



Inspiring Excellence

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| Course Code:     | CSE111   |
| Course Title:    | Programming Language II  |
| Homework No:     | 03   |
| Topic:           | OOP(Classes and objects)   |
| Submission Type: | Hard Copy (Only submit the part of the code that you have been instructed to write. DO NOT write any given code.)  |
| Resources:       | <ol style="list-style-type: none"><li>1. Class lectures</li><li>2. BuX lectures<ol style="list-style-type: none"><li>a. English: <a href="https://shorturl.at/dhjAZ">https://shorturl.at/dhjAZ</a></li><li>b. Supplementary: <a href="https://shorturl.at/wMPRU">https://shorturl.at/wMPRU</a></li></ol></li></ol> |

## Task 1

Design the **CellPackage** class and write suitable driver code to produce the output:

Subtasks:

- (#1) **Assign** the arguments into appropriate attributes: **data**, **talk\_time**, **messages**, **cashback**, **validity** and **price** via a parameterized constructor. All the attributes should be of **int** data type. Note that **data** is stored in *Megabytes* ( $1\text{ GB} = 1024\text{ MB}$ ) and the **cashback** amount is calculated from a percentage value.
- (#2,3,4) **Implement** driver code to display all the information of a package. **Check** if any particular attribute does not exist (is equal to 0), do not print that attribute. Attributes **validity** and **price** are always printed.

```
# Driver Code
# Subtask 1: Write the CellPackage Class

pkg = CellPackage(150, '6 GB', 99, 20, '7%', 7)
print('===== Package 1 =====')
# Subtask 2: Check each attribute and print

pkg2 = CellPackage(700, '35 GB', 700, 0, '10%', 30)
print('===== Package 2 =====')
# Subtask 3: Check each attribute and print

pkg4 = CellPackage(120, '0 GB', 190, 0, '0%', 10)
print('===== Package 3 =====')
# Subtask 4: Check each attribute and print
```

### Output:

```
===== Package 1 =====
Data = 6144 MB
Talktime = 99 Minutes
SMS/MMS = 20
Validity = 7 Days
--> Price = 150 tk
Buy now to get 10 tk cashback.
===== Package 2 =====
Data = 35840 MB
Talktime = 700 Minutes
Validity = 30 Days
--> Price = 700 tk
Buy now to get 70 tk cashback.
===== Package 3 =====
Talktime = 190 Minutes
Validity = 10 Days
--> Price = 120 tk
```

## Task 2

### Part A:

Write the **box** class so that the given driver code gives the expected output.

[You are not allowed to change the code below]

| Driver Code  | Output   |
|--|--|
| <pre># Write your class code here print("Box 1") b1 = box([10,10,10]) print("=====") b1.boxDescription() print(b1.volume()) print("-----") print("Box 2") b2 = box((30,10,10)) print("=====") b2.boxDescription() print(b2.volume()) b2.height = 300 print("Updating Box 2!") print("Height:", b2.height) print("Width:", b2.width) print("Breadth:", b2.breadth) volume = b2.height * b2.width * b2.breadth print(f"Volume of the box is {volume} cubic units.") print("-----") print("Box 3") b3 = b2 b3.boxDescription() print(b3.volume())</pre> | <pre>Box 1 Creating a Box! ===== Height: 10 Width: 10 Breadth: 10 Volume of the box is 1000 cubic units. ----- Box 2 Creating a Box! ===== Height: 30 Width: 10 Breadth: 10 Volume of the box is 3000 cubic units. Updating Box 2! Height: 300 Width: 10 Breadth: 10 Volume of the box is 30000 cubic units. ----- Box 3 Height: 300 Width: 10 Breadth: 10 Volume of the box is 30000 cubic units.</pre> |

### Part B

After the given driver code, if we run the following lines of code:

```
one = (b3 == b2)

b3.width = 100
two = (b3 == b2)
```

1. What will be the values for variables `one` and `two`? Explain your answer briefly in text.

2. What will be the value of `b2.width`? Has that value changed since the driver code ran? If yes, explain why in brief text.

### Task 3

Read the following **Vector3D** class that represents a vector in 3D space. The x-axis, y-axis, and z-axis components of the vector are represented by the attributes *x*, *y*, and *z* respectively.

