Hussain Izhar **Third Assignment/Task 2** **6th May 2021**
L9EIKJ
l9eikj@inf.elte.hu
Group 3

Task

In the hydrological cycle of the Earth, various areas affect the weather as well as areas are also affected by various weathers. Areas involved in the simulation: plain, grassland, lakes region. Each area has a name, and the amount of water stored in the certain area is also given in km3 . The humidity of the air over the areas is also given in percentage.
The possible types of weather are the following: sunny, cloudy, rainy, depending on the humidity of the air. In case the humidity exceeds 70%, the weather gets rainy and the humidity decreases to 30%.
In case the humidity is between 40-70%, the calculation of the chance of rainy weather is: (humidity-40)*3,3%, otherwise the weather is cloudy. Humidity below 40% leads to sunny weather.
In the following, we declare how the certain areas respond to the different type of weathers. First the amount of water stored by the area varies then the weather will be affected. There is no type of areas with negative amount of water stored.

- In case the type is plain, if the weather is sunny, the amount of water will be decreased by 3 km3 ; if cloudy, it will be decreased by 1 km3 ; for rainy weather it will be increased by 20 km3 . The humidity of the air is increased by 5%. If the amount of the stored water is greater than 15 km3 , the plain area changes into grassland.
- In case of type grassland: in sunny weather, the amount of water is decreased by 6 km3 , for cloudy it will be decreased by 2 km3 , but and for rainy, it will be increased by 15 km3 . The humidity of the air is increased by 10%. The area becomes lakes region obtaining amount of water over 50 km3 , whereas in case the amount of stored water goes below 16 km3 , the area changes to plain.
- In case of type lakes region: in sunny weather, the amount of water is decreased by 10 km3 , for cloudy it will be decreased by 3 km3 , for rainy it will be increased by 20 km3 . The humidity will be increased by 15%. Beyond an amount of water of 51 km3 the area changes into grassland.

The program reads data from a text file. The first line of the file contains a single integer N indicating the number of areas. Each of the following N lines contains the attributes of an area separated by spaces: the owner of the area, the type of the area, and the amount of water stored bythe area. In the last line, the humidity of the air is given in percentage. The type is identified by a character: P – plain, G – grassland, L – lakes region.

We continue the simulation until each area has the same type. The program should print all attributes of the certain areas by simulation rounds!

The program should ask for a filename, then print the content of the input file. You can assume that the input file is correct. Sample input:

```
4
Mr Bean L 86
Mr Green G 26
Mr Dean P 12
Mr Teen G 35
98
```

IDEA:

We will introduce two classes: ***Weather*** and ***Area***. In both the classes will have three children classes. **Weather:** *Sunny, Couldy, Rainy.* **Area:** *Plain, Grassland, Lake.*

In Weather Class, we will declare setter and getter methods, and one virtual destructor. We will also introduce changeWeather(int Humidity) and changeHumidity(Area *area) member methods. changeWeather(int Humidity) method will change the current weather based on the given humidity. changeHumidity(Area *area) method will change the member-varaible Humidity based on the given area. We will inherit Sunny, Cloudy, Rainy classes from Weather Class. All the childeren classes will have their own destructors.

In Area Class, we will declare setter and getter methods, and one virtual destrucotr. We will also intorudce changeWaterLevel(Weather *weather) and changeArea() virtual member methods that we can ovveride in the childern classes as well. We will inherit Plain, Grassland, and Lake from Area Class. All the children classes will have their own constructor and will override the virtual methods mentioned above.

So, the following will be the variations on different Areas and Weathers when the Water Level and Humidity will change:

Plain:

Weather	Water Level	Humidity
Sunny	-3	5
Rainy	+20	5
Cloudy	-1	5

NOTE: If the water level exceeds 15 km^3, then the Plain area will change to Grassland.

Grassland:

