

Object-Oriented Programming – Exam – April 6, 2015

Problem 2 – Army of Creatures

Few **armies** are fighting with their ancient mythology creatures.

- Each **creature** has properties: **attack**, **defense**, **health points**, **damage** and **list of specialties**.
- Each **specialty** can apply special rules (changing creatures properties) during the battle.
- The battle consists of turns. Each turn can be one of 3 possible actions:
 - **Adding** new creatures to one of the armies
 - **Attacking** one creature from one army to other creature from another army
 - **Skipping** turn. In this action the creature does not attack, but can receive some bonuses to its properties

You are given an object-oriented implementation of the creatures, specialties and battles between the armies.

Your task is to **extend the existing code** following all the requirements described in this document.

Examine the existing code for hints and to better understand how the code works. Pay special attention to where the specialty methods are called (**ApplyWhenAttacking**, **ApplyWhenDefending**, **ApplyAfterDefending**, **ChangeDamageWhenAttacking**, **ApplyOnSkip**).

To give you an overview of the code: There are **3 folders** in the given project:

- Some of the code is already implemented in **ArmyOfCreatures.Logic** namespace (**/Logic/ folder**). **You are not allowed to change, add or remove code in this folder.** The important classes in this folder are:
 - The **BattleManager** class which is responsible for simulating a battle between two armies of creatures. It contains the logic of the **Add**, **Attack** and **Skip** actions during a battle.
 - The **CreaturesInBattle** contains the current properties for one type of creatures in the battle. It has 3 important methods: **DealDamage**, **Skip** and **StartNewTurn**.
 - The abstract class **Creature** and few creature implementations
 - The abstract class **Specialty** and few specialty implementations
 - The **CreaturesFactory** class is responsible for creating creatures from given type name as string.
- There is **ArmyOfCreatures.Console** namespace (**/Console/ folder**) which is responsible for reading and writing to the console and command parser for the 4 commands controlling the battles between the armies.
 - **You are not allowed to change, add or remove code from this folder, too.**
 - The only methods **you are allowed to change** in **ArmyOfCreatures.Console** namespace are:
 - The static method **GetCreaturesFactory** in the **Program** class.
 - The static method **GetBattleManager** in the **Program** class.
 - You should not concern yourself with handling input and output data – the engine does it for you.
- There is an empty namespace **ArmyOfCreatures.Extended** (**/Extended/ folder**) in which you should put all of your code.
 - In the folder named **Creatures** in the **Extended** folder put your implementations of the **Creature** class
 - In the folder **Specialties** put your implementations of the **Specialty** class

- All other code files put directly in the folder **Extended**
- You can safely delete the DeleteMe.cs file

Commands

There are 4 commands that the application supports:

- **add** command – adds **Count** number of **CreatureType** creatures to one of the two armies (with number **ArmyId**)
 - Syntax: **add Count CreatureType(ArmyId)**
 - Example: **add 10 Archangel(2)** – adds 10 archangels to the second army
 - Note: no two creatures with both the same creature type and army id will be added
- **attack** command – executes an attack between creature with type **AttackerType** from army with number **AttackerArmyId** and creature with type **DefenderType** from army with number **DefenderArmyId**
 - Syntax: **attack AttackerType(AttackerArmyId) DefenderType(DefenderArmyId)**
 - Example: **attack Angel(2) Goblin(1)** – the angels from the second army attack the goblins from the first army
- **skip** command – skips the turn of the given **CreatureType** from the given **ArmyId**
 - Syntax: **skip CreatureType(ArmyId)**
 - Example: **skip Griffin(2)** – skips the turn of the griffins from the second army
- **exit** command – Immediately exits the console application
 - Syntax: **exit**