[You are not allowed to change the code below]

```
class Vector3D:
    def __init__(self, x, y, z):
        self.x = x
        self.y = y
        self.z = z
        print(f'Vector <{self.x}, {self.y}, {self.z}>
created.')
```

# Write your driver code here

Your task is to write the driver code that:

- Creates 2 **Vector3D** objects. The first one is given as  $V_1 = \langle 2, -3, 1 \rangle$  and the second one is given as  $V_2 = \langle -1, 4, 0 \rangle$ .
- Prints their components and magnitude as shown in the output. The magnitude of a vector  $\langle a, b, c \rangle$  is calculated as  $|\langle a, b, c \rangle| = \sqrt{a^2 + b^2 + c^2}$ .
- Finds the **dot product** of the 2 Vectors. Dot product of 2 vectors  $\langle a_1, a_2, a_3 \rangle$  and  $\langle b_1, b_2, b_3 \rangle$  is calculated as  $\langle a_1, a_2, a_3 \rangle \cdot \langle b_1, b_2, b_3 \rangle = a_1 b_1 + a_2 b_2 + a_3 b_3$ .
- Finds the **Cross product** of the 2 Vectors. The cross product of 2 vectors  $\langle a_1, a_2, a_3 \rangle$  and  $\langle b_1, b_2, b_3 \rangle$  creates *a new Vector3D Object* which is calculated as  $\langle a_1, a_2, a_3 \rangle \times \langle b_1, b_2, b_3 \rangle = \langle a_2 b_3 - a_3 b_2, a_3 b_1 - a_1 b_3, a_1 b_2 - a_2 b_1 \rangle$ .
- Generates the output as given below.
- Your program should run for any two 3D vectors.

**Output:**

```

Vector <2, -3, 1> has been created.
Vector <-1, 4, 0> has been created.
Magnitude of the first vector = 3.7416573867739413
Magnitude of the second vector = 4.123105625617661
Dot product of the two vectors = -14
Vector <-4, -1, 5> has been created.
Cross product of the two vectors = <-4, -1, 5>

```

## Task 4

Design the following **abcTech** class so that it generates the following output:

**Hints:**

- If the working hour of the employee is more than 144 hours in the month, then he/she will be paid Tk. 800 for each extra hour worked along with the base salary.
- If the working hour of the employee is less than or equal to 144 hours, then the salary will be the same as the base salary.

| Driver Code   | Output  |
|---|---|
| <pre> print("-----") b1 =abcTech("Tamim Hasan", "Software Engineer", "Android Development") print("-----") b1.addProgrammingSkills(["Java", "Python"]) b1.addProgrammingSkills(["Dart", "C++"]) b1.addFrameworks(["Express.js", "React"]) b1.printInfo() print("-----") print(f"Your salary for this month is Tk. {b1.calculateSalary(45000, 156)}") print("-----") print("-----") b2 =abcTech("Jahin Khandoker", "Senior Developer", "App Development") print("-----") b2.addProgrammingSkills(["Java", "Dart", "Swift"]) </pre> | <pre> ----- Welcome to abcTech, Tamim Hasan! ----- Name:  Tamim Hasan Designation:  Software Engineer Department: Android Development Programming Skills:  Java, Python, Dart, C++ Frameworks:  Express.js, React ----- Your salary for this month is Tk. 54600 ----- ----- Welcome to abcTech, Jahin Khandoker! ----- Name:  Jahin Khandoker Designation:  Senior Developer Department:  App Development Programming Skills:  'Java', 'Dart', 'Swift' Frameworks:  'Flutter', 'React Native', 'Xamarin' ----- </pre> |

|   |  |
|---|--|
| <pre> b2.addFrameworks(["Flutter", "React Native"]) b2.addFrameworks(["Xamarin"]) b2.printInfo() print("-----") print(f"Your salary for this month is Tk. {b2.calculateSalary(103000, 123)}") print("-----") </pre> | <p>Your salary for this month is Tk. 103000</p> <p>-----</p> |
|---|--|

## Task 5

Design **StudentDatabase** class so that the following output is produced: Calculation of GPA:

