# CS 611 Legends: Monsters and Heroes

In this assignment you will implement a role-playing game in Java **using object-oriented principles and design**. This is a magical game full of spells, monsters, and heroes.

The monsters and heroes live in a fictional world. They do not get along and therefore fight each other. Every time the heroes win, they gain experience and money. Heroes use the money to buy a variety of items to aid them in their battles with the monsters. When they accumulate enough experience, they level up, which improves their skills. The goal of the game is for the heroes to defeat monsters and level up indefinitely.

## I. The World of Play

The world of the game is represented by a fixed, square grid of spaces. The grid contains three types of spaces:
- Inaccessible spaces, which the heroes cannot enter
- Market spaces, where items can be bought or sold
- Common spaces, where battles can occur

Every time the heroes visit a common tile, there is a chance that they will engage in a battle with the monsters. These monsters are not created when the map is created. Every time the heroes visit a space, we "roll a dice," and, if they are unlucky, then the monsters are created and the battle begins immediately.

The party of heroes is always located in a specific space of the grid. When not in a battle, the party can move up, down, left, or right to an adjacent space. The player can enter the market if the party is on a market space.

An example world size is 8 spaces by 8 spaces. In this size our suggestion is to have 20% inaccessible spaces, 30% market spaces, and 50% common spaces.

## II. The Battle

The battle pits the party of heroes against a group of monsters. A battle consists of multiple rounds, where the heroes and monsters each make moves. The fight ends when the HP of either all of the monsters or all of the heroes is zero. If the heroes win the fight, they earn money and experience, potentially leveling up. If the monsters win the fight, the game is over.

The monsters are created at the beginning of the battle. Their level should be scaled to the level of the heroes. There will be as many monsters as there are heroes. For example, if the player begins their adventure with two heroes, then every battle will be against two monsters. A more complex (and dangerous!) version might vary the number of monsters encountered and the monsters' levels.

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The heroes move first in each round. During the heroes' turn, the player chooses for each hero whether they will do **one** of the following:

- Attack, using the hero's equipped weapon
- Cast a spell from the hero's inventory
- Use a potion from the hero's inventory
- Equip a weapon or piece of armor

In addition, at any time during the heroes' turn, the player can display the statistics (ex. strength, or base damage) of a hero or a monster. This will not consume the turn. Monsters have a base dodge chance, allowing them to occasionally avoid taking damage from an attack or a spell. If an attack or a spell lowers a monster's HP to 0, that monster is defeated and removed from the battle.

After the heroes have made their moves, the monsters' turn begins. The monsters will only attack the heroes, as they do not have items or spells to use. Heroes also have a dodge chance that will allow them to occasionally avoid taking damage from a monster's attack. If a monster's attack lowers a hero's HP to 0, that hero will faint. Fainted heroes cannot take actions for the remainder of the battle.

During the round, **clearly show to the player who took what action and that action's result**. For example: "Karl the Barbarian attacked the Red Dragon for 504 damage!", "Merlin used a health potion and recovered 300 HP!", or "The Giant Bug attacked Wallace the Lame for 120 damage! Wallace the Lame fainted!"

At the end of each round (after the monsters' turn), heroes that have not fainted regain some of their HP and mana.

The heroes win the battle if they defeat all of the monsters. If the heroes win, they gain experience and money, and all fainted heroes are revived. The experience gained should be scaled to the level of the monsters defeated. For example, a level 1 monster may grant 1 experience point, while a level 10 monster may grant 10 experience points. The money gained should also be scaled to the level of the monsters defeated. For example, a level 1 monster may grant 100 gold, while a level 10 monster may grant 1000 gold. A fainted hero is revived with half of their HP and mana, but they will not gain any gold or experience.

The battle has several ways that it can be fought. The simplest version would be a series of 1-on-1 fights between an individual monster and an individual hero. A more complex version would be a full-team fight between the party and the monster group, where each combatant chooses their target when attacking. There are many variations of these two ideas, as well as completely different ways to conduct the battle. The version you choose to implement needs only to allow for all of the behavior specified above, namely that it is possible for all of the heroes to faint and for all of the monsters to be defeated.

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## III. The Heroes and Monsters

The heroes of the world have banded together into a party to fight monsters. At the start of the game, allow the player to choose how many heroes to play with. There should be a limit to how many heroes there are in the party.

A hero has several attributes:
- A name
- A level with an amount of experience points
- HP (hit points, the hero's in battle)
- MP (mana or magic points, for casting spells)
- A strength value
- A dexterity value
- An agility value
- An amount of gold
- An inventory of items

The example rules section at the end of this document contains several formulae you can use for determining HP, MP, and the calculations involving strength, dexterity, and agility.

**Level and experience points.** A hero has a level, representing how strong (or not) that hero is. Experience points determine the hero's level. A hero levels up after accumulating enough experience points. A hero's skills increase when the hero levels up. A hero never loses experience. It accumulates over the course of the game.

