

Expense CLI: A Command-Line Expense Management Program

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1 Introduction

This piece of software is a command-line expense management tool. Its intended purpose is to allow the user to enter their income and their expenses and to have them stored and tracked for them. More specifically, the objectives of the software are that the user should be able to:

- Enter their monthly income, be it from single or from multiple sources.
- Set an overall monthly budget as well as a budget for categories of expense.
- Enter their expenses based on expense categories.
- Add new expense categories.
- View an expense report in terms of day/week/month/year and also with respect to a category.
- Generate and export a graph of their expenses in *PDF* format.
- The expense report should inform the user when they are over/under budget for a specific category in a specific month.
- The expense report should also display the average expense per category.
- These objectives should be achieved using a backend *SQLite* database and with the *Pandas* and *Matplotlib* modules.

In retrospect to the development process, all of these objectives have been successfully implemented and achieved relatively smoothly and without issue. The biggest problems faced throughout the development of the software involved averaging the expenses of the user while generating the expense report. Furthermore, displaying the user's expenses in a nicely formatted fashion in a command-line environment proved difficult, as opposed to implementing a *GUI* solution. The format was solved by designing an algorithm that makes use of Python's concept of *list comprehension* in synergy with the inbuilt *any()* function.

2 Design of System

2.1 Design Paradigm

First and foremost, the design of the software is based upon the *procedural* programming paradigm, derived from the *imperative* paradigm. This can very much be reflected in the structure of the codebase. The program functions by the `--main--` module making a call to the `main()` function or *procedure*, which in turn make calls to other functions which also make calls to other functions. An example of this can be observed within `expcli.py`.

```
option_choice = get_user_option ([])

if option_choice[0] == 1:
    get_income()

elif option_choice[0] == 2:
    monthly_budget = get_monthly_budget ([])
    sql.store_monthly_budget(monthly_budget[0])

elif option_choice[0] == 3:
    expense = get_expense()
    sql.store_expense(expense)

elif option_choice[0] == 4:
    categories = get_categories ([])
    sql.store_categories(categories)

elif option_choice[0] == 5:
    date = get_expense_date ([])
    expenses = get_display_expenses('day', date[0], None)
    display_expenses(expenses)
```

Listing 1: An example of procedural program design from `expcli.py`

As shown in Listing 1, the program obtains the user's choice for which option to take. Depending on the user's choice, the *control flow* of the program is determined by making a function call to the function that corresponds with the user's choice. In fact, when combined with *recursion*, this is how the entirety of the program functions; the user enters their option, the corre-

sponding function calls are made, and then the user enters another option *ad infinitum*.

The procedural paradigm was chosen in the design of this program due to its focus on using *variables*, *data structures* and *functions* to design and carry out algorithmic tasks. Whereas, for example, the *object-oriented* design paradigm focuses on conceptualising real world concepts as objects that contain both data and methods to interact with said data. In the context of this program, user expenses and input are stored as data structures, more specifically as lists of dictionaries. Therefore, using procedurally designed functions to interact with this data makes more sense. Furthermore, object-oriented programming is often less efficient than procedural programming[1], and with the relatively simple nature of the data involved in this program (expenses have only 4 properties), object-oriented was not deemed necessary nor favourable.

2.2 Modular Programming

In combination with the procedural paradigm, the technique of *modular programming* has also been focused upon throughout the design of this program. There are multiple reasons for this design choice.

Firstly, splitting the program into individual modules that each handle one area of functionality effectively *encapsulates* complexity. Therefore, once a module has been implemented and thoroughly tested, it can be reused by I or another programmer without knowing how it works. All the knowledge required to use it would be its purpose, its arguments (if it has any) and its output. An example of this can be observed many times throughout the codebase of the program, although most notably in the usage of the *exptools* module.

```
def get_monthly_budget(budget_var):  
  
    monthly_budget = input('Enter monthly budget: ')  
  
    if ex.validate_input(monthly_budget, 1, 18, str):  
        try:  
            monthly_budget = float(monthly_budget)  
            budget_var.append(monthly_budget)
```

```

    except (Exception):
        ex.print_important('Invalid _number, _please _try _again!')
        get_monthly_budget(budget_var)
else:
    ex.print_important('Invalid _number, _please _try _again!')
    get_monthly_budget(budget_var)

return budget_var

```

Listing 2: An example of encapsulation achieved via modular programming in *expli.py*

This function’s purpose is to recursively collect a monthly budget from the user and makes use of the *validate_input()* and *print_important()* functions from the *exptools* module, although in this context its module object is defined as *ex* for shorthand use.

Secondly, as alluded to in the first point, modular programming allows for very effective *code reuse*. Indeed, this was in fact the original reasoning behind the creation of modular programming, first implemented in *ALGOL 68-R* in 1970.[2]. As can be seen in Listing 2, the *validate_input()* function can be called (reused) whenever needed.

Thirdly and finally, modular programming achieves *separation of concerns*. This means that each concern (or aspect of functionality) of the program belongs to a self-contained module. This ties in with the first point in that it allows the code of modules to change completely and still work perfectly as long as their expected inputs and outputs remain the same to interface properly with the rest of the program.

3 Testing the System

4 Demonstrating the System

A User Guide

B Code

C Test Suites

References

- [1] Cardelli, Luca (1996), *Bad Engineering Properties of Object-Oriented Languages*, Digital Equipment Corporation Systems Research Center Sourced from: <http://lucacardelli.name/Papers/BadPropertiesOfOO.html>, Accessed: [22nd January 2020].
- [2] C. H. Lindsey (University of Manchester) & H. J. Boom (Mathematisch Centrum, Amsterdam), *A Modules and Separate Compilation Facility for ALGOL 68*, Sourced from: http://archive.computerhistory.org/resources/text/algol/ACM_Algo1_bulletin/1061719/p19-lindsey.pdf, Accessed: [22nd January 2020].