

2023 Spring OOP II

HW_4

Q.1

Write a decorator to compare the time taken to compute Fibonacci(35) by the following 3 functions:

- (1) recursive Fibonacci with no memoization
- (2) recursive Fibonacci with memoization
- (3) Fibonacci via a generator

Q.2

You are working on a project to create a basic student management system for a school. You are tasked with creating a SQLite3 database using Python to store and manage student records. The database should have the following functionalities:

- (1) Create a table named "students" with the following columns: student_id (integer), first_name (text), last_name (text), age (integer), and grade (text).
- (2) Write a Python function that adds a new student record to the "students" table with the given inputs: first name, last name, age, and grade.
- (3) Write a Python function that retrieves all the student records from the "students" table and displays them in a formatted manner.
- (4) Write a Python function that allows the user to search for a student record by their student ID and displays the record if found.
- (5) Write a Python function that allows the user to update the age of a student by their student ID.
- (6) Write a Python function that allows the user to delete a student record by their student ID.

Your task is to implement the above functionalities using SQLite3 and Python. Include appropriate error handling and make sure to close the database connection after each operation.

Start with inserting the following 5 students into the "students" table:

First Name	Last Name	Age	Grade
John	Doe	18	Grade 12
Jonathan	Cole	16	Grade 10
Jane	Smith	17	Grade 11
Elisabeth	Shue	17	Grade 11
David	Lee	16	Grade 10

Note: You can assume that the student_id column is unique and auto-incrementing.

Q.3

Write a string reverser using a generator in Python. For the input string

Roger Federer: GOAT

the output is

TAOG :reredeF regoR

Q.4 Stack Implementations

- (1) Using inheritance (is-a relationship), implement your own stack class by extending the built-in list.
- (2) Using composition (has-a relationship), implement your own stack class by creating a list as an attribute (or a data member/field).

Q.5

You are given a list of integers. Write a Python program that generates a new list of integers using a generator function. The generator should only include even numbers from the original list, and each even number should be squared.

Example input: `[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]`

Example output: `[4, 16, 36, 64, 100]`

Q.6

The United States still uses the traditional English system of measurement. Each inch on a ruler is marked off as fractions, using tick marks that look like this:



The tallest tick mark falls at the center dividing into halves, two shorter tick marks indicate the quarter divisions, and even shorter ones are used to mark the eighths and sixteenths, and so on. Write the following recursive function:

```
drawRuler(x, y, width, height)
```

where (x, y) represents the lower-left corner of a rectangle that has dimensions `width` × `height`.

The ruler will be drawn within that rectangle. The function draws a line along the rectangle's bottom edge and then recursively draws vertical tick marks. The rectangle itself is not drawn. The middle-most tick mark is centered in the rectangle and is as tall as the rectangle height. Each smaller tick mark is half the height of the next larger one. Once the tick marks become sufficiently small, the recursion terminates. The recursive insight to this problem is to recognize that the middle-most tick mark subdivides the rectangle into two smaller rectangles, each of which is a smaller ruler of its own. Use Turtle Graphics to draw the figure.