**HP.** HP is the hero's current health. For simplicity, the hero's HP does not have to be capped (have a maximum amount). For example, in other games a hero has a maximum of 100 HP and cannot go over this limit (it is said to be capped). So, if the hero currently has 90 hp and uses a potion that increases HP by 50, then the hero's HP would now become 100. In Monsters and Heroes you can assume that the hero's HP will become 140 in the same scenario. The initial HP value is determined by hero's level. When a hero levels up, they have their HP set according to the same formula.

**MP.** MP (or mana) is used to cast spells. For simplicity, the hero's MP does not have to be capped (like HP). The initial MP value is determined by the hero's level. When a hero levels up, they have their MP set according to the same formula.

**Strength.** A hero's strength increases the amount of damage they deal when using a weapon.

**Dexterity.** A hero's dexterity increases the amount of damage they deal when casting a spell.

**Agility.** A hero's agility increases their chance to dodge a monster's attack.

**Gold.** Gold represents the hero's money for use in the market.

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**Inventory.** A hero has a collection of items that they have bought during the game. At the start of the game, the inventory is empty. For simplicity, there does not need to be a maximum inventory size.

There are three types of heroes, each with their own balance of skills:

- **Warriors** are favored on strength and agility.
- **Sorcerers** are favored on dexterity and agility.
- **Paladins** are favored on strength and dexterity.

A "favored" skill will be increased more than normal at the start of the game and on each level up.

A monster has several attributes:
- A name
- A level
- HP
- A base damage value
- A defense value
- A dodge ability

The example rules section contains formulae for the monster's attributes that you can use in your game.

**Base damage.** For simplicity, a monster's attack damage is calculated using this value. A more complex alternative would be to give the monster a strength value like a hero and a default "monster weapon" to deal damage with.

**Defense.** Monsters don't wear armor, relying on their natural hides and carapaces to protect them from the heroes' attacks. This value reduces the amount of damage a monster takes from a hero's attack or spell.

**Dodge ability.** This represents how well a monster can avoid a hero's attack. It functions in a similar way to the hero's agility.

There are three kinds of monsters, each with a favored attribute:
- **Dragons** have increased base damage.
- **Exoskeletons** have increased defense.
- **Spirits** have increased dodge ability.

## IV.The Market

The heroes can buy and sell items at any market. Each market in the world is unique and should have different items for sale. The market is a special menu where the player will be able to see all the items for sale with their details (ex. price and level).

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Heroes enter the market individually. Each hero has a private wallet (their gold amount) and does not share money with the other heroes. Likewise, each hero has their own inventory of items that they do not share with their fellow heroes. A hero should be able to sell an item in their inventory to the market, but only for less than the price for which it was bought (ex. for half the purchase price). A successful purchase will reduce the amount of gold the hero has and transfer the item from the market to the hero's inventory. A successful sale will increase the amount of gold the hero has and add that item to the market's item list. This will allow other heroes to buy it, or for the selling hero to repurchase it later.

All items have a name, a price, and a level. A hero cannot buy: (1) an item that costs more than the money they have, or (2) an item that is a higher level than they are. The types of items in Monsters and Heroes are:
- Weapons
- Armor
- Potions
- Spells

Items should all have several uses before they are no longer useable. Once they are unusable, you can either replace them, or have them repaired at the market for half of the purchase price.

**Weapons.** A weapon is used by a hero to attack a monster. A weapon has a name, a price, a level, a damage value, and the number of hands required to use it. A weapon must be equipped by the hero before it can be used. The damage value is used to calculate the damage dealt during an attack move in a battle. A weapon may require one or two hands to be used (i.e. a bow requires two hands). The weapons requiring two hands must always be held with 2 hands. **However, you can equip a one-handed weapon with both hands and doing so should increase the strength of the weapon**.

**Armor.** Armor reduces the incoming damage from a monster's attack. A piece of armor has a name, a price, a level, and a damage reduction value. When equipped, armor will reduce the damage taken by the hero by its damage reduction value. For simplicity you can assume that a hero can equip at most one piece of armor at a time. A more complex version would have multiple armor slots and armor types for each slot.

**Potions.** Potions can be used by a hero to increase one of their statistics by some amount. **Potions are single-use items**: once they are used, potions cannot be reused. Potions have a name, a price, a level, and an effect amount. Using the potion should increase the given statistic by the effect amount. There should be potions for increasing HP, MP, strength, dexterity, and agility. More complex potions could include defense potions, revival potions, or even a fire potion (the possibilities are endless!). A more complex extension could include multi-use potions.

**Spells.** A spell represents a magic attack performed by a hero. A spell has a name, a price, a level, a damage value, a mana cost, and a spell type. A hero will require at least the mana cost amount of MP to cast the spell. Therefore, if a hero has no MP, that hero cannot cast any spells. The damage value is used along with the hero's dexterity value to calculate the

damage dealt during a spell cast move in a battle. After casting a spell, the mana cost is deducted from the hero's MP. Spells also have an additional effect besides their damage. The types of spells and their effects are:

- **Ice spell**: reduces the damage of the target
- **Fire spell**: reduces the defense of the target
- **Lightning spell**: reduces the dodge chance of the target

**Spells are consumable items**: like potions, spells can only be used a certain number of times. For simplicity, you can make spells single-use items. A more complex version would make spells multi-use items.

