**Batch: A2 Roll No.: 16010121045**

**Experiment / assignment / tutorial No.**

**Grade: AA / AB / BB / BC / CC / CD /DD**

**Signature of the Staff In-charge with date**

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| **TITLE: Inheritance**  |

**AIM:** Write a program to implement inheritance to display information of bank account.

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**Expected OUTCOME of Experiment:** Apply Object oriented programming concepts in Python

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**Resource Needed: Python IDE**

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**Theory:**

Inheritance is the capability of one class to derive or inherit the properties from some another class. The benefits of inheritance are:

1. It represents real-world relationships well.

2. It provides reusability of a code. We don’t have to write the same code again and again. Also, it allows us to add more features to a class without modifying it.

3. It is transitive in nature, which means that if class B inherits from another class A, then all the subclasses of B would automatically inherit from class A.

**Syntax:**

class Person(object):

    # Constructor

    def \_\_init\_\_(self, name):

        self.name = name

    # Inherited or Sub class (Note Person in bracket)

 class Employee(Person):

    # Here we return true

    def isEmployee(self):

        return True

**Different forms of Inheritance:**

**1. Single inheritance**: When a child class inherits from only one parent class, it is called as single inheritance. We saw an example above.

**2. Multiple inheritance**: When a child class inherits from multiple parent classes, it is called as multiple inheritance.

class Base1(object):

 . . . .

class Base2(object):

 . . . .

class Derived(Base1, Base2):

 . . . .

Multiple Inheritance in Python

3. **Multilevel inheritance**: When we have child and grand child relationship.

class Person(object):

 . . .

# Inherited or Sub class (Note Person in bracket)

class Child(Base):

 . . .

# Inherited or Sub class (Note Child in bracket)

class GrandChild(Child):

 . . . .



Multilevel Inheritance

**Private members of parent class:**

Python doesn't have any mechanism that effectively restricts access to any instance variable or method. Python prescribes a convention of prefixing the name of the variable/method with single or double underscore to emulate the behaviour of protected and private access specifiers.

We don’t always want the instance variables of the parent class to be inherited by the child class i.e. we can make some of the instance variables of the parent class private, which won’t be available to the child class.

All members in a Python class are public by default. Any member can be accessed from outside the class environment.

Example: Public Attributes

**class employee:**

 **def \_\_init\_\_(self, name, sal):**

 **self.name=name**

 **self.salary=sal**

**e1= employee(1000)**

**print(e1.salary)**

Python's convention to make an instance variable protected is to add a prefix \_ (single underscore) to it. This effectively prevents it to be accessed, unless it is from within a sub-class. This doesn't prevent instance variables from accessing or modifying the instance

Example: Protected Attributes

**class employee:**

 **def \_\_init\_\_(self, name, sal):**

 **self.\_name=name # protected attribute**

 **self.\_salary=sal # protected attribute**

A double underscore \_\_ prefixed to a variable makes it private. It gives a strong suggestion not to touch it from outside the class. Any attempt to do so will result in an AttributeError:

Example: Private Attributes

**class employee:**

 **def \_\_init\_\_(self, name, sal):**

 **self.\_\_name=name # private attribute**

 **self.\_\_salary=sal # private attribute**

Python performs name mangling of private variables. Every member with double underscore will be changed to \_object.\_class\_\_variable. If so required, it can still be accessed from outside the class, but the practice should be refrained.

**e1=Employee("Bill",10000)**

**print(e1.\_Employee\_\_salary)**

**e1.\_Employee\_\_salary=20000**

**print(e1.\_Employee\_\_salary)**

**super() method and method resolution order(MRO)**

In Python, super() built-in has two major use cases:

Allows us to avoid using base class explicitly

Working with Multiple Inheritance

**super() with Single Inheritance:**

In case of single inheritance, it allows us to refer base class by super().

class Mammal(object):

 def \_\_init\_\_(self, mammalName):

 print(mammalName, 'is a warm-blooded animal.')

class Dog(Mammal):

 def \_\_init\_\_(self):

 print('Dog has four legs.')