Tasks

- Add class **Goblin**. The **Goblin** is a creature with attack **4**, defence **2**, health points **5** and damage **1.5** and has **no specialties**.
 - *Hint: Examine other successors of the **Creature** class*
- Add class **AncientBehemoth**. The **AncientBehemoth** is a creature with attack **19**, defense **19**, damage **40**, health points **300** and has the following specialties:
 - **ReduceEnemyDefenseByPercentage** specialty with 80% damage reduction
 - **DoubleDefenseWhenDefending** specialty for 5 rounds
 - *Hint: The class **AncientBehemoth** is similar to **Behemoth** creature class.*
- Add class **DoubleDamage**. The **DoubleDamage** is a specialty that **doubles the current damage** during battle.
 - The **DoubleDamage** class should have only one **constructor** that accepts one argument – the number of rounds for the specialty to have effect. After these rounds (attacks) the effect of this specialty stops.
 - The number of rounds in the constructor should be greater than 0
 - The number of rounds in the constructor should be less than or equal to 10
 - Override the default **ToString()** implementation to return the name of the specialty with the number of rounds remaining in parenthesis. Example: **"DoubleDamage(7)"**
 - *Hint: The class **Hate** (specialty) also changes the damage during the battle.*
 - *Hint: The class **DoubleDefenseWhenDefending** also has fixed rounds of effectiveness.*

- Add class **WolfRaider**. The **WolfRaider** is a creature with attack **8**, defense **5**, health points **10**, damage **3.5** and:
 - **DoubleDamage** specialty for 7 rounds
- Add class **Griffin**. The **Griffin** is a creature with attack **8**, defense **8**, damage **4.5** and health points **25**. It also has the following specialties:
 - **DoubleDefenseWhenDefending** for 5 rounds
 - **AddDefenseWhenSkip** with 3 defense points
 - **Hate** specialty to **WolfRaider** creatures
 - *Hint: The **Angel**, **Archangel**, **Devil** and **ArchDevil** creatures also have **Hate** specialty.*
- Add class **AddAttackWhenSkip**. The **AddAttackWhenSkip** is a specialty that **adds attack points** to the permanent attack points of the creature and is applied **when creature skips** its turn.
 - The class should have only one **constructor** which accepts integer argument (between 1 and 10, inclusive) – the value to add to the permanent attack of the creature during skip action in battle.
 - Override the default **ToString()** implementation to return the name of the specialty with the number of attack to add in parenthesis. Example: "**AddAttackWhenSkip(3)**"
 - *Hint: The class **AddAttackWhenSkip** is similar to **AddDefenseWhenSkip**.*
- Add class **DoubleAttackWhenAttacking**. The **DoubleAttackWhenAttacking** is a specialty. It doubles the current attack when creature is attacking.
 - The class should have only one **constructor** that accepts one argument – the number of rounds for the specialty to has effect. After these rounds the effect of this specialty stops.
 - The number of rounds in the constructor should be greater than 0
 - Override the default **ToString()** implementation to return the name of the specialty with the number of rounds left in parenthesis. Example: "**DoubleAttackWhenAttacking(4)**"
- Add class **CyclopsKing**. The **CyclopsKing** is a creature with attack **17**, defense **13**, damage **18**, health points **70** and the following specialties:
 - **AddAttackWhenSkip** with 3 attack points for each skip action.
 - **DoubleAttackWhenAttacking** for 4 rounds
 - **DoubleDamage** for 1 round
- **Implement support for working with 3 armies (instead of only 2 in the current implementation)**
 - The console application should be able to process commands where the *ArmyId* is equal to 3
 - **add 10 ArchDevil(3)** should be valid command
 - **attack Angel(1) ArchDevil(3)** should also be a valid command
 - See the **second example** below
 - Remember: You are NOT allowed to edit the **BattleManager** class neither the commands classes in the **Console** folder.

Additional Requirements

As you know **100 of the points** for this task are given by <http://bgcoder.com> and the other 100 points will be awarded after we manually test your code. Each of these requirements will affect your final exam points:

- Name all classes exactly as explained above
 - For example the class containing **AddAttackWhenSkip** speciality should be called exactly **AddAttackWhenSkip**
- All reference arguments that are passed to externally visible methods **should be checked against null**.
 - Throw an **ArgumentNullException** when the argument is **null**.