## V. Controls

Example controls for Monsters and Heroes include:
- **W/w:** move up
- **A/a:** move left
- **S/s:** move down
- **D/d:** move right
- **Q/q:** quit game
- **I/i:** show information
- **M/m:** enter market

**WASD/wasd.** These keys can be used to move the party around the world. This only applies outside of a battle.

**Q/q.** The player should be able to quit the game at any time by pressing this key.

**I/i.** Outside of battle this should show information about the heroes (their level, their hp, their mana, their current experience points, their money, and their skill levels).
During a battle this should show information about the heroes (their level, their hp, their mana and their currently equipped weapons and armors) and information about the monsters (their level, their hp, their damage, their defense, and their dodge chance).
Thus, **the player should be able at any moment to display the heroes' information.**

**M/m.** The heroes should only be able to enter a market if the party is located on a market space. This should open the market menu.

**Additionally,** when the heroes are outside of a market or a battle, they should be able to check their inventories to change their weapons or armor. They should also be able to consume a potion. The player should be able at any moment to display the map (the world). There should also be a way to visually represent all of the tiles and their properties. This includes the presence of the heroes' party in a tile, whether a tile is accessible, and if it contains a market. The player should be able at any moment to quit the game.

Finally, please include **in your game** the instructions for how to play. While you and I now know the keys used to play the game, keep in mind while coding that you might want to give this to your little brother who does not know any of this… make it user-friendly.

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## VI. Example Rules

The following rules are intended to be used in conjunction with the monsters, heroes, and items detailed in the provided Legends_Monsters_Heroes.zip file available on Blackboard. There is no guarantee that the resulting game will be balanced or particularly fun to play when using these formulae. There is no requirement to use these exact numbers or formulae. The example formulae:

- Hero's spell damage = $spell\_base\_damage + \left(\frac{dexterity}{10000}\right) \times spell\_base\_damage$
- HP of monsters and heroes = $level \times 100$
  When a hero levels up, this formula is used to reset their HP.
- MP of the heroes when they level up = $current\_mana \times 1.1$
- Hero's attack damage (with weapon) = $(strength + weapon\_damage) \times 0.05$
- Hero's dodge chance = $agility \times 0.002$
- Monster's dodge chance = $dodge\_chance \times .01$
- Experience points to level up = $hero\_current\_level \times 10$
- When a hero levels up all of their skills increase by 5% and their favored skills increase by an extra 5%.
- At the end of each round of a battle the heroes regain 10% of their HP and 10% of their MP. That is, $HP = HP \times 1.1$ and $MP = MP \times 1.1$
- Hero gold gain = $monster\_level \times 100$ for heroes who did not faint
- Hero experience gain = $number\_monsters \times 2$
- Monster's skill loss caused by spell effect = $affected_{skill} \times 0.1$
- Monster's level = level of highest-level hero in the party
- Items sell for half of their purchase price.
- The party size is between 1 and 3 heroes.

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## Assignment Logistics and Final Notes

The specification simulates a role-playing game of skill.

Implement the game **using the principles and practices of object-oriented design** as presented and discussed in lecture.

The objective of this assignment is to identify and represent correct relationships between classes while maintaining best practices in programming and OO design.

Our focus in grading will be on your OO structure and overall design, as well as how well you implemented those relationships. **We will not be as focused on how strictly you followed the rules of the game.** The rules are there as a guide and to make the whole experience more realistic, meaningful, and enjoyable. Feel free to get creative with additional functionalities given that you have fulfilled the existing requirements!

The helper files you have received have not been tested for fairness and you are free to adjust those values. We will be demonstrating a working version of the game during discussion sessions this week to help clarify the requirements of the game. In addition to the specification, the attached zip file contains the specifics for the heroes, monsters, weapons, armors, potions, and spells. You are always welcome to use your imagination to add more or use your own naming.

Your code should implement the ability to read in the text files for default attributes. These can be modified in game such as a hero leveling up, but at the start of the next game, values should reset to default.

**Please note that this is NOT a group assignment.** Your design and your implementation should be your own. Your program will be evaluated as follows:
- Object Design, with an emphasis on:
  - Scalability
  - Extendibility
- Implementation, with a specific emphasis on:
  - Usability
  - Readability
  - Best Practices

Deliverables:
- readme text file
- Java source code


A word of advice: Begin by understanding the game. The specification is long and wordy, but it is up to you to flesh out the requirements. We will be doing an in-class demonstration this week in discussion but come prepared with questions to ensure you have a solid understanding of the requirements. Have fun and have a great adventure!!