 **super().\_\_init\_\_('Dog') # instead of Mammal.\_\_init\_\_(self, 'Dog')**

**d1 = Dog()**

The super() builtin returns a proxy object, a substitute object that has ability to call method of the base class via delegation. This is called indirection (ability to reference base object with super())

Since the indirection is computed at the runtime, we can use point to different base class at different time (if we need to).

**Method Resolution Order (MRO):**

It's the order in which method should be inherited in the presence of multiple inheritance. You can view the MRO by using \_\_mro\_\_ attribute.

**Problem Definition:**

1. For given program find output

|  |  |  |
| --- | --- | --- |
| Sr.No | Program | Output |
| 1 | class Rectangle: def \_\_init\_\_(self, length, width): self.length = length self.width = width def area(self): return self.length \* self.width def perimeter(self): return 2 \* self.length + 2 \* self.widthclass Square(Rectangle): def \_\_init\_\_(self, length): super().\_\_init\_\_(length, length)square = Square(4)print(square.area()) | 16 |
| 2 | class Person: def \_\_init\_\_(self, fname, lname): self.firstname = fname self.lastname = lname def printname(self): print(self.firstname, self.lastname)class Student(Person): def \_\_init\_\_(self, fname, lname, year): super().\_\_init\_\_(fname, lname) self.graduationyear = yearx = Student("Wilbert", "Galitz", 2018)print(x.graduationyear) | 2018 |
| 3 | class Base1(object): def \_\_init\_\_(self): self.str1 = "Python" print("First Base class")class Base2(object): def \_\_init\_\_(self): self.str2 = "Programming"  print("Second Base class")class Derived(Base1, Base2): def \_\_init\_\_(self):  # Calling constructors of Base1 # and Base2 classes Base1.\_\_init\_\_(self) Base2.\_\_init\_\_(self) print("Derived class")  def printStrs(self): print(self.str1, self.str2) ob = Derived()ob.printStrs() | First Base classSecond Base classDerived classPython Programming |

2. Assume that a bank maintains two kinds of accounts for customers, one called as savings account and the other as current account. The savings account provides simple interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance Rs. 500 and if the balance falls below this level, a service charge is imposed to 2%.

Create a class account that stores customer name, account number and type of account. From this derive the classes cur\_acct and sav\_acct to make them more specific to their requirements. Include necessary member functions in order to achieve the following tasks:

* Accept deposit from a customer and update the balance.
* Display the balance.
* Compute and deposit interest.
* Permit withdrawal and update the balance.
* Check for the minimum balance, impose penalty, necessary and update the balance.

**Result**

**Books/ Journals/ Websites referred:**

* 1. **Reema Thareja , “Python Programming: Using Problem Solving Approach”, Oxford University Press, First Edition 2017, India**
	2. **Sheetal Taneja and Naveen Kumar,” Python Programing: A Modular Approach”, Pearson India, Second Edition 2018, India**
	3. <https://www.programiz.com/python-programming/methods/built-in/super>
	4. <https://www.tutorialsteacher.com/python/private-and-protected-access-modifiers-in-python>
	5. <https://www.geeksforgeeks.org/inheritance-in-python/>

**Implementation details:**

class account:

    def \_\_init\_\_(*self*,*name*,*accNo*,*type*,*balance*):

        *self*.name=*name*

        *self*.accNo=*accNo*

        *self*.type=*type*

        *self*.balance=*balance*

    def details(*self*):

        print("Name :",*self*.name)

        print("Account No :",*self*.accNo)

        print("Account Type :",*self*.type)

        print("Balance Ammount :",*self*.balance)

    def withdraw(*self*,*ammouut*):

        *if*(*self*.balance>*ammouut*):

            *self*.balance-=*ammouut*

        *else*:

            print("Insufficient Balance")

        *return* *self*.balance

    def deposit(*self*,*ammount*):

        *self*.balance+=*ammount*

        *return* *self*.balance

class current(account):

    def \_\_init\_\_(*self*,*name*,*accNo*,*balance*=0):

        super().\_\_init\_\_(*name*,*accNo*,"Current",*balance*)

        print("Customer has Checkbook Facility")

    def deposit(*self*, *ammount*):

