Middle East Technical University | Department of Computer Engineering

CENG 242

Programming Language Concepts

Spring '2015-2016

Programming Assignment 4

Due date: 19 May 2016, Thursday, 23:59

1 Objectives

In this assignment you will practice the Abstraction, Inheritance and Polymorphism concepts of Object Oriented Programming.

Keywords: *OOP, inheritance, polymorphism, (pure) abstract class*

2 Problem Definition

After War of the Five Kings, Westeros is not in a good shape. Kingdoms are always in combat with each other to take The Iron Throne, located in King's Landing. Who will be the conqueror at the end? Will it be **The Lannisters**? Or the rightful heir's kingdom, **The Baratheons**? Or **The Targaryens**? No one could know exactly *(at least until George decides to finish the series)*.

UNTIL NOW!

With the help of *Tyrion Lannister (may blessings be upon you)*, we have managed to create a Simulator which will help deciding the rightful King(dom), without any bloodshed. The Kingdoms will have duels until a winner is decided. But, we need your help.

3 Specifications

3.1 House

A House is represented by a duel contender (a `Character`). It's identified by its `houseName`, and the number of its `inhabitants`. Every inhabitant will cheer their duellist, which will increase the duellist's attack power by 1. After duels, it may increase or decrease.

There will be 2 different types of houses `(GreatHouse, NobleHouse)`.

3.1.1 Great House

A Great House will consist of 50 supporters at the beginning. Winning increases by 5, losing decreases by 5. It can not be below 0, or over 100.

Duel between two Great Houses:

1. Apply cheer damage buff to Character(s).
2. Duel Characters.
3. Decide the winner and the loser House.
4. If the duel ends within 2 rounds, the loser House's supporters will be highly disappointed and leave the arena. Decrease loser House's supporter count by 8. Increase the winner House's supporter count by 4. (It will be not active if the duel is a draw.)
5. If the duel does not end within 6 rounds, the supporters will be bored and leave the arena. Decrease both sides supporter count by 6.
6. Increase/Decrease support count by winning/losing.

Note: These extra increments/decrements are **NOT** overriding the default increments. For example, if a Great House wins in 1st or 2nd round, it will gain $5 + 4 = 9$ supporters.

3.1.2 Noble House

A Noble House will consists of 30 supporters at the beginning. Winning increases by 3, losing decreases by 3. It can not be below 0, or over 60.

Duel between two Noble Houses:

1. Apply cheer damage buff to Character(s).
2. Duel Characters.
3. Decide the winner and the loser House.
4. If the loser House has more supporters than the winner House, there will be a **Fight** between supporters.
5. In case of a **Fight**, decrease winner House's supporter count by 20%. (Get the **floor** of the value. For example; if there are 24 supporters, decrease the count by 4, not 5.)
6. Increase/Decrease support count by winning/losing.

3.2 Character

The Duel Contender. It's identified by its `characterName`, `health`, and `attackPower`.

Every Character has a special skill that will be activated at the end of the turn, and they are stackable. **Note that all skills must be activated before use, hence their effects will be seen in the next turn.**

Duel between two Characters:

1. Restore Character's health to its original state (with Armor and Religion values added if exists), remove every debuff.
2. Apply Cheer Damage Bonus (from House that Character belongs).
3. Do:
4. Apply Debuff Damages.
5. Both of the duellist will attack at the same time. Hence;
   `firstCharactersHealth -= secondCharactersAttackPower;`
   `secondCharactersHealth -= firstCharactersAttackPower;`
6. until one (or both) of them dies (`health` <= 0). Note that they may both die simultaneously.

Note: Do not forget to take debuffs (magical damage, bleeding, frostbite) into account. They shall be applied before duellist hit each other.

For example, a Whitewalker may die from `Bleeding`, and the opponent Wildling may die at the same time from `Frostbite`.

There will be 3 different types of Characters `(Wizard, Whitewalker, Wildling)`.

3.2.1 Wizard

`Health = 450, Attack Power = 60, Abbreviation = "-WIZ-".`

Will activate `Magical Attack`, which will decrease opponent's health by `MAGICAL_DAMAGE` at each turn. Stackable up to 3.

3.2.2 Whitewalker

`Health = 600, Attack Power = 40, Abbreviation = "-WHI-".`

Will activate `Frostbite`, which will decrease opponent's health by `FROSTBITE_DAMAGE` at each turn. Stackable up to 3.

3.2.3 Wildling

`Health = 425, Attack Power = 70, Abbreviation = "-WIL-".`

Will activate `Bleeding`, which will decrease opponent's health by `BLEEDING_DAMAGE` at each turn. Stackable up to 3.

