Homework Assignment: Advanced Concepts with Functions, Arguments, Parameters, and Return Statements in Python

Objective: This assignment builds upon the foundational concepts of functions, arguments, parameters, and return statements. It includes more advanced exercises and challenges to reinforce understanding and practical application.

Problem 1: Function with a Callback

1. Write a Python script that defines a function called `apply_operation` which takes two numbers and a callback function as parameters. The callback function should perform a specific mathematical operation (e.g., addition, subtraction, multiplication). The `apply_operation` function should return the result of applying the callback function to the two numbers.

2. Implement callback functions for addition, subtraction, and multiplication. Use the `apply_operation` function to demonstrate each operation with different pairs of numbers.

Problem 2: Lambda Functions

3. Create a program that uses a lambda function to filter a list of numbers and return only the even numbers. The filtering criteria should be passed as a lambda function.

4. Write a function called `process_numbers` that takes a list of numbers and a lambda function as parameters. The function should apply the lambda function to each number in the list and return the modified list.

Problem 3: Recursive Challenge

5. Implement a recursive function called `power` that calculates the result of raising a base to an exponent. The function should take two parameters (base and exponent) and return the result.

6. Use the `power` function to calculate the result of 2^5 and print the result.

Problem 4: Decorators

7. Write a decorator function named `logger` that logs the name of the function being called and the arguments passed to it. Apply this decorator to the `apply_operation` function from Problem 1.

8. Demonstrate the decorated `apply_operation` function by calling it with different operations and observing the log output.

Additional Tips:

- Utilize online resources, Python documentation, and course materials to reinforce your understanding.
- Collaborate with classmates to discuss concepts and problem-solving.
- Seek assistance from your instructor or classmates if you encounter difficulties.