        *return* super().deposit(*ammount*)

    def withdraw(*self*, *ammount*):

        *if*(*self*.balance<500):

            print("A service charge of 2% is imposed as the balance is less than Rs. 500")

            *self*.balance-=10

            print("New Balance Rs.",*self*.balance)

        *return* super().withdraw(*ammount*)

    def details(*self*):

        print("Customer has Checkbook Facility")

        *return* super().details()

class savings(account):

    def \_\_init\_\_(*self*, *name*, *accNo*,*balance*=0):

        super().\_\_init\_\_(*name*, *accNo*,"Savings", *balance*)

        print("Customer has Interest Facility")

    def deposit(*self*, *ammount*):

        *return* super().deposit(*ammount*)

    def withdraw(*self*, *ammouut*):

        *return* super().withdraw(*ammouut*)

    def interest(*self*,*p*,*t*):

        r=0.05

        *return* (*p*\*(1+(r\**t*)))

    def details(*self*):

        print("Customer has Interest Facility")

        *return* super().details()

def main():

    cond=True

    *while* cond:

        print("Welcome to The Bank")

        name=input("Enter customer's Name: ")

        accNo=input("Enter Account No: ")

        print("""Kindly select an account to proceed futher

        (1) Current Account

        (2) Savings Account

        (3) Exit""")

        n=input("Enter a choice: ")

        *if* n=="1":

            obj=current(name,accNo)

            k=True

            *while* k:

                print("""Kindly Select an Option

                    (1) Deposite ammount

                    (2) Withdraw ammount

                    (3) Display Details

                    (4) Exit

                    """)

                n1=input()

                *if* n1=='1':

                    obj.deposit(float(input("Enter ammount to deposit: ")))

                *elif* n1=='2':

                    obj.withdraw(float(input("Entter ammount to withdraw: ")))

                *elif* n1=="3":

                    obj.details()

                *elif* n1=='4':

                    k=False

                    cond=False

                *else*:

                    print("Enter correct option Only!")

        *elif* n=="2":

            obj=savings(name,accNo)

            k=True

            *while* k:

                print("""Kindly Select an Option

                    (1) Deposite ammount

                    (2) Withdraw ammount

                    (3) Display Details

                    (4) Compute Interest for customer

                    (5) Exit

                    """)

                n1=input()

                *if* n1=='1':

                    obj.deposit(float(input("Enter ammount to deposit: ")))

                *elif* n1=='2':

                    obj.withdraw(float(input("Entter ammount to withdraw: ")))

                *elif* n1=="3":

                    obj.details()

                *elif* n1=="4":

                    p=float(input("Enter Principle ammount: "))

                    t=float(input("Enter time in years: "))

                    print("The computed return is: ",obj.interest(p,t))

                *elif* n1=='5':

                    k=False

                    cond=False

                *else*:

                    print("Enter correct option Only!")

        *elif* n=="3":

            cond=False

        *else*:

            print("Enter correct option Only!")

main()

**Output(s):**













**Conclusion:**

Understood Inheritance in python and successfully implemented in the give program.

**Post Lab Questions:**

1. Explain *isinstance()* and *issubclass()* functions with example?

**isinstance()** method is used to check if an object is an instance of a class. It takes two parameters. The first one is the object to test and the second one is a single class or a tuple of classes. It will check if the first parameter object is an instance of class classinfo. If the second parameter is a tuple of classes, it will check if the first object is an instance of any of the classes in the tuple.

n = 14

print('n is int:', isinstance(n, int))

**issubclass()** method is used to check if a class is a subclass of a different class. It will check if class is a subclass of another class classinfo or a tuple of classes. Note that for both methods, the second parameter is a single class or a tuple of classes.

class parent:

    *pass*

class child(parent):

    *pass*

class grandChild(child):

    *pass*

print("Is grandChild subclass of child",issubclass(grandChild,child))

print("Is child subclass of grandChild",issubclass(child,grandChild))

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_ Signature of faculty in-charge**