**GPA = Sum of (Grade Points \* Credits)/ Credits attempted**

- Each course a student takes is of 3 credits.
- **For example:** Wanda has taken 3 courses in Summer 2022 semester. So her CGPA will be

$$[(\text{CSE111 GP} \times 3) + (\text{CSE260 GP} \times 3) + (\text{ENG101 GP} \times 3)] / (3 \text{ courses} \times 3)$$

$$[(3.7 \times 3) + (3.7 \times 3) + (4.0 \times 3)] / (3 \times 3) = \mathbf{3.8}$$

| Driver Code   | Output  |
|---|---|
| <pre> # Write your code here s1 = StudentDatabase('Pietro', '10101222') s1.calculateGPA(['CSE230: 4.0', 'CSE220: 4.0', 'MAT110: 4.0'], 'Summer2020') s1.calculateGPA(['CSE250: 3.7', 'CSE330: 4.0'], 'Summer2021') print(f'Grades for {s1.name}\n{s1.grades}') print('-----') s1.printDetails() s2 = StudentDatabase('Wanda', '10103332') s2.calculateGPA(['CSE111: 3.7', 'CSE260: 3.7', 'ENG101: 4.0'], 'Summer2022') print('-----') print(f'Grades for {s2.name}\n{s2.grades}') print('-----') s2.printDetails() </pre> | <pre> Grades for Pietro {'Summer2020': {'CSE230', 'CSE220', 'MAT110'): 4.0}, 'Summer2021': {'CSE250', 'CSE330'): 3.85}} ----- - Name: Pietro ID: 10101222 Courses taken in Summer2020: CSE230 CSE220 MAT110 GPA: 4.0 Courses taken in Summer2021: CSE250 CSE330 GPA: 3.85 ----- - Grades for Wanda </pre> |

|  |   |
|--|---|
|  | <pre>{'Summer2022': {'CSE111', 'CSE260', 'ENG101'}: 3.8}} ----- - Name: Wanda ID: 10103332 Courses taken in Summer2022: CSE111 CSE260 ENG101 GPA: 3.8</pre> |
|--|---|

## Task 6

Imagine your friend owns a grocery store and he is having trouble managing the day to day activities. So he wants a software that will track and manage the stock of his items, the current balance of the store etc. Now you have offered to help because you are a kind soul and also this will be a paid project. Design the **Store** class to generate the desired output:

| Driver Code  | Expected Output   |
|--|---|
| <pre>print("=====") branch1 = Store(5000) print(f"Current Balance: {branch1.balance}") print(f"Total items: {branch1.total_items}") branch1.viewAllItems() branch1.viewAllItemDetails() print("=====") print(f"Current Balance: {branch1.balance}") branch1.add_item(["ChaCha Noodles", 10, 5, 8]) print(f"Current Balance: {branch1.balance}") branch1.add_item(["Sparrow Shampoo", 5, 10, 20]) print(f"Current Balance: {branch1.balance}") print("=====") branch1.viewAllItems() print() branch1.viewAllItemDetails() print() print("=====") print(f"Current Balance: {branch1.balance}\n")</pre> | <pre>===== New branch created! Current Balance: 5000 Total items: 0 There are no items in your inventory {} ===== Current Balance: 5000 Item added: ChaCha Noodles Current Balance: 4950 Item added: Sparrow Shampoo Current Balance: 4900 ===== All Items: ChaCha Noodles, Sparrow Shampoo  {'ChaCha Noodles': {'stock': 10, 'buying_price': 5, 'selling_price': 8}, 'Sparrow Shampoo': {'stock': 5, 'buying_price': 10,</pre> |

```

branch1.sell_item("ChaCha Noodles", 15)
print(f"Current Balance: {branch1.balance}\n")
branch1.viewAllItemDetails()
print()
branch1.sell_item("ChaCha Noodles", 10)
print()
print(f"Current Balance: {branch1.balance}\n")
branch1.viewAllItemDetails()
print()
print("=====")
print(f"Current Balance: {branch1.balance}\n")
branch1.restock_item("ChaCha Noodles", 5)
print()
branch1.viewAllItemDetails()
print()
print(f"Current Balance: {branch1.balance}\n")
print("=====")

