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Foundations of Programming (Python)

Assignment 08

# Object Oriented Programming with Python

## Introduction

In this document, I will provide an overview of using object oriented programming techniques with Python. This report will include discussion of the CDInventory08.py script and what challenges I came across.

## CD Inventory Script

Building upon the last few week's assignments of managing a CD inventory, I integrated object oriented programming (OOP) concepts into the code. I will only describe the changes included to the script, since majority of the pseudocode and functionality stayed the same.

I extended the structure of my code to include classes to define objects, creating attributes for objects, creating methods (functions), and restrict access to an object's attributes.

```
17 class CD:
18     """Stores data about a CD:
19
20     ...properties:
21     .....cd_id: (int) with CD ID
22     .....cd_title: (string) with the title of the CD
23     .....cd_artist: (string) with the artist of the CD
24
25     ...methods:
26     .....user_add: user adds an index to the CD inventory
27     .....user_del: user selects and deletes an index from the CD inventory
28
29     ..."""
30
31     """--Attributes--"""
32     def __init__(self, cd_id, cd_title, cd_artist):
33         self.__cd_id = cd_id
34         self.__cd_title = cd_title
35         self.__cd_artist = cd_artist
36
```

Figure 1 CD Class

In line 32, I use the built in double underscored init method to initialize object's state. The constructor initializes (assigns) values to the members of that class. In this case, I wanted to include "cd\_id", "cd\_title", and "cd\_artist".

```

37 ... """--Properties--"""
38 ... @property
39 ... def cd_id(self):
40 ...     return self.__cd_id
41 ... @property
42 ... def cd_title(self):
43 ...     return self.__cd_title
44 ... @property
45 ... def cd_artist(self):
46 ...     return self.__cd_artist
47 ...
48 ... @cd_id.setter
49 ... def cd_id(self, value):
50 ...     self.__cd_id = value
51 ...
52 ... @cd_title.setter
53 ... def cd_title(self, value):
54 ...     self.__cd_title = value
55 ...
56 ... @cd_artist.setter
57 ... def cd_artist(self, value):
58 ...     self.__cd_artist = value

```

Figure 2 Set and Get Properties

In lines 38-58, I wrote “gets” and “sets” to define the property of the class. The purpose of this is to prevent accidental modification of data. In other words, it helps structure the code to have change or set private attributes. Note, I created individual properties for each of the three user input data (id, title, artist). In this case, I did three pairs of “set” and “get”. I followed the notation of setting private variables in lines 50, 54, and 58 with a double underscore.

The rest of the code followed the previous weeks’ code structure. There was a class for input output presentation, there was a class for data processing, and a class for file operations (reading, writing). The main body of the code included a while loop that presented a menu of choices to the user when the code is run.

Example runs from Spyder and the terminal are included in the Appendix.

## Questions

- What is the difference between a class and the objects made from a class?
  - Objects are an instantiation from a class.
- What are the components that make up the standard pattern of a class?
  - There are fields, constructors, attributes, properties, and methods.
- What is the purpose of a class constructor?
  - Constructors are run once during the creation of the object. They pass arguments provided when creating an object.
- When do you use the keyword "self"?
  - “Self” is used as convention in the programming community to be the first parameter in every method. This helps the class understand which objects to use in the method.
- When do you use the keyword "@staticmethod"?

- They cannot access properties of the class itself. Thus, when those function properties only belong to the class would warrant staticmethod.
- How are fields and attributes and property functions related?
  - Fields are data stores of a class. Attributes are internal fields or variables that hold data. Attributes can then be made private – these special methods are called properties.
- What is the difference between a property and a method?
  - Properties control validity of values assigned to attributes in a class. Methods are functions in a class.
- Why do you include a docstring in a class?
  - It helps define and describe what the class contains and is supposed to do. Including docstrings will also help readability for other programmers to utilize when reviewing or modifying code.

## Summary

In this lab, I explored using OOP concepts and applied them to my CD inventory script. Using OOP techniques help shape and structure the code to reflect manipulation of classes, objects, and more.<sup>1</sup> I think I struggled with grasping how fields, attributes, properties, and methods all interact with each other.<sup>2</sup> The code still runs, however, it can most likely be made more efficiently using OOP. I'm curious to see what the clean and concise code is supposed to look like. I've also included my [GitHub](#).

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<sup>1</sup> <https://www.tutorialspoint.com/getter-and-setter-in-python>

<sup>2</sup> [https://www.geeksforgeeks.org/\\_init\\_-in-python/](https://www.geeksforgeeks.org/_init_-in-python/)

