Laboratory Activity No. 2	
Inheritance, Encapsulation, and Abstraction	
Course Code: CPE009	**Program:** BSCPE
Course Title: Object-Oriented Programming	**Date Performed: 09-29-2024**
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1. Objective(s):

This activity aims to familiarize students with the concepts of Object-Oriented Programming

2. Intended Learning Outcomes (ILOs):

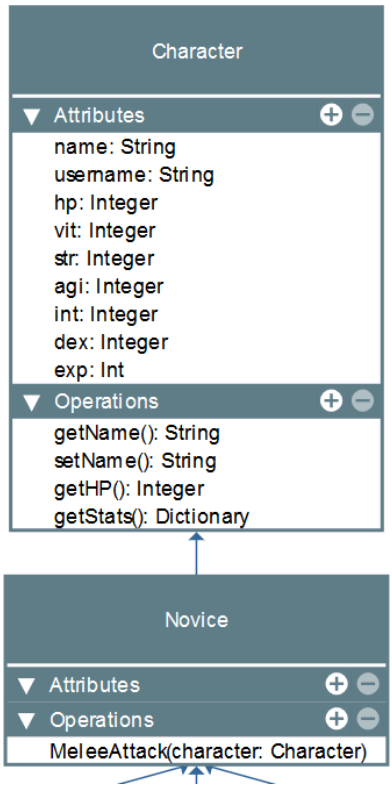
The students should be able to:

2.1 Identify the possible attributes and methods of a given object
2.2 Create a class using the Python language
2.3 Create and modify the instances and the attributes in the instance.

3. Discussion:

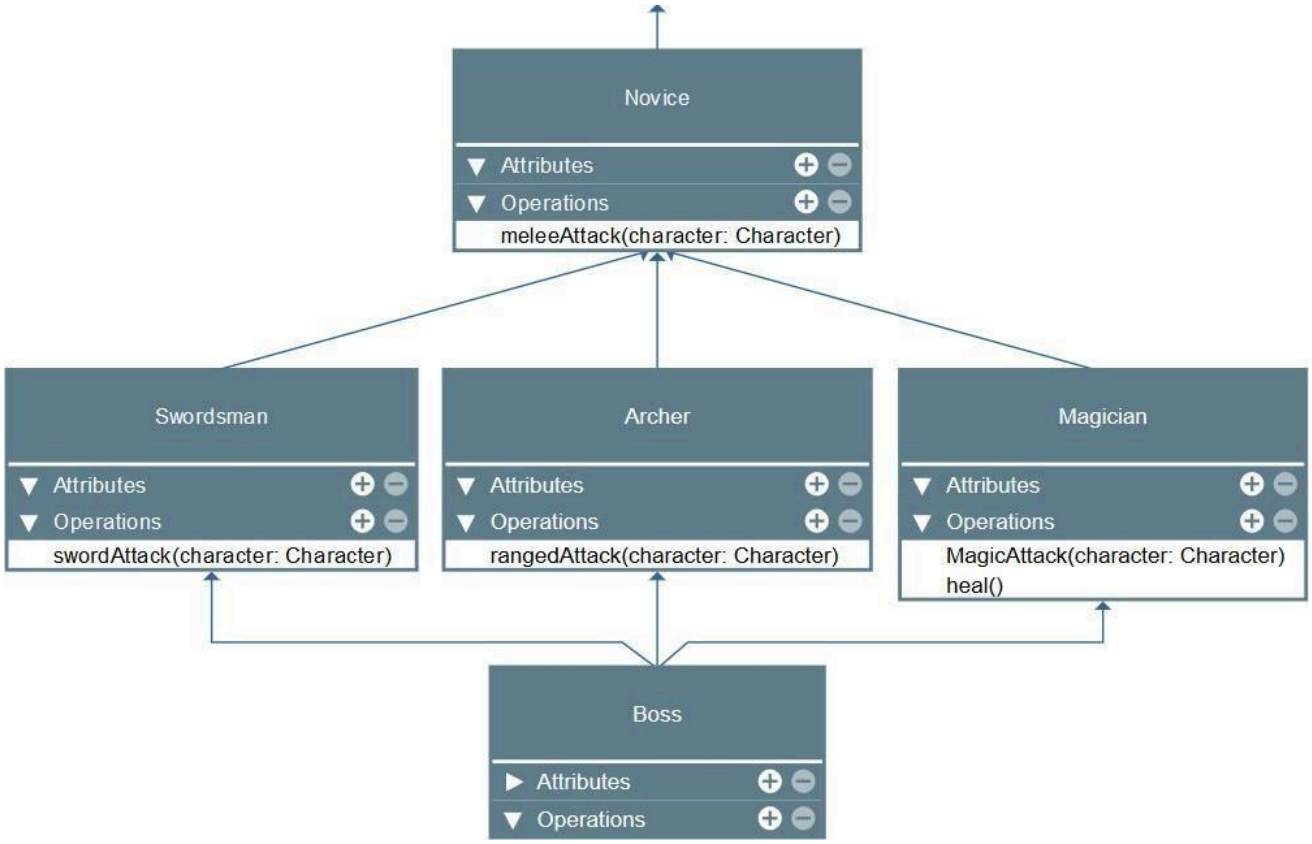
Object-Oriented Programming (OOP) has 4 core Principles: Inheritance, Polymorphism, Encapsulation, and Abstraction. The main goal of Object-Oriented Programming is code reusability and modularity meaning it can be reused for different purposes and integrated in other different programs. These 4 core principles help guide programmers to fully implement Object-Oriented Programming. In this laboratory activity, we will be exploring Inheritance while incorporating other principles such as Encapsulation and Abstraction which are used to prevent access to certain attributes and methods inside a class and abstract or hide complex codes which do not need to be accessed by the user.

