally, but it also appears in the shortcuts). Shortcuts are listed the same way as in Task 4, and no other operations will access shortcuts (i.e. no navigation to them, no copying, etc.)
* **cd** – changes the current directory. Receives a single **path** parameter, which indicates the **name of a directory**, inside the **current directory**, to which to navigate, or the string **".."**, which indicates **the parent of the current directory** (NOTE: this is like the DOS **cd** command, however you do not need to implement complex path parsing)

You should submit a single **.zip** file for this task, containing ONLY the file(s) YOU created. The Judge system has a copy of the other files and will compile them, along with your file, in the same directory.

**Restrictions**

The input will always contain correct operations – i.e. any object used by an operation will have already been created. There will be no invalid or duplicate names, no invalid **cd**/**cut**/**sc** operations.

The provided code handles input/output and operation management – you should focus on implementing the classes it uses and on implementing the **Explorer** class.

**Examples**

|  |  |
| --- | --- |
| **Input** | **Output** |
| mf example.txt some example bytes as text  md examples  cut example.txt  cd examples  paste  md nested  cd nested  mf otherFile.txt other text  cd ..  cd ..  md rootDir  mf rootFile.txt this file is in the file system root  end | examples  --->example.txt  --->nested  --->--->otherFile.txt  rootDir  rootFile.txt |
| mf example.txt some example bytes as text  md examples  cut example.txt  cd examples  paste  md nested  sc nested  cd nested  mf otherFile.txt other text  sc otherFile.txt  mf rootFile.txt this file is in the file system root  cut rootFile.txt  cd ..  cd ..  md rootDir  paste  sc rootDir  mf noDot can't use name to check if directory or file :)  cut noDot  cd examples  cd nested  paste  end | [shortcuts]  --->nested  --->--->noDot  --->--->otherFile.txt  --->otherFile.txt  --->rootDir  examples  --->example.txt  --->nested  --->--->noDot  --->--->otherFile.txt  rootDir  rootFile.txt |