# Appendix

## Complete Code for CDInventory08.py

```
1 """
2 Title: Assignment08.py
3 Desc: Assignment 08 - Working with classes
4 DBiesinger, 2020-Jan-01, created file
5 DBiesinger, 2020-Jan-01, added pseudocode to complete assignment 08
6 Jeffrey Shen, 2020-Mar-11, created initial code for main body
7 Jeffrey Shen, 2020-Mar-12, created initial code for classes
8 Jeffrey Shen, 2020-Mar-14, edited properties, methods, fields inside classes
9 Jeffrey Shen, 2020-Mar-15, added docstrings and debugged
10 """
11
12 """ DATA """
13 strChoice = "" # User input
14 strFilename = "CDInventory.txt"
15 lstOfCDobjects = []
16
17 class CD:
18     """Stores data about a CD:
19
20     ...properties:
21     .....cd_id: (int) with CD ID
22     .....cd_title: (string) with the title of the CD
23     .....cd_artist: (string) with the artist of the CD
24
25     ...methods:
26     .....user_add: user adds an index to the CD inventory
27     .....user_del: user selects and deletes an index from the CD inventory
28
29     ..."""
30
31     """...Attributes..."""
32     def __init__(self, cd_id, cd_title, cd_artist):
33         self.__cd_id = cd_id
34         self.__cd_title = cd_title
35         self.__cd_artist = cd_artist
36
37     """...Properties..."""
38     @property
39     def cd_id(self):
40         return self.__cd_id
41     @property
42     def cd_title(self):
43         return self.__cd_title
44     @property
45     def cd_artist(self):
46         return self.__cd_artist
47
48     """...CD ID setter
49     .....def cd_id(self, value):
50     .....self.__cd_id = value
51
52     .....@cd_title.setter
53     .....def cd_title(self, value):
54     .....self.__cd_title = value
55
56     .....@cd_artist.setter
57     .....def cd_artist(self, value):
58     .....self.__cd_artist = value
59
60     """...Methods..."""
61     @staticmethod
62     def user_add_cd_id, title, artist, table):
63         """Adds CD title and artist from user input
64
65         .....Args:
66         .....cd_id (string): string representing the ID of the album
67         .....cd_title (string): string representing the title of the album
68         .....cd_artist (string): string representing the artist
69
70         .....Returns:
71         .....table (list of dicts): 2d structure, list of dictionaries containing cd information
72
73         .....dictrow = {'id': cd_id, 'title': title, 'artist': artist}
74         .....table.append(dictrow)
75         .....return table
76
77     """
78     def user_del_id_to_delete, table):
79         """Deletes CD from user input
80
81         .....Args:
82         .....id_to_delete (string): id representing the cd to remove from inventory
83         .....table (list of dicts): 2d structure, list of dictionaries containing cd information
84
85         .....Returns:
86         .....table (list of dicts): 2d structure, list of dictionaries containing cd information
87
88         .....if row == "":
89         .....blnCDremoved = False
90         .....for row in table:
91         .....    if row["id"] == id_to_delete:
92         .....        blnCDremoved = True
93         .....        break
94         .....if blnCDremoved:
95         .....    print("The CD was removed")
96         .....else:
97         .....    print("Could not find this CD")
98         .....return table
99
100     """
101     """...Persistence..."""
102     class FileIO:
103         """Processes data to and from file:
104
105         .....Properties:
106         .....strFilename:
107
108         .....Methods:
109         .....save_inventory(file_name, lst_inventory): -- None
110         .....load_inventory(file_name): -- (a list of CD objects)
111
112         ....."""
113
114         """...Methods..."""
115         @staticmethod
116         def read_file(filename, table):
117             """Function to manage data ingestion from file to a list of dictionaries
118
119             .....Returns:
120             .....table (list of dicts): 2d data structure (list of dicts) that holds the data during runtime
121
122             .....Args:
123             .....file_name (string): name of file used to read the data from
124             .....table (list of dicts): 2d data structure (list of dicts) that holds the data during runtime
125
126             .....Returns:
127             .....table (list of dicts): 2d data structure (list of dicts) that holds the data during runtime
128
129             .....try:
130             .....    objFile = open(filename, "r")
131             .....    table.clear() # this clears existing data and allows to load data from file
132             .....    for line in objFile:
133             .....        data = line.strip().split(",")
134             .....        dictrow = {'id': data[0], 'title': data[1], 'artist': data[2]}
135             .....        table.append(dictrow)
136             .....    objFile.close()
137
138             .....except:
139             .....    print("Error loading data from file")
140             .....    return table
141
142             .....finally:
143             .....    objFile.close()
144
145             .....return table
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147             .....except:
148             .....    print("Error saving data to file")
149             .....    return table
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151             .....finally:
152             .....    objFile.close()
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154             .....return table
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156             .....except:
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841             .....    print("Error saving data to file")
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## Example Run from Spyder

```
Menu
[1] load Inventory from file
[a] Add CD
[i] Display Current Inventory
[d] delete CD from Inventory
[s] Save Inventory to file
[x] exit

Which operation would you like to perform? [1, a, i, d, s or x]: 1

WARNING: If you continue, all unsaved data will be lost and the Inventory re-loaded from file.

type 'yes' to continue and reload from file. otherwise reload will be canceled: yes
reloading...
===== The Current Inventory: =====
ID      CD Title (by: Artist)
-----
1       The Search (by:AJR)
2       Paralyzed (by:NF)
3       Everything (by:Michael Buble)
4       Rewind (by:Louis Futon)
=====
Menu

[1] load Inventory from file
[a] Add CD
[i] Display Current Inventory
[d] delete CD from Inventory
[s] Save Inventory to file
[x] exit

Which operation would you like to perform? [1, a, i, d, s or x]: a

Enter ID: song
Not an integer
Build in error info:
<class 'ValueError'>
invalid literal for int() with base 10: 'song'
Inappropriate argument value (of correct type).