- Implement all described data validations
 - For example: As described above **AddAttackWhenSkip** constructor should accept only positive values between 1 and 10, inclusive.
- Your code should compile without any warnings.
- Do not hide existing methods with the **new** keyword.
- Follow all the described rules and DO NOT change the existing code as described above.
- etc.

Example Input and Output

In the given skeleton you will find the input and output files for the two examples given bellow.

If you pass only the first example test you are most likely to have 70 points in the judge system (bgcoder.com).

Sample Input	Sample Output
<pre> add 10 AncientBehemoth(1) add 100 WolfRaider(1) add 100 Goblin(1) add 10 CyclopsKing(2) add 50 Griffin(2) add 10 Archangel(2) attack Archangel(2) Goblin(1) attack AncientBehemoth(1) Archangel(2) attack Griffin(2) WolfRaider(1) attack WolfRaider(1) Griffin(2) skip CyclopsKing(2) attack Archangel(2) WolfRaider(1) attack AncientBehemoth(1) Archangel(2) attack Griffin(2) AncientBehemoth(1) attack CyclopsKing(2) AncientBehemoth(1) attack Archangel(2) AncientBehemoth(1) attack </pre>	<pre> --- Creature added to army 1 - AncientBehemoth (ATT:19; DEF:19; HP:300; DMG:40) [ReduceEnemyDefenseByPercentage(80),DoubleDefenseWhenDefending(5)] --- Creature added to army 1 - WolfRaider (ATT:8; DEF:5; HP:10; DMG:3.5) [DoubleDamage(7)] --- Creature added to army 1 - Goblin (ATT:4; DEF:2; HP:5; DMG:1.5) [] --- Creature added to army 2 - CyclopsKing (ATT:17; DEF:13; HP:70; DMG:18) [AddAttackWhenSkip(3),DoubleAttackWhenAttacking(4),DoubleDamage(1)] --- Creature added to army 2 - Griffin (ATT:8; DEF:8; HP:25; DMG:4.5) [DoubleDefenseWhenDefending(5),AddDefenseWhenSkip(3),Hate(WolfRaider)] --- Creature added to army 2 - Archangel (ATT:30; DEF:30; HP:250; DMG:50) [Hate(Devil),Hate(ArchDevil),Resurrection] --- Attacker before - 10 Archangel (ATT:30; DEF:30; THP:2500; LDMG:0) --- Defender before - 100 Goblin (ATT:4; DEF:2; THP:500; LDMG:0) --- Attacker after - 10 Archangel (ATT:30; DEF:30; THP:2500; LDMG:1200) --- Defender after - 0 Goblin (ATT:4; DEF:2; THP:0; LDMG:0) --- Attacker before - 10 AncientBehemoth (ATT:19; DEF:19; THP:3000; LDMG:0) --- Defender before - 10 Archangel (ATT:30; DEF:30; THP:2500; LDMG:0) --- Attacker after - 10 AncientBehemoth (ATT:19; DEF:19; THP:3000; LDMG:660) --- Defender after - 8 Archangel (ATT:30; DEF:6; THP:2000; LDMG:0) --- Attacker before - 50 Griffin (ATT:8; DEF:8; THP:1250; LDMG:0) --- Defender before - 100 WolfRaider (ATT:8; DEF:5; THP:1000; LDMG:0) --- Attacker after - 50 Griffin (ATT:8; DEF:8; THP:1250; LDMG:388.125) --- Defender after - 62 WolfRaider (ATT:8; DEF:5; THP:612; LDMG:0) --- Attacker before - 62 WolfRaider (ATT:8; DEF:5; THP:612; LDMG:0) --- Defender before - 50 Griffin (ATT:8; DEF:8; THP:1250; LDMG:0) --- Attacker after - 62 WolfRaider (ATT:8; DEF:5; THP:612; LDMG:347.2) --- Defender after - 37 Griffin (ATT:8; DEF:16; THP:903; LDMG:0) --- Before skip - 10 CyclopsKing (ATT:17; DEF:13; THP:700; LDMG:0) --- After skip - 10 CyclopsKing (ATT:20; DEF:16; THP:700; LDMG:0) --- Attacker before - 8 Archangel (ATT:30; DEF:30; THP:2000; LDMG:0) </pre>