```

```

'selling_price': 20}}

=====
Current Balance: 4900

Sorry! ChaCha Noodles is not
available at your desired
quantity. Currently we have: 10
Current Balance: 4900

{'ChaCha Noodles': {'stock': 10,
'buying_price': 5,
'selling_price': 8}, 'Sparrow
Shampoo': {'stock': 5,
'buying_price': 10,
'selling_price': 20}}

Current Balance: 4980

{'ChaCha Noodles': {'stock': 0,
'buying_price': 5,
'selling_price': 8}, 'Sparrow
Shampoo': {'stock': 5,
'buying_price': 10,
'selling_price': 20}}

=====
Current Balance: 4980

Restocked item: ChaCha Noodles,
Current Stock: 5

{'ChaCha Noodles': {'stock': 5,
'buying_price': 5,
'selling_price': 8}, 'Sparrow
Shampoo': {'stock': 5,
'buying_price': 10,
'selling_price': 20}}

Current Balance: 4955

=====

```



## Task 7

|    |  |
|----|--|
| 1  | <code>class Scope:</code>  |
| 2  | <code>    def __init__(self):</code>                               |
| 3  | <code>        self.x, self.y, self.z = 1, 8, [1,2,3]</code>        |
| 4  | <code>    def met1(self):</code>                                   |
| 5  | <code>        x = 3</code>   |
| 6  | <code>        x = self.x + self.z[2] + self.met2(self.z[0])</code> |
| 7  | <code>        self.y = self.y + self.x + 5</code>                  |
| 8  | <code>        self.z[2] = self.y + self.met2(3) + self.y</code>    |
| 9  | <code>        print(x, self.y, self.z[2])</code>                   |
| 10 | <code>    def met2(self,x):</code>                                 |
| 11 | <code>        y = x + self.z[0]</code>                             |
| 12 | <code>        print(self.x, y, self.z[1])</code>                   |
| 13 | <code>        self.x = self.x + y + self.z[1]</code>               |
| 14 | <code>        self.y = self.y + 13</code>                          |
| 15 | <code>        self.z[1] = y + self.y</code>                        |
| 16 | <code>        return self.x + y</code>                             |

|   |   |   |   |
|---|---|---|---|
| Write the output of the following code:<br><pre>q2 = Scope() q2.met1() q2.met2(8) q1=q2</pre> | x | y | z |
|   |   |   |   |
|   |   |   |   |
|   |   |   |   |
|   |   |   |   |

|           |  |  |  |
|-----------|--|--|--|
| q2.met2() |  |  |  |
|-----------|--|--|--|

## Task 8

|    |   |
|----|---|
| 1  | <code>class Test7:</code>                               |
| 2  | <code>def __init__(self):</code>                        |
| 3  | <code>self.sum = 0</code>                               |
| 4  | <code>self.y = 0</code>                                 |
| 5  | <code>def methodA(self):</code>                         |
| 6  | <code>x=y=k=0</code>                                    |
| 7  | <code>msg = [5]</code>                                  |
| 8  | <code>while (k &lt; 2):</code>                          |
| 9  | <code>    y += msg[0]</code>                            |
| 10 | <code>    x = y + self.methodB(msg, k)</code>           |
| 11 | <code>    self.sum = x + y + msg[0]</code>              |
| 12 | <code>    print(x , " " , y, " " , self.sum)</code>     |
| 13 | <code>    k+=1</code>                                   |
| 14 | <code>def methodB(self, mg2, mg1):</code>               |
| 15 | <code>    x = 0</code>                                  |
| 16 | <code>    self.y += mg2[0]</code>                       |
| 17 | <code>    x = x + 3 + mg1</code>                        |
| 18 | <code>    self.sum += x + self.y</code>                 |
| 19 | <code>    mg2[0] = self.y + mg1</code>                  |
| 20 | <code>    mg1 += x + 2</code>                           |
| 21 | <code>    print(x , " " ,self.y, " " , self.sum)</code> |

22

`return mg1`

What is the output of the following code sequence?

```
t1 = Test7()  
t1.methodA()  
t1.methodA()
```

**x****y****sum**