Weather	Water Level	Humidity
Sunny	-6	10
Cloudy	-2	10
Rainy	+15	10

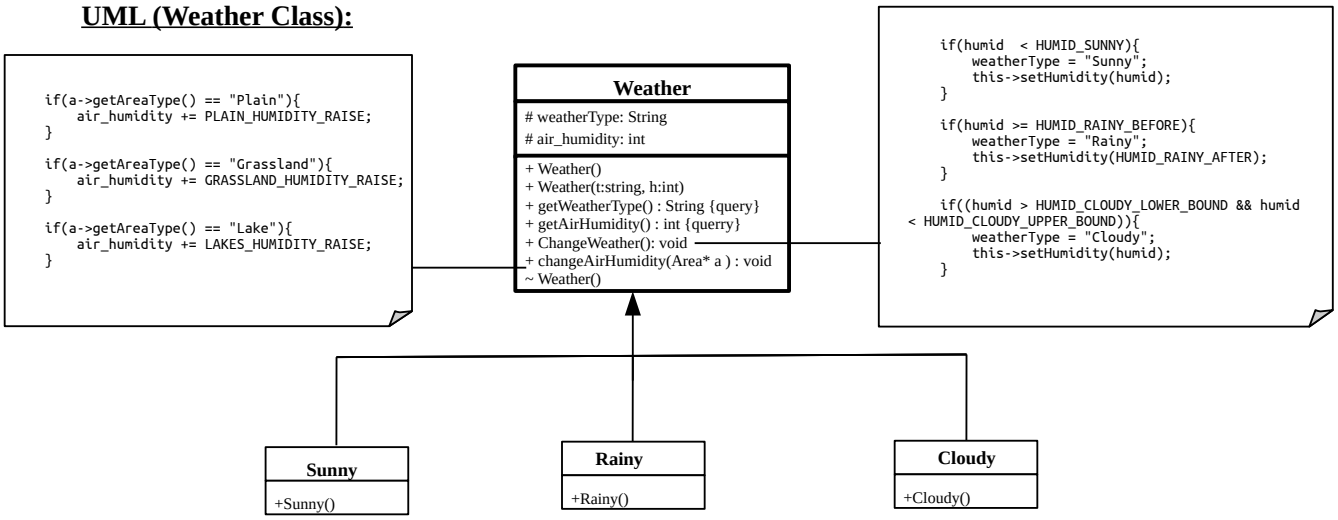
NOTE: If the water level exceeds 3- Km^3, Grassland changes into Lake. If it is decreased to 15 Km^3 or lower, then Grassland changes into Plain area.

Lake:

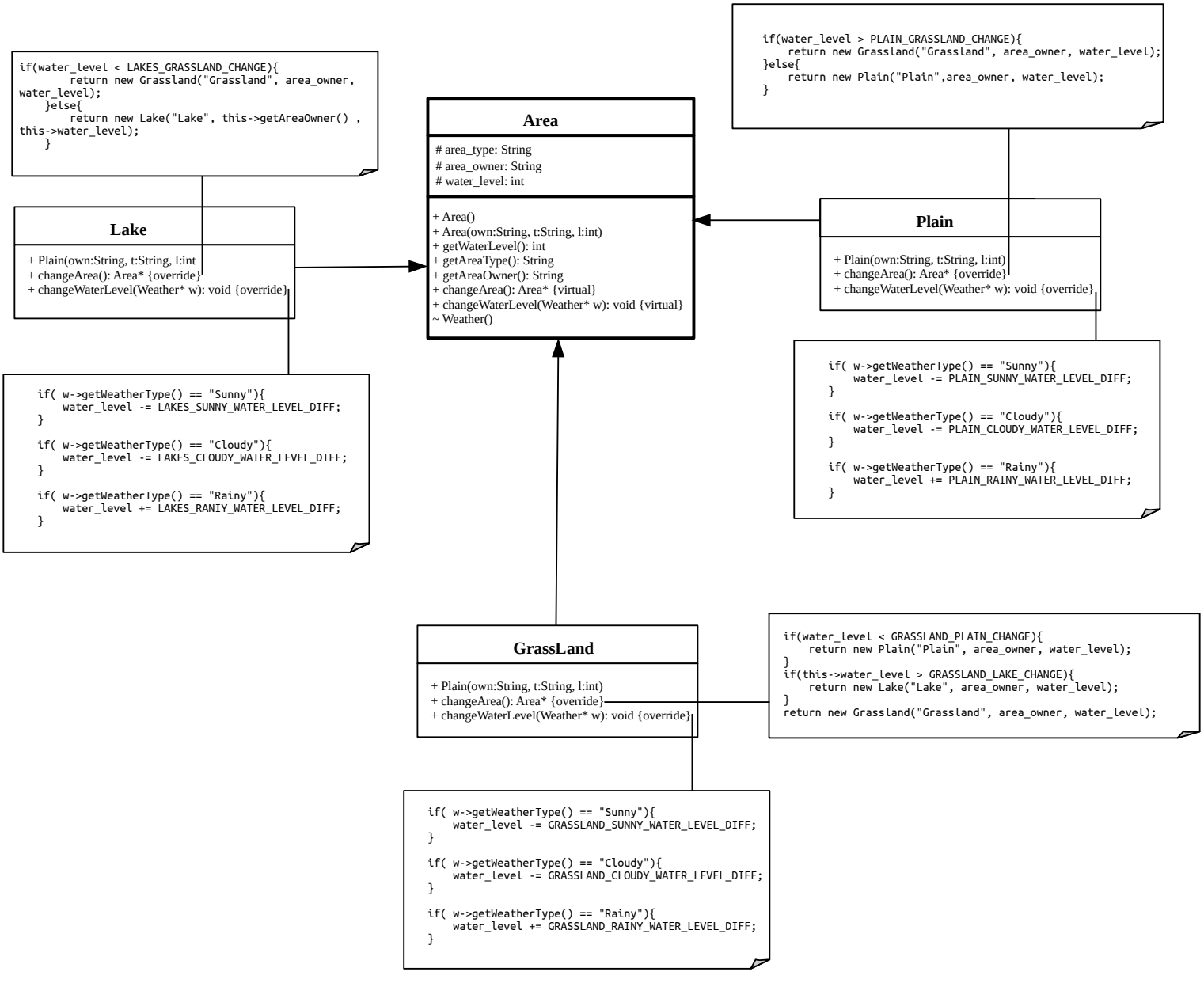
Weather	**Water Level**	**Humidity**
Sunny	-10	15
Cloudy	-3	15
Rainy	20	15