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AncientBehemoth(1)
CyclopsKing(2)
attack Griffin(2)
AncientBehemoth(1)
attack
CyclopsKing(2)
AncientBehemoth(1)
attack Archangel(2)
AncientBehemoth(1)
attack
AncientBehemoth(1)
CyclopsKing(2)
exit

--- Defender before - 62 WolfRaider (ATT:8; DEF:5; THP:612; LDMG:0)
--- Attacker after - 8 Archangel (ATT:30; DEF:30; THP:2000; LDMG:900)
--- Defender after - 0 WolfRaider (ATT:8; DEF:5; THP:0; LDMG:0)
--- Attacker before - 10 AncientBehemoth (ATT:19; DEF:19; THP:3000; LDMG:0)
--- Defender before - 8 Archangel (ATT:30; DEF:30; THP:2000; LDMG:0)
--- Attacker after - 10 AncientBehemoth (ATT:19; DEF:19; THP:3000; LDMG:660)
--- Defender after - 6 Archangel (ATT:30; DEF:6; THP:1500; LDMG:0)
--- Attacker before - 37 Griffin (ATT:8; DEF:8; THP:903; LDMG:0)
--- Defender before - 10 AncientBehemoth (ATT:19; DEF:19; THP:3000; LDMG:0)
--- Attacker after - 37 Griffin (ATT:8; DEF:8; THP:903; LDMG:49.95)
--- Defender after - 10 AncientBehemoth (ATT:19; DEF:38; THP:2951; LDMG:0)
--- Attacker before - 10 CyclopsKing (ATT:20; DEF:16; THP:700; LDMG:0)
--- Defender before - 10 AncientBehemoth (ATT:19; DEF:19; THP:2951; LDMG:0)
--- Attacker after - 10 CyclopsKing (ATT:40; DEF:16; THP:700; LDMG:396)
--- Defender after - 9 AncientBehemoth (ATT:19; DEF:38; THP:2555; LDMG:0)
--- Attacker before - 6 Archangel (ATT:30; DEF:30; THP:1500; LDMG:0)
--- Defender before - 9 AncientBehemoth (ATT:19; DEF:19; THP:2555; LDMG:0)
--- Attacker after - 6 Archangel (ATT:30; DEF:30; THP:1500; LDMG:240)
--- Defender after - 8 AncientBehemoth (ATT:19; DEF:38; THP:2315; LDMG:0)
--- Attacker before - 8 AncientBehemoth (ATT:19; DEF:19; THP:2315; LDMG:0)
--- Defender before - 10 CyclopsKing (ATT:20; DEF:16; THP:700; LDMG:0)
--- Attacker after - 8 AncientBehemoth (ATT:19; DEF:19; THP:2315; LDMG:560)
--- Defender after - 2 CyclopsKing (ATT:20; DEF:4; THP:140; LDMG:0)
--- Attacker before - 37 Griffin (ATT:8; DEF:8; THP:903; LDMG:0)
--- Defender before - 8 AncientBehemoth (ATT:19; DEF:19; THP:2315; LDMG:0)
--- Attacker after - 37 Griffin (ATT:8; DEF:8; THP:903; LDMG:49.95)
--- Defender after - 8 AncientBehemoth (ATT:19; DEF:38; THP:2266; LDMG:0)
--- Attacker before - 2 CyclopsKing (ATT:20; DEF:16; THP:140; LDMG:0)
--- Defender before - 8 AncientBehemoth (ATT:19; DEF:19; THP:2266; LDMG:0)
--- Attacker after - 2 CyclopsKing (ATT:40; DEF:16; THP:140; LDMG:39.6)
--- Defender after - 8 AncientBehemoth (ATT:19; DEF:38; THP:2227; LDMG:0)
--- Attacker before - 6 Archangel (ATT:30; DEF:30; THP:1500; LDMG:0)
--- Defender before - 8 AncientBehemoth (ATT:19; DEF:19; THP:2227; LDMG:0)