An example is given below considering a simple UML Class Diagram:



The Base Character class will contain the following attributes and methods and a Novice Class will become a child of Character. The OOP Principle of Inheritance will make Novice have all the attributes and methods of the Character class as well as other

unique attributes and methods it may have. This is referred to as Single-level Inheritance. In this activity, the Novice class will be made the parent of three other different classes Swordsman, Archer, and Magician. The three classes will now possess the attributes and methods of the Novice class which has the attributes and methods of the Base Character Class. This is referred to as Multi-level inheritance.



The last type of inheritance that will be explored is the Boss class which will inherit from the three classes under Novice. This Boss class will be able to use any abilities of the three Classes. This is referred to as Multiple inheritance.

4. Materials and Equipment:

Desktop Computer with
Anaconda Python Windows
Operating System

5. Procedure:

Creating the Classes

1. Inside your folder **oopfa1_<lastname>**, create the following classes on separate .py files with the file names: Character, Novice, Swordsman, Archer, Magician, Boss.
2. Create the respective class for each .py files. Put a temporary pass under each class created except in Character.py Ex.

```
class Novice():
    pass
```

3. In the Character.py copy the following codes

```python
class Character():
    def __init__(self, username):
        self.__username = username
        self.__hp = 100
        self.__mana = 100
        self.__damage = 5
        self.__str = 0 # strength stat
        self.__vit = 0 # vitality stat
        self.__int = 0 # intelligence stat
        self.__agi = 0 # agility stat
    def getUsername(self):
        return self.__username
    def setUsername(self, new_username):
        self.__username = new_username
    def getHp(self):
        return self.__hp
    def setHp(self, new_hp):
        self.__hp = new_hp
    def getDamage(self):
        return self.__damage
    def setDamage(self, new_damage):
        self.__damage = new_damage
    def getStr(self):
        return self.__str
    def setStr(self, new_str):
        self.__str = new_str
    def getVit(self):
        return self.__vit
    def setVit(self, new_vit):
        self.__vit = new_vit
    def getInt(self):
        return self.__int
    def setInt(self, new_int):
        self.__int = new_int
    def getAgi(self):
        return self.__agi
    def setAgi(self, new_agi):
        self.__agi = new_agi
    def reduceHp(self, damage_amount):
        self.__hp = self.__hp - damage_amount
    def addHp(self, heal_amount):
        self.__hp = self.__hp + heal_amount
```

Note: The double underscore __signifies that the variables will be inaccessible outside of the class.