NOTE: If the water level is decreased to 50 km^3 or lower, then Lake changes into Grassland. Actually makes sense.

UML (Weather Class):



UML (Area Class):



NOTE: The Water level must not fall below zero. In the Area() constructor, if the water level falls below zero, it is important we throw an exception. In the main( ) function we would handle it.

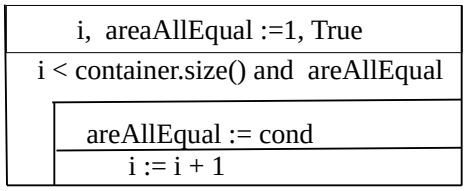
Specification:

To continue the simulation, we would check wheather all the areas of the same type or not. So, we write the following specification.

A: container: areaWeatherContainer^{n}, areAllEqual:L,
araWeatherContainer=rec(weather:Weather*, area:Area*)
Pre: container = container'
Post: areAllEqual = $\forall_{i:=0..N-1}$ (container'[i].area->getAreaType() == container'[0]->getAreaType())

Anology(Optimistic Linear Search – Decision):

Enor(E)	i=1..n
cond(e)	container'[i].area->getAreaType() == container'[0]->getAreaType()
l	areAllEqual



where cond = container'[i].area->getAreaType() == container'[0]->getAreaType()
NOTE: It actully returns the cont value, and based on that we would continue simulation in the main() function.

TESTING:

Grey Box: Following grey box testing were wrtten in the program. Can be found in the tests.cpp file.

1. Checking changeWaterLevel() for random where area is Lake and seasons are Sunny, Cloudy, Rainy. Work out the solution beforehand.
2. Checking changeWaterLevel() for random where area is Grassland and seasons are Sunny, Cloudy, Rainy. Work out the solution beforehand.
3. Checking changeWaterLevel() for random where area is Plain and seasons are Sunny, Cloudy, Rainy. Work out the solution beforehand.
4. Checking changeWaterLeve() for negative values in each area and each season.
5. Checking changeArea() based on the water level for each area, and each Season. Season must not affect the given area.
6. Changing a vector of Area() on different inputs. Checking mainly the constant values given in the task like for Plain, it's 15. If the water level exceeds the limit, Grassland should change to the Grassland.
7. Checking changeAirHumidity() for random inputs. Work out the solution beforehand.
8. Checking changeWeather() for random inputs. Area doesn't affect the Season. Work out your solution beforehand.
9. Empty file.
10. Exectption Handling.

CONSTANTS:

Following constants were define in the program, and are also used in the documentaion above:

HUMID_SUNNY = 40
HUMID_RAINY_BEFORE = 70
HUMID_RAINY_AFTER = 30
HUMID_CLOUDY_UPPER_BOUND = 70
HUMID_CLOUDY_LOWER_BOUND = 40
HUMID_MULTIPLICITY_CONST1 = 3.3
HUMID_MULTIPLICITY_CONST2 = 30

PLAIN_SUNNY_WATER_LEVEL_DIFF = 3
PLAIN_CLOUDY_WATER_LEVEL_DIFF = 1
PLAIN_RAINY_WATER_LEVEL_DIFF = 20
PLAIN_HUMIDITY_RAISE = 5
PLAIN_GRASSLAND_CHANGE = 15

GRASSLAND_SUNNY_WATER_LEVEL_DIFF = 6
GRASSLAND_CLOUDY_WATER_LEVEL_DIFF = 2
GRASSLAND_RAINY_WATER_LEVEL_DIFF = 15
GRASSLAND_HUMIDITY_RAISE = 10
GRASSLAND_PLAIN_CHANGE = 16
GRASSLAND_LAKE_CHANGE = 50

LAKES_SUNNY_WATER_LEVEL_DIFF = 10
LAKES_CLOUDY_WATER_LEVEL_DIFF = 3
LAKES_RANIY_WATER_LEVEL_DIFF = 20
LAKES_HUMIDITY_RAISE = 15
LAKES_GRASSLAND_CHANGE = 51