3.3 Kingdom

A Kingdom is consisted of 1 Great House, and 3 Noble Houses. It's identified by its `kingdomName` and its `religion`.

- The Kingdom's religion will affect its habitants, which are Characters of Great House and Noble Houses. Whenever a Great House is assigned or a Noble House is added in a Kingdom, their Characters will accept the Kingdom's religion.
- Note: A Kingdom may change its religion while War goes on.

- A kingdom may dismiss its Great House, assign a new Great House, remove one of its Noble House, or add a new Noble House while War goes on. However, there will always be 1 Great House and 3 Noble Houses in a Kingdom.
- Note: If a Great House is dismissed or a Noble House is removed from a Kingdom, they will lose their Religion (*No pun intended for R.E.M*) (set Religion to NONE).

3.4 War

The War class is responsible for holding duels. So, how are those duels going to happen?

1. Pick two Kingdoms from the list. Start a duel with them if they didn't duel before.
2. Do until every kingdom is duelled with each other. (For example, if there are 4 kingdoms, there should be 6 duels - 1vs2, 2vs3, 3vs4, 1vs3, 2vs4, 1vs4.) Winner gets +1 point.
3. Duel order is important, and detailed in Output Notes below.
4. When the duelling is finished, announce the winner with the most point as the new owner of King's Landing.
5. In case of a draw, announce the winner(s) as a coalition(!).

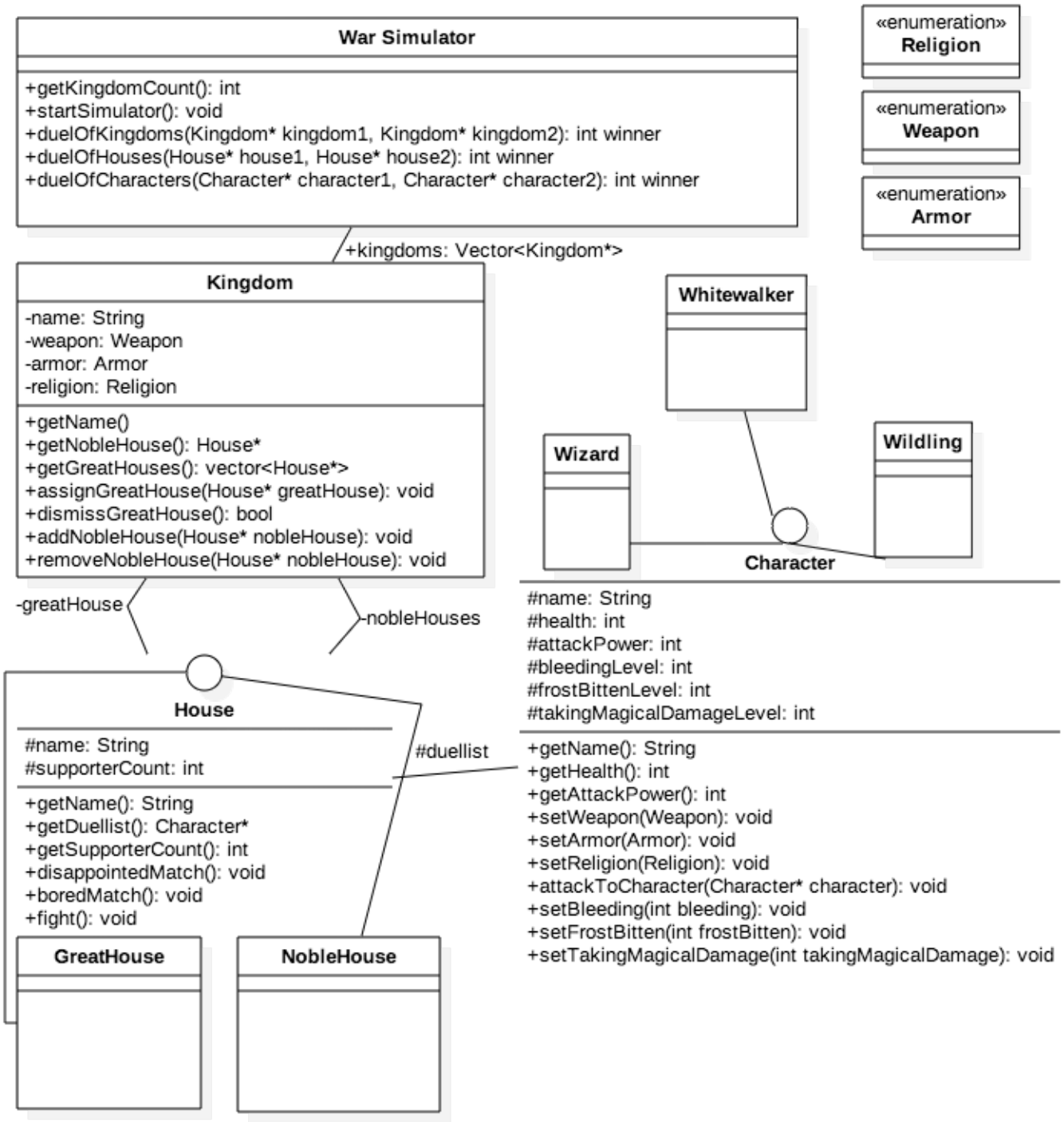
Duel between two Kingdoms:

1. Pick one Noble House from both side. Start a duel if they didn't duel before.
2. Do until every Noble House is duelled with every opposite Noble House. Winner gets +1 point. In case of a draw (both duelists may die simultaneously), no points will be given for either sides.
3. Duel order is important, and detailed in Output Notes below.
4. Duel Great Houses. Winner gets +3 points. Same rule of draw applies.
5. Compare points. In case of a draw, give both Kingdoms +1 point.

3.5 Enumerators

There are 16 Weapon type, 4 Armor type and 8 Religion types. They will buff `Character`'s health and attack power, according to the type. Weapon types affects attack power, Armor affects health, Religion affects both. Every value is already written and given to you in Enums.cpp.

4 Class Diagram



5 Regulations

1. **Programming Language:** You must code your program in C++. You are expected make sure your code compiles successfully with `g++` on department lab computers using the flags `-ansi -pedantic`. A Makefile will be provided for sample usage.
2. **Late Submission:** A penalty of $5 * day * day$ will be applied.
3. **Cheating:** Cheating will result in receiving 0 from all assignments and the university regulations will be applied.
4. **Newsgroup:** You must follow the CENG242 newsgroup for discussions and possible updates on a daily basis.
5. **Evaluation:** Your program will be evaluated automatically using "black-box" technique so make sure to obey the specifications.

6 Input Format

The input format will be like:

```
Kingdom Count :  n

Kingdom0Name/KingdomReligion
GreatHouseName/CharacterName/CharacterType/CharacterWeapon/CharacterArmor
NobleHouse1Name/CharacterName/CharacterType/CharacterWeapon/CharacterArmor
NobleHouse2Name/CharacterName/CharacterType/CharacterWeapon/CharacterArmor
NobleHouse3Name/CharacterName/CharacterType/CharacterWeapon/CharacterArmor

...
```

6.1 Input Example

```
1  Kingdom Number : 3
2
3  The Westernlands/Great Stallion-6
4  House Frey/Jamie Lannister/Whitewalker/Ice Blade-1/Armor_None-0
5  Crakehalls/Desmond Crakehall/Wildling/Dagger-7/Leather-1
6  Paynes/Ilyn Payne/Whitewalker/Ice Blade-5/Chainmail-2
7  Lannister of Lannisports/Reginald Lannister/Wildling/Dagger-7/Leather-1
8
9  The Iron Islands/God of Death-5
10 House Greyjoy/Balon Greyjoy/Wildling/Dagger-7/Leather-1
11 Goodbrothers/Urragon Goodbrother/Wildling/Dagger-7/Platemail-3
12 Merlyns/Meldred Merlyn/Whitewalker/Ice Blade-5/Chainmail-2
13 Harlaws/Alannys Harlaw/Whitewalker/Ice Blade-5/Armor_None-0
14
15 Dorne/Old Gods of the Forest-2
16 House Martell/Doran Martell/Wildling/Dagger-7/Armor_None-0
17 Jordaynes/Trebor Jordayne/Wizard/Lighting Staff-3/Platemail-3
18 Gargalens/Lord Gargalen/Whitewalker/Ice Blade-5/Armor_None-0
19 Manwoodys/Dagos Manwoody/Wildling/Longbow-6/Armor_None-0
```

7 Notes

7.1 Input Notes

1. Names can include spaces.
2. Enumerated inputs -such as `Weapon, Armor, Religion`- are given number, hence you do not need to save/parse their names.
3. There will be no erroneous input.

7.2 Output Notes

1. The order of duels is important. Although sample outputs will be given, here is an example for the given input example;

   The Westernlands vs The North
   `Phase 1 of Noble Houses`

   - *First Duel*: Serrets vs Dustins
   - *Second Duel*: Leffords vs Manderlys
   - *Third Duel*: Yarwycks vs Mormonts

   `Phase 2 of Noble Houses`

   - *Fourth Duel*: Serrets vs Manderlys
   - *Fifth Duel*: Leffords vs Mormonts
   - *Sixth Duel*: Yarwycks vs Dustins

   `Phase 3 of Noble Houses`

   - *Seventh Duel*: Serrets vs Mormonts
   - *Eighth Duel*: Leffords vs Dustins
   - *Ninth Duel*: Yarwycks vs Manderlys

   `Phase of Great Houses`

   - Tenth (last) Duel: House Frey vs House Stark

   The North vs The Vale of Arryn
   ...
   The Westernlands vs The Vale of Arryn
   ..
   And the winner.