4. In the same Character.py file, under the code try to create an instance of Character and try to print the username Ex.
   character1 = Character("Your Username") print(character1.username)
   print(character1.getUsername())
5. Observe the output and analyze its meaning then comment the added code.

Single Inheritance

1. In the Novice.py class, copy the following code.

```python
from Character import Character

class Novice(Character):
    def basicAttack(self, character):
        character.reduceHp(self.getDamage())
        print(f"{self.getUsername()} performed Basic Attack! -{self.getDamage()}")
```

2. In the same Novice.py file, under the code try to create an instance of Character and try to print the username Ex.
   character1 = Novice("Your Username")
   print(character1.getUsername())
   print(character1.getHp())
3. Observe the output and analyze its meaning then comment the added code.

Multi-level Inheritance

1. In the Swordsman, Archer, and Magician .py files copy the following codes for each file: Swordsman.py

```python
from Novice import Novice

class Swordsman(Novice):
    def __init__(self, username):
        super().__init__(username)
        self.setStr(5)
        self.setVit(10)
        self.setHp(self.getHp()+self.getVit())

    def slashAttack(self, character):
        self.new_damage = self.getDamage()+self.getStr()
        character.reduceHp(self.new_damage)
        print(f"{self.getUsername()} performed Slash Attack! -{self.new_damage}")
```

Archer.py

```python
from Novice import Novice
import random

class Archer(Novice):
    def __init__(self, username):
        super().__init__(username)
        self.setAgi(5)
        self.setInt(5)
        self.setVit(5)
        self.setHp(self.getHp()+self.getVit())

    def rangedAttack(self, character):
        self.new_damage = self.getDamage()+random.randint(0,self.getInt())
        character.reduceHp(self.new_damage)
        print(f"{self.getUsername()} performed Slash Attack! -{self.new_damage}")
```

Magician.py

```python
from Novice import Novice

class Magician(Novice):
    def __init__(self, username):
        super().__init__(username)
        self.setInt(10)
        self.setVit(5)
        self.setHp(self.getHp()+self.getVit())

    def heal(self):
        self.addHp(self.getInt())
        print(f"{self.getUsername()} performed Heal! +{self.getInt()}")

    def magicAttack(self, character):
        self.new_damage = self.getDamage()+self.getInt()
        character.reduceHp(self.new_damage)
        print(f"{self.getUsername()} performed Magic Attack! -{self.new_damage}")
```

2. Create a new file called Test.py and copy the codes below:

```python
from Swordsman import Swordsman
from Archer import Archer
from Magician import Magician


Character1 = Swordsman("Royce")
Character2 = Magician("Archie")
print(f"{Character1.getUsername()} HP: {Character1.getHp()}")
print(f"{Character2.getUsername()} HP: {Character2.getHp()}")
Character1.slashAttack(Character2)
Character1.basicAttack(Character2)
print(f"{Character1.getUsername()} HP: {Character1.getHp()}")
print(f"{Character2.getUsername()} HP: {Character2.getHp()}")
Character2.heal()
Character2.magicAttack(Character1)
print(f"{Character1.getUsername()} HP: {Character1.getHp()}")
print(f"{Character2.getUsername()} HP: {Character2.getHp()}")
```

3. Run the program Test.py and observe the output.
4. Modify the program and try replacing Character2.magicAttack(Character1) with Character2.slashAttack(Character1) then run the program again and observe the output.