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	<p>--- Attacker after - 6 Archangel (ATT:30; DEF:30; THP:1500; LDMG:465)</p> <p>--- Defender after - 6 AncientBehemoth (ATT:19; DEF:19; THP:1762; LDMG:0)</p> <p>--- Attacker before - 6 AncientBehemoth (ATT:19; DEF:19; THP:1762; LDMG:0)</p> <p>--- Defender before - 2 CyclopsKing (ATT:20; DEF:16; THP:140; LDMG:0)</p> <p>--- Attacker after - 6 AncientBehemoth (ATT:19; DEF:19; THP:1762; LDMG:420)</p> <p>--- Defender after - 0 CyclopsKing (ATT:20; DEF:4; THP:0; LDMG:0)</p>
<pre> add 10 Angel(1) add 10 Devil(1) add 10 Archangel(2) add 10 ArchDevil(3) attack Archangel(2) Devil(1) attack ArchDevil(3) Angel(1) attack Angel(1) ArchDevil(3) attack Devil(1) Archangel(2) attack Archangel(2) Devil(1) attack ArchDevil(3) Angel(1) attack Archangel(2) ArchDevil(3) attack ArchDevil(3) Archangel(2) attack Archangel(2) ArchDevil(3) attack ArchDevil(3) Archangel(2) attack Archangel(2) ArchDevil(3) attack ArchDevil(3) Archangel(2) attack Archangel(2) ArchDevil(3) exit </pre>	<p>--- Creature added to army 1 - Angel (ATT:20; DEF:20; HP:200; DMG:50) [Hate(Devil),Hate(ArchDevil)]</p> <p>--- Creature added to army 1 - Devil (ATT:19; DEF:26; HP:160; DMG:35) [Hate(Angel),Hate(Archangel),ReduceEnemyDefenseByPercentage(100)]</p> <p>--- Creature added to army 2 - Archangel (ATT:30; DEF:30; HP:250; DMG:50) [Hate(Devil),Hate(ArchDevil),Resurrection]</p> <p>--- Creature added to army 3 - ArchDevil (ATT:21; DEF:28; HP:200; DMG:35) [Hate(Angel),Hate(Archangel),ReduceEnemyDefenseByPercentage(100)]</p> <p>--- Attacker before - 10 Archangel (ATT:30; DEF:30; THP:2500; LDMG:0)</p> <p>--- Defender before - 10 Devil (ATT:19; DEF:26; THP:1600; LDMG:0)</p> <p>--- Attacker after - 10 Archangel (ATT:30; DEF:30; THP:2500; LDMG:900)</p> <p>--- Defender after - 5 Devil (ATT:19; DEF:26; THP:700; LDMG:0)</p> <p>--- Attacker before - 10 ArchDevil (ATT:21; DEF:28; THP:2000; LDMG:0)</p> <p>--- Defender before - 10 Angel (ATT:20; DEF:20; THP:2000; LDMG:0)</p> <p>--- Attacker after - 10 ArchDevil (ATT:21; DEF:28; THP:2000; LDMG:1076.25)</p> <p>--- Defender after - 5 Angel (ATT:20; DEF:0; THP:924; LDMG:0)</p> <p>--- Attacker before - 5 Angel (ATT:20; DEF:20; THP:924; LDMG:0)</p> <p>--- Defender before - 10 ArchDevil (ATT:21; DEF:28; THP:2000; LDMG:0)</p> <p>--- Attacker after - 5 Angel (ATT:20; DEF:20; THP:924; LDMG:300)</p> <p>--- Defender after - 9 ArchDevil (ATT:21; DEF:28; THP:1700; LDMG:0)</p> <p>--- Attacker before - 5 Devil (ATT:19; DEF:26; THP:700; LDMG:0)</p> <p>--- Defender before - 10 Archangel (ATT:30; DEF:30; THP:2500; LDMG:0)</p> <p>--- Attacker after - 5 Devil (ATT:19; DEF:26; THP:700; LDMG:511.875)</p> <p>--- Defender after - 8 Archangel (ATT:30; DEF:0; THP:2000; LDMG:0)</p> <p>--- Attacker before - 8 Archangel (ATT:30; DEF:30; THP:2000; LDMG:0)</p> <p>--- Defender before - 5 Devil (ATT:19; DEF:26; THP:700; LDMG:0)</p> <p>--- Attacker after - 8 Archangel (ATT:30; DEF:30; THP:2000; LDMG:720)</p> <p>--- Defender after - 0 Devil (ATT:19; DEF:26; THP:0; LDMG:0)</p> <p>--- Attacker before - 9 ArchDevil (ATT:21; DEF:28; THP:1700; LDMG:0)</p> <p>--- Defender before - 5 Angel (ATT:20; DEF:20; THP:924; LDMG:0)</p> <p>--- Attacker after - 9 ArchDevil (ATT:21; DEF:28; THP:1700; LDMG:968.625)</p> <p>--- Defender after - 0 Angel (ATT:20; DEF:0; THP:0; LDMG:0)</p> <p>--- Attacker before - 8 Archangel (ATT:30; DEF:30; THP:2000; LDMG:0)</p> <p>--- Defender before - 9 ArchDevil (ATT:21; DEF:28; THP:1700; LDMG:0)</p> <p>--- Attacker after - 8 Archangel (ATT:30; DEF:30; THP:2000; LDMG:660)</p> <p>--- Defender after - 6 ArchDevil (ATT:21; DEF:28; THP:1040; LDMG:0)</p>

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--- Attacker before - 6 ArchDevil (ATT:21; DEF:28; THP:1040; LDMG:0)
--- Defender before - 8 Archangel (ATT:30; DEF:30; THP:2000; LDMG:0)
--- Attacker after - 6 ArchDevil (ATT:21; DEF:28; THP:1040;
LDMG:645.75)
--- Defender after - 6 Archangel (ATT:30; DEF:0; THP:1500; LDMG:0)
--- Attacker before - 6 Archangel (ATT:30; DEF:30; THP:1500; LDMG:0)
--- Defender before - 6 ArchDevil (ATT:21; DEF:28; THP:1040; LDMG:0)
--- Attacker after - 6 Archangel (ATT:30; DEF:30; THP:1500; LDMG:495)
--- Defender after - 3 ArchDevil (ATT:21; DEF:28; THP:545; LDMG:0)
--- Attacker before - 3 ArchDevil (ATT:21; DEF:28; THP:545; LDMG:0)
--- Defender before - 6 Archangel (ATT:30; DEF:30; THP:1500; LDMG:0)
--- Attacker after - 3 ArchDevil (ATT:21; DEF:28; THP:545;
LDMG:322.875)
--- Defender after - 5 Archangel (ATT:30; DEF:0; THP:1250; LDMG:0)
--- Attacker before - 5 Archangel (ATT:30; DEF:30; THP:1250; LDMG:0)
--- Defender before - 3 ArchDevil (ATT:21; DEF:28; THP:545; LDMG:0)
--- Attacker after - 5 Archangel (ATT:30; DEF:30; THP:1250;
LDMG:412.5)
--- Defender after - 1 ArchDevil (ATT:21; DEF:28; THP:133; LDMG:0)
--- Attacker before - 1 ArchDevil (ATT:21; DEF:28; THP:133; LDMG:0)
--- Defender before - 5 Archangel (ATT:30; DEF:30; THP:1250; LDMG:0)
--- Attacker after - 1 ArchDevil (ATT:21; DEF:28; THP:133;
LDMG:107.625)
--- Defender after - 5 Archangel (ATT:30; DEF:0; THP:1250; LDMG:0)
--- Attacker before - 5 Archangel (ATT:30; DEF:30; THP:1250; LDMG:0)
--- Defender before - 1 ArchDevil (ATT:21; DEF:28; THP:133; LDMG:0)
--- Attacker after - 5 Archangel (ATT:30; DEF:30; THP:1250;
LDMG:412.5)
--- Defender after - 0 ArchDevil (ATT:21; DEF:28; THP:0; LDMG:0)

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