   In summary, the order of Kingdom duel (of 5) is:

   1-vs-2, 2-vs-3, 3-vs-4, 4-vs-5,
   1-vs-3, 2-vs-4, 3-vs-5,
   1-vs-4, 2-vs-5,
   1-vs-5.

The order of House duel is:
1-vs-1, 2-vs-2, 3-vs-3,
1-vs-2, 2-vs-3, 3-vs-1,
1-vs-3, 2-vs-1, 3-vs-2,

So, the duel count of Kingdom is $kingdomCount * (kingdomCount - 1)/2$. A kingdom will have 10 duels within. Hence, there should be 30 duels for example input.

7.2.1 Output Format

NH1 = Noble House 1, +N = Name, +S = Supporter Count,
NH2 = Noble House 2, +N = Name, +S = Supporter Count
NH1D = Noble House 1 Duellist(Character) Name, +H = Health, +A = Abbreviation
NH2D = Noble House 2 Duellist(Character) Name, +H = Health, +A = Abbreviation

War has started with N kingdoms.
- Duel x: `<Kingdom1Name>` vs `<Kingdom2Name>`
- Duel between `<NH1N>(NH1S)` `<NH1DA>` vs `<NH2N>(NH2S)` `<NH2DA>` has begun.
- `<NH1D>(NH1DH)` took `xxx` as DOT. (Print only if xxx > 0)
- `<NH2D>(NH2DH)` took `yyy` as DOT. (Print only if yyy > 0)
- `<NH1D>(NH1DH)` hit `<NH2D>(NH2DH) qqq`.
- `<NH2D>(NH2DH)` hit `<NH1D>(NH1DH) www`.
- ****
- `<NH1D or NH2D>(NH1DH or NH2DH)` has won.
- ...
- `<NH1N>` got `A` house points. `<NH2N>` got `B` house points.

- The winner is: `<Kingdom1Name> or <Kingdom2Name>` with currently `Kingdom1Point or Kingdom2Point` points.
...
The war is over. The new owner of King's Landing is `ChampionKingdomName` with a total of `ChampionKingdomPoint`.

7.3 Memory Notes

1. Characters are not tied to Houses, and Houses are not tied to Kingdoms. A Kingdom may dismiss its Great House, a Great House may dismiss its Character. Hence, the Characters and Houses must stay alive *(No pun intended for Bee Gees)* when they are dismissed.

2. Be careful about leaks. When the War ends, everything should be deallocated properly. Additionally, we may test the Characters/Houses/Kingdoms at the end of the War whether they still exists.

7.4 General Notes

1. Be careful about resetting values, especially the values of attack power and health.

2. You may add private/protected methods/attributes to classes. But you are not allowed to change the explicitly said -not to change- methods/attributes.

3. A Character cannot belong more than 1 house, a House cannot belong more than 1 Kingdom.

4. A Kingdom will always have 1 Great House and 3 Noble Houses.

5. Even though you did not need to fill Wizard.cpp (for example), do not forget to create and add Wizard.cpp in your zipped file.

8 TL;DR

1. Implement the methods defined in given .h files (Character.h, House.h, Kingdom.h, War.h).
   - Keep in mind that you are not able to instantiate a virtual class.
   - Also keep in mind that you cannot build and run with the given files only.

2. Define and implement these classes (this order is not a must, but advised):

   - NobleHouse
   - GreatHouse
   - Wizard
   - Wildling
   - Whitewalker
   - Kingdom
   - War

3. There are some methods that will ease your understanding of this homework. You are not entitled to use/implement them, but you are **strongly encouraged***(I love this phrase)* to do so.

4. Take a look at given main.cpp to see how things goes on. The result of main.cpp is in mainResult.out.

5. If you think there are errors/inconsistencies/dragons in the given info/input/output, feel free to inform me any time (yes, it **DOES** include 3:42 AM).

6. May it be easy.

9 Submission

Submission will be done via COW. Create a zip file named `hw4.zip` that contains all your source code files. Do not submit a file that contains a `main` function. Such a file will be provided and your code will be compiled with it.
Note: The submitted zip file should not contain any directories! The following command sequence is expected to run your program on a Linux system:

```
$ unzip hw4.zip
$ make clean
$ make all
$ make run
```