Multiple Inheritance

1. In the Boss.py file, copy the codes as shown:

```python
from Swordsman import Swordsman
from Archer import Archer
from Magician import Magician

class Boss(Swordsman, Archer, Magician): # multiple inheritance
    def __init__(self, username):
        super().__init__(username)
        self.setStr(10)
        self.setVit(25)
        self.setInt(5)
        self.setHp(self.getHp()+self.getVit())
```

2. Modify the Test.py with the code shown below:

```
from Swordsman import Swordsman
from Archer import Archer
from Magician import Magician
from Boss import Boss

Character1 = Swordsman("Royce")
Character2 = Boss("Archie")
print(f"{Character1.getUsername()} HP: {Character1.getHp()}")
print(f"{Character2.getUsername()} HP: {Character2.getHp()}")
Character1.slashAttack(Character2)
Character1.basicAttack(Character2)
print(f"{Character1.getUsername()} HP: {Character1.getHp()}")
print(f"{Character2.getUsername()} HP: {Character2.getHp()}")
Character2.heal()
Character2.basicAttack(Character1)
Character2.slashAttack(Character1)
Character2.rangedAttack(Character1)
Character2.magicAttack(Character1)
print(f"{Character1.getUsername()} HP: {Character1.getHp()}")
print(f"{Character2.getUsername()} HP: {Character2.getHp()}")
```

3. Run the program Test.py and observe the output.

6. Supplementary Activity:

Task

Create a new file Game.py inside the same folder use the pre-made classes to create a simple Game where two players or one player vs a computer will be able to reduce their opponent's hp to 0.

Requirements:

1. The game must be able to select between 2 modes: Single player and Player vs Player. The game can spawn multiple matches where single player or player vs player can take place.
2. In Single player:
    - the player must start as a Novice, then after 2 wins, the player should be able to select a new role between Swordsman, Archer, and Magician.
    - The opponent will always be a boss named Monster.
3. In Player vs Player, both players must be able to select among all the possible roles available except Boss.
4. Turns of each player for both modes should be randomized and the match should end when one of the players hp is zero.
5. Wins of each player in a game for both the modes should be counted.

Character.py	**These codes are seen at the top of this Lab Activity *(5.Procedure)***
Novice.py	
Swordsman.py	
Archer.py	
Magician.py	
Boss.py	