===== The Current Inventory: =====
ID      CD Title (by: Artist)
-----
1       The Search (by:AJR)
2       Paralyzed (by:NF)
3       Everything (by:Michael Buble)
4       Rewind (by:Louis Futon)
=====

Enter ID: 5

What is the CD's title? Crashing

What is the Artist's name? Illenium
===== The Current Inventory: =====
ID      CD Title (by: Artist)
-----
1       The Search (by:AJR)
2       Paralyzed (by:NF)
3       Everything (by:Michael Buble)
4       Rewind (by:Louis Futon)
5       Crashing (by:Illenium)
=====
Menu

[1] load Inventory from file
[a] Add CD
[i] Display Current Inventory
[d] delete CD from Inventory
[s] Save Inventory to file
[x] exit

Which operation would you like to perform? [1, a, i, d, s or x]: d

===== The Current Inventory: =====
ID      CD Title (by: Artist)
-----
1       The Search (by:AJR)
2       Paralyzed (by:NF)
3       Everything (by:Michael Buble)
4       Rewind (by:Louis Futon)
5       Crashing (by:Illenium)
=====
```

```
Which ID would you like to delete? delete
Not an integer
Build in error info:
<class 'ValueError'>
invalid literal for int() with base 10: 'delete'
Inappropriate argument value (of correct type).

===== The Current Inventory: =====
ID      CD Title (by: Artist)
-----
1       The Search (by:AJR)
2       Paralyzed (by:NF)
3       Everything (by:Michael Buble)
4       Rewind (by:Louis Futon)
5       Crashing (by:Illenium)
=====

Which ID would you like to delete? 5
The CD was removed
===== The Current Inventory: =====
ID      CD Title (by: Artist)
-----
1       The Search (by:AJR)
2       Paralyzed (by:NF)
3       Everything (by:Michael Buble)
4       Rewind (by:Louis Futon)
=====
Menu

[1] load Inventory from file
[a] Add CD
[i] Display Current Inventory
[d] delete CD from Inventory
[s] Save Inventory to file
[x] exit

Which operation would you like to perform? [1, a, i, d, s or x]: x
```

## Example Run from Terminal

```
Menu
[1] load Inventory from file
[a] Add CD
[i] Display Current Inventory
[d] delete CD from Inventory
[s] Save Inventory to file
[x] exit

which operation would you like to perform? [1, a, i, d, s or x]: 1

WARNING: If you continue, all unsaved data will be lost and the Inventory re-loaded from file.
Type 'yes' to continue and reload from file. Otherwise reload will be canceled: yes
reloading...
===== The Current Inventory: =====
ID      CD Title (by: Artist)
1       The Search (by:AJR)
2       Paralyzed (by:NF)
3       Everything (by:Michael Buble)
4       Rewind (by:Louis Futon)
=====
Menu

[1] load Inventory from file
[a] Add CD
[i] Display Current Inventory
[d] delete CD from Inventory
[s] Save Inventory to file
[x] exit

which operation would you like to perform? [1, a, i, d, s or x]: a

Enter ID: id
Not an Integer
Build in error info:
<class 'ValueError':
Invalid literal for int() with base 10: 'id'
Inappropriate argument value (of correct type).

===== The Current Inventory: =====
ID      CD Title (by: Artist)
1       The Search (by:AJR)
2       Paralyzed (by:NF)
3       Everything (by:Michael Buble)
4       Rewind (by:Louis Futon)
=====
Enter ID: s
what is the CD's title? songs
what is the Artist's name? artists
===== The Current Inventory: =====
ID      CD Title (by: Artist)
1       The Search (by:AJR)
2       Paralyzed (by:NF)
3       Everything (by:Michael Buble)
4       Rewind (by:Louis Futon)
5       songs (by:artists)
=====
Menu

[1] load Inventory from file
[a] Add CD
[i] Display Current Inventory
[d] delete CD from Inventory
[s] Save Inventory to file
[x] exit

which operation would you like to perform? [1, a, i, d, s or x]: d

===== The Current Inventory: =====
ID      CD Title (by: Artist)
1       The Search (by:AJR)
2       Paralyzed (by:NF)
3       Everything (by:Michael Buble)
4       Rewind (by:Louis Futon)
5       songs (by:artists)
=====
Which ID would you like to delete? 5
The CD was removed
===== The Current Inventory: =====
ID      CD Title (by: Artist)
1       The Search (by:AJR)
2       Paralyzed (by:NF)
3       Everything (by:Michael Buble)
4       Rewind (by:Louis Futon)
=====
Menu

[1] load Inventory from file
[a] Add CD
[i] Display Current Inventory
[d] delete CD from Inventory
[s] Save Inventory to file
[x] exit

which operation would you like to perform? [1, a, i, d, s or x]: x
```