Game.py

```python
import random
from character import Character
from novice import Novice
from swordsman import Swordsman
from archer import Archer
from magician import Magician
from boss import Boss


class Game:
    def __init__(self):
        self.player1 = None
        self.player2 = None
        self.current_player = None
        self.game_mode = None
        self.player1_wins = 0
        self.player2_wins = 0

    def start(self):
        self.choose_game_mode()
        self.setup_players()
        self.game_loop()

    def choose_game_mode(self):
        print("Select Game Mode:")
        print("1. Single Player")
        print("2. Player vs Player")
        while True:
            try:
                choice = int(input("Enter your choice (1 or 2): "))
                if choice in (1, 2):
                    self.game_mode = choice
                    break
                else:
                    print("Invalid choice. Please enter 1 or 2.")
            except ValueError:
                print("Invalid input. Please enter a number.")

    def setup_players(self):
        if self.game_mode == 1:
            self.player1 = Novice(input("Enter your username: "))
            self.player2 = Boss("Monster")
        else:
            self.select_player(1)
            self.select_player(2)
```

```
        self.current_player = random.choice([self.player1, self.player2])
        print(f"{self.current_player.getUsername()} starts first!")

    def select_player(self, player_num):
        print(f"Player {player_num} Select Class:")
        print("1. Novice")
        print("2. Swordsman")
        print("3. Archer")
        print("4. Magician")
        while True:
            try:
                choice = int(input("Enter your choice (1-4): "))
                if choice in (1, 2, 3, 4):
                    if player_num == 1:
                        self.player1 = self.get_class(choice)
                    else:
                        self.player2 = self.get_class(choice)
                    break
                else:
                    print("Invalid choice. Please enter a number between 1 and 4.")
            except ValueError:
                print("Invalid input. Please enter a number.")

    def get_class(self, choice):
        if choice == 1:
            return Novice(input("Enter your username: "))
        elif choice == 2:
            return Swordsman(input("Enter your username: "))
        elif choice == 3:
            return Archer(input("Enter your username: "))
        else:
            return Magician(input("Enter your username: "))

    def game_loop(self):
        while True:
            self.take_turn(self.current_player)
            if self.check_win():
                break
            self.switch_turns()
            if self.game_mode == 1:
                self.update_player1_after_wins()

    def take_turn(self, player):
        print(f"\n{player.getUsername()}'s Turn:")
        if self.game_mode == 1:
```

```
            player.attack(self.player2)
        else:
            self.select_opponent(player)
            player.attack(self.opponent)

        print(f"{player.getUsername()} HP: {player.getHp()}")
        print(f"{self.opponent.getUsername()} HP: {self.opponent.getHp()}")

    def select_opponent(self, player):
        if player == self.player1:
            self.opponent = self.player2
        else:
            self.opponent = self.player1

    def switch_turns(self):
        self.current_player = (
            self.player2 if self.current_player == self.player1 else self.player1
        )

    def check_win(self):
        if self.player1.getHp() <= 0:
            self.player2_wins += 1
            print(f"{self.player2.getUsername()} Wins!")
            return True
        elif self.player2.getHp() <= 0:
            if self.game_mode == 1:
                self.player1_wins += 1
                print(f"{self.player1.getUsername()} Wins!")
            else:
                self.player2_wins += 1
                print(f"{self.player2.getUsername()} Wins!")
            return True
        return False

    def update_player1_after_wins(self):
        if self.game_mode == 1 and self.player1_wins == 2:
```

Questions

1. Why is Inheritance important?
   - Inheritance is crucial in OOP as it promotes code reusability and modularity, allowing you to create new classes that inherit properties and behaviors from existing ones.
2. Explain the advantages and disadvantages of using applying inheritance in an Object-Oriented Program.
   - Inheritance offers benefits like code reuse, modularity, and flexibility. However, it can also lead to tight coupling and complex inheritance hierarchies.
3. Differentiate single inheritance, multiple inheritance, and multi-level inheritance.
   - Single inheritance involves one parent class, while multiple inheritance allows for multiple parent classes. Multi-level inheritance creates a chain of inheritance.

4. Why is super()._init_(username) added in the codes of Swordsman, Archer, Magician, and Boss?
   - The super().__init__(username) call in these classes is used to call the __init__ method of the parent class (likely Character), ensuring that the username attribute is properly initialized in the parent class before any additional initialization code is executed in the child class.

5. How do you think Encapsulation and Abstraction helps in making good Object-Oriented Programs?
   - Encapsulation protects the internal state of an object from external access, preventing unintended modifications, and promoting modularity and maintainability. Abstraction hides unnecessary details from the user, allowing them to interact with the object at a higher level of abstraction, promoting flexibility, reusability, and code organization.

7. Conclusion:

Inheritance, encapsulation, and abstraction are fundamental concepts in object-oriented programming that work together to create well-structured and reusable code.By using inheritance, you may build new classes that inherit the properties and methods of older ones. This prevents duplication and encourages code reuse 1. Encapsulation is the process of combining methods that work with data (attributes) into a single unit (class). This guarantees that modifications to one area of the code don't have unexpected effects on other areas and helps to preserve data integrity. Definition of an object's basic features is the main goal of abstraction, which conceals extraneous information. This makes the code easier to read and maintain while also simplifying the interface for users. Programmers may design more modular, adaptable, and maintainable software solutions by utilizing these ideas successfully.

8. Assessment Rubric: