SCHOOL OF COMPUTER SCIENCE AND ARTIFICIAL INTELLIGENCE	DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

Program Name: B. Tech	**Assignment Type: Lab**	**Academic Year:**2025-2026

Instructor(s) Name	S Naresh Kumar		
Course Code	24CS002PC215	**Course Title**	AI Assisted Coding
Year/Sem	III/II	**Regulation**	R24
Date and Day of Assignment	Week3 – wednesday	**Time(s)**	
Duration	2 Hours	**Applicable to Batches**	
Assignment Number:6.1(Present assignment number)/**24**(Total number of assignments)			

Q.No.	Question	*Expected Time to complete*
	Lab 6: AI-Based Code Completion – Classes, Loops, and Conditionals **Lab Objectives:** ● To explore AI-powered auto-completion features for core Python constructs. ● To analyze how AI suggests logic for class definitions, loops, and conditionals. ● To evaluate the completeness and correctness of code generated by AI assistants. **Lab Outcomes (LOs):** After completing this lab, students will be able to: ● Use AI tools to generate and complete class definitions and methods. ● Understand and assess AI-suggested loops for iterative tasks. ● Generate conditional statements through prompt-driven suggestions. ● Critically evaluate AI-assisted code for correctness and clarity.	Week3 - Monday
1	**Task Description #1 (Loops – Automorphic Numbers in a Range)** ● Task: Prompt AI to generate a function that displays all Automorphic numbers between 1 and 1000 using a for loop. ● Instructions: ○ Get AI-generated code to list Automorphic numbers using a for	

loop.

- Analyze the correctness and efficiency of the generated logic.
- Ask AI to regenerate using a while loop and compare both implementations.

Expected Output #1:

- Correct implementation that lists Automorphic numbers using both loop types, with explanation.

Prompt

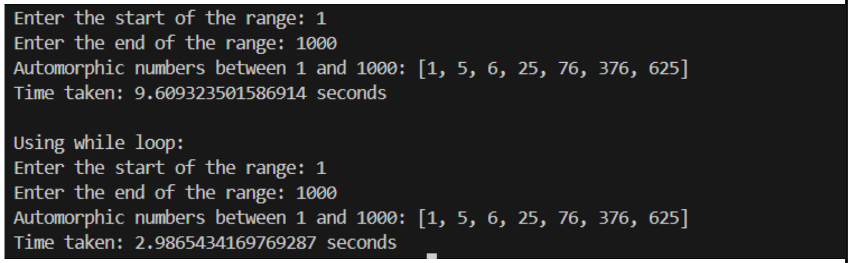
```
Genrate a lists of automorphic numbers in a given
range
```

Code

Using "**for Loop**"

```
import time as t
def is_automorphic(num):
    square = num * num
    num_str = str(num)
    square_str = str(square)
    return square_str.endswith(num_str)
def automorphic_numbers_in_range(start, end):
    automorphic_numbers = []
    for num in range(start, end + 1):
        if is_automorphic(num):
            automorphic_numbers.append(num)
    return automorphic_numbers
start_time = t.time()
start_range = int(input("Enter the start of the
range: "))
end_range = int(input("Enter the end of the range:
"))
automorphic_numbers =
automorphic_numbers_in_range(start_range,
end_range)
print(f"Automorphic numbers between {start_range}
and {end_range}: {automorphic_numbers}")
end_time = t.time()
print(f"Time taken: {end_time - start_time}
seconds\n")
```

Output



```
Enter the start of the range: 1
Enter the end of the range: 1000
Automorphic numbers between 1 and 1000: [1, 5, 6, 25, 76, 376, 625]
Time taken: 9.609323501586914 seconds

Using while loop:
Enter the start of the range: 1
Enter the end of the range: 1000
Automorphic numbers between 1 and 1000: [1, 5, 6, 25, 76, 376, 625]
Time taken: 2.9865434169769287 seconds
```

Explanation

The program finds Automorphic numbers by checking whether the square of a number ends with the number itself using loop logic.

2

Task Description #2 (Conditional Statements – Online Shopping Feedback Classification)

- Task: Ask AI to write nested if-elif-else conditions to classify online shopping feedback as Positive, Neutral, or Negative based on a numerical rating (1–5).
- Instructions:
  - Generate initial code using nested if-elif-else.
  - Analyze correctness and readability.
  - Ask AI to rewrite using dictionary-based or match-case structure.

Expected Output #2:

- Feedback classification function with explanation and an alternative approach.

Prompt

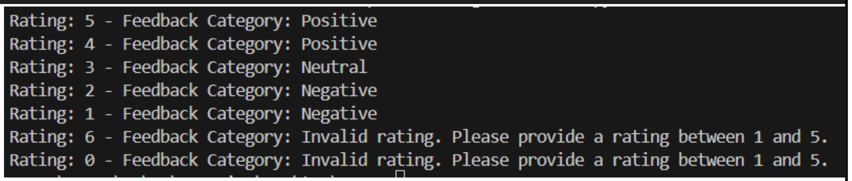
```
Genrate a online shopping feedback system using
nested if-elif-else to categorize feedback into
positive, negative, and neutral based on 1-5
rating scale.
```

Code

```
def categorize_feedback(rating):
    if rating >= 4 and rating <= 5:
        return "Positive"
    elif rating == 3:
        return "Neutral"
    elif rating >= 1 and rating <= 2:
        return "Negative"
    else:
        return "Invalid rating. Please provide a 
rating between 1 and 5."
# Example usage
ratings = [5, 4, 3, 2, 1, 6, 0]
for rating in ratings:
    category = categorize_feedback(rating)
    print(f"Rating: {rating} - Feedback Category: 
{category}")
```

Output

```
Time Complexity: O(1) - The function performs a 
constant number of operations regardless of input 
size.
Space Complexity: O(1) - The function uses a 
constant amount of space for variables
```



```
Rating: 5 - Feedback Category: Positive
Rating: 4 - Feedback Category: Positive
Rating: 3 - Feedback Category: Neutral
Rating: 2 - Feedback Category: Negative
Rating: 1 - Feedback Category: Negative
Rating: 6 - Feedback Category: Invalid rating. Please provide a rating between 1 and 5.
Rating: 0 - Feedback Category: Invalid rating. Please provide a rating between 1 and 5.
```

Explanation

The feedback classification uses conditional statements to correctly label ratings as Negative, Neutral, or Positive based on given values.

3

Task 3: Statistical_operations

Define a function named statistical_operations(tuple_num) that performs the following statistical operations on a tuple of numbers:

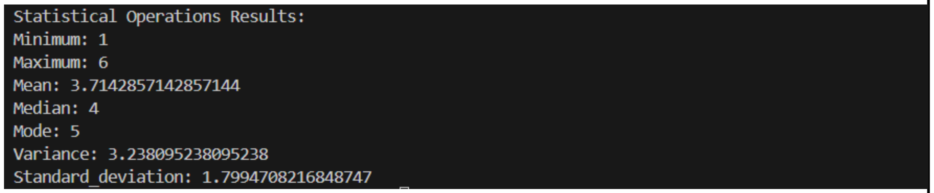
- Minimum, Maximum
- Mean, Median, Mode
- Variance, Standard Deviation

While writing the function, observe the code suggestions provided by GitHub Copilot.Make decisions to accept, reject, or modify the suggestions based on their relevance and correctness

Code

```python
import statistics

def statistical_operations(tuple_num):
    if not tuple_num:
        return {}

    nums = list(tuple_num)

    min_val = min(nums)
    max_val = max(nums)
    mean_val = statistics.mean(nums)
    median_val = statistics.median(nums)

    try:
        mode_val = statistics.mode(nums)
    except statistics.StatisticsError:
        mode_val = None

    variance_val = statistics.variance(nums)
    stdev_val = statistics.stdev(nums)

    return {
        'minimum': min_val,
        'maximum': max_val,
        'mean': mean_val,
        'median': median_val,
        'mode': mode_val,
        'variance': variance_val,
        'standard_deviation': stdev_val
    }

# Example usage
if __name__ == "__main__":
    sample_tuple = (1, 2, 3, 4, 5, 5, 6)
    results = statistical_operations(sample_tuple)
    print("Statistical Operations Results:")
    for key, value in results.items():
        print(f"{key.capitalize()}: {value}")
```

Output



```
Statistical Operations Results:
Minimum: 1
Maximum: 6
Mean: 3.7142857142857144
Median: 4
Mode: 5
Variance: 3.238095238095238
Standard_deviation: 1.7994708216848747
```

Explanation

The function uses Python built-in statistics methods to compute minimum, maximum, mean, median, mode, variance, and standard deviation accurately.

4

Task 4: Teacher Profile

- **Prompt:** Create a class Teacher with attributes teacher_id, name, subject, and experience. Add a method to display teacher details.
- **Expected Output:** Class with initializer, method, and object creation.

Prompt

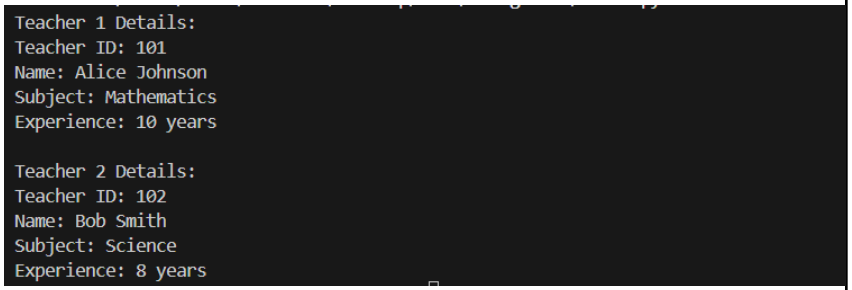
```
Create a class Teacher with attributes teacher_id,
name, subject, and experience. Add a method to
display teacher details.
```

Code

```
class Teacher:
    def __init__(self, teacher_id, name, subject,
experience):
        self.teacher_id = teacher_id
        self.name = name
        self.subject = subject
        self.experience = experience

    def display_details(self):
        print(f"Teacher ID: {self.teacher_id}")
        print(f"Name: {self.name}")
        print(f"Subject: {self.subject}")
```

```python
        print(f"Experience: {self.experience} years")

# Example usage
if __name__ == "__main__":
    teacher1 = Teacher(101, "Alice Johnson", "Mathematics", 10)
    teacher2 = Teacher(102, "Bob Smith", "Science", 8)

    print("Teacher 1 Details:")
    teacher1.display_details()
    print("\nTeacher 2 Details:")
    teacher2.display_details()
```

Output



```
Teacher 1 Details:
Teacher ID: 101
Name: Alice Johnson
Subject: Mathematics
Experience: 10 years

Teacher 2 Details:
Teacher ID: 102
Name: Bob Smith
Subject: Science
Experience: 8 years
```

Explanation

The Teacher class demonstrates object oriented programming by initializing attributes through a constructor and displaying details using a class method.

5

Task #5 – Zero-Shot Prompting with Conditional Validation

Use zero-shot prompting to instruct an AI tool to generate a function that validates an Indian mobile number.

Requirements

- The function must ensure the mobile number:
    - Starts with 6, 7, 8, or 9
    - Contains exactly 10 digits

Expected Output

- A valid Python function that performs all required validations without using any input-output examples in the prompt.

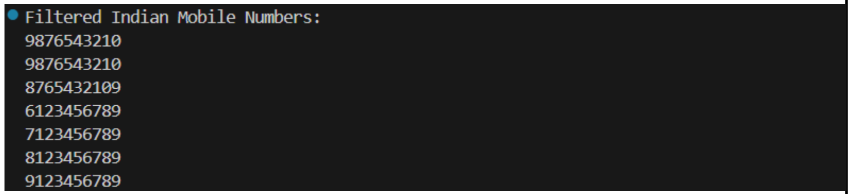
  Prompt

```
create a filter out the indian mobile numbers from
the given text file the condition is that the
number should start with 6,7,8 or 9 and it should
be of 10 digit long  create some set of examples
```

  Code

```python
import re
def filter_indian_mobile_numbers(file_path):
    indian_mobile_numbers = []
    pattern = re.compile(r'\b[6-9]\d{9}\b')

    with open(file_path, 'r') as file:
        content = file.read()
        matches = pattern.findall(content)
        indian_mobile_numbers.extend(matches)

    return indian_mobile_numbers
# Example usage
if __name__ == "__main__":
    file_path = 'mobile_numbers.txt'  # Replace
with your file path
    filtered_numbers =
filter_indian_mobile_numbers(file_path)
    print("Filtered Indian Mobile Numbers:")
    for number in filtered_numbers:
        print(number)
```

  Output



```
Filtered Indian Mobile Numbers:
9876543210
9876543210
8765432109
6123456789
7123456789
8123456789
9123456789
```

Explanation

using mobile numbers txt file it will filter out the all the indian numbers. in txt file i have already created a set of numbers. it is filter out using condicion that which i have given in range 6 - 9 starting numbers and *contains 10 digits long. it will read txt file which i have given an filer it out all the number as per my conduction.*

6

Task Description #6 (Loops – Armstrong Numbers in a Range)

Task: Write a function using AI that finds all Armstrong numbers in a user-specified range (e.g., 1 to 1000).

Instructions:

- Use a for loop and digit power logic.
- Validate correctness by checking known Armstrong numbers (153, 370, etc.).
- Ask AI to regenerate an optimized version (using list comprehensions).

Expected Output #7:

- Python program listing Armstrong numbers in the range.
- Optimized version with explanation.

Prompt

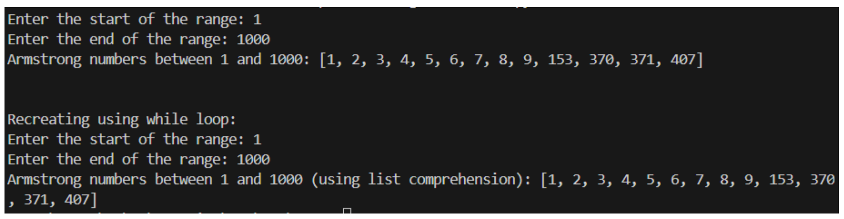
```
Write a function that finds all Armstrong numbers
in a user-specified range (e.g., 1 to 1000).
```

Code

```
def is_armstrong(num):
    num_str = str(num)
    num_digits = len(num_str)
    sum_of_powers = sum(int(digit) ** num_digits
for digit in num_str)
    return sum_of_powers == num
def armstrong_numbers_in_range(start, end):
    armstrong_numbers = []
    for num in range(start, end + 1):
        if is_armstrong(num):
            armstrong_numbers.append(num)
    return armstrong_numbers
# Example usage
if __name__ == "__main__":
    start_range = int(input("Enter the start of
the range: "))
    end_range = int(input("Enter the end of the
range: "))
    armstrong_numbers =
armstrong_numbers_in_range(start_range, end_range)
```

```
    print(f"Armstrong numbers between
{start_range} and {end_range}:
{armstrong_numbers}")

print("\n")
print("Recreating using while loop:")
'''regenerate the using list comprehensions'''
def armstrong_numbers_in_range_list_comp(start,
end):
    return [num for num in range(start, end + 1)
if is_armstrong(num)]
# Example usage
if __name__ == "__main__":
    start_range = int(input("Enter the start of
the range: "))
    end_range = int(input("Enter the end of the
range: "))
    armstrong_numbers =
armstrong_numbers_in_range_list_comp(start_range,
end_range)
    print(f"Armstrong numbers between
{start_range} and {end_range} (using list
comprehension): {armstrong_numbers}")
# Analysis:
# Time Complexity: O(n * d) - where n is the
number of numbers in the range and d is the number
of digits in the largest number. Each number
requires checking each digit.
# Space Complexity: O(k) - where k is the number
of Armstrong numbers found in the
```

Output



```
Enter the start of the range: 1
Enter the end of the range: 1000
Armstrong numbers between 1 and 1000: [1, 2, 3, 4, 5, 6, 7, 8, 9, 153, 370, 371, 407]


Recreating using while loop:
Enter the start of the range: 1
Enter the end of the range: 1000
Armstrong numbers between 1 and 1000 (using list comprehension): [1, 2, 3, 4, 5, 6, 7, 8, 9, 153, 370
, 371, 407]
```

Explanation

The program identifies Armstrong numbers by comparing each number *with the sum of its digits raised to the power of total digits.*

7

Task Description #7 (Loops – Happy Numbers in a Range)
Task: Generate a function using AI that displays all Happy Numbers within a user-specified range (e.g., 1 to 500).
Instructions:

- Implement the logic using a loop: repeatedly replace a number with the sum of the squares of its digits until the result is either 1 (Happy Number) or enters a cycle (Not Happy).
- Validate correctness by checking known Happy Numbers (e.g., 1, 7, 10, 13, 19, 23, 28…).
- Ask AI to regenerate an optimized version (e.g., by using a set to detect cycles instead of infinite loops).

Expected Output #8:

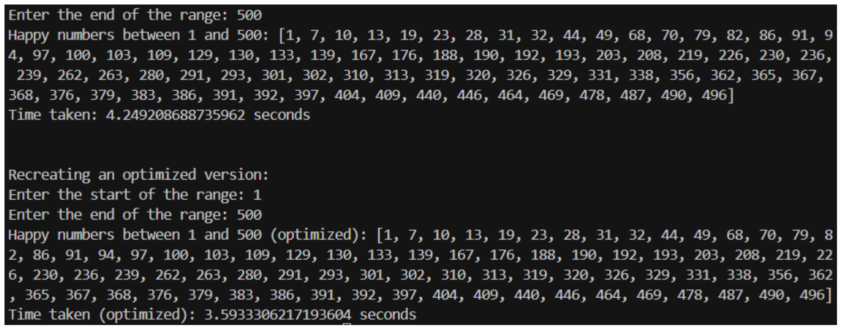
- Python program that prints all Happy Numbers within a range.

```
Genrate a all Happy Numbers within a
user-specified range (e.g., 1 to 500) using
functions.
```

Code

```
import time as t
def is_happy_number(num):
    seen = set()
    while num != 1 and num not in seen:
        seen.add(num)
        num = sum(int(digit) ** 2 for digit in
str(num))
    return num == 1
start_time = t.time()
def happy_numbers_in_range(start, end):
    happy_numbers = []
    for num in range(start, end + 1):
        if is_happy_number(num):
            happy_numbers.append(num)
    return happy_numbers
# Example usage
if __name__ == "__main__":
    start_range = int(input("Enter the start of
the range: "))
    end_range = int(input("Enter the end of the
range: "))
    happy_numbers =
happy_numbers_in_range(start_range, end_range)
    print(f"Happy numbers between {start_range}
and {end_range}: {happy_numbers}")
end_time = t.time()
print(f"Time taken: {end_time - start_time}
seconds")
```

Output



```
Enter the end of the range: 500
Happy numbers between 1 and 500: [1, 7, 10, 13, 19, 23, 28, 31, 32, 44, 49, 68, 70, 79, 82, 86, 91, 9
4, 97, 100, 103, 109, 129, 130, 133, 139, 167, 176, 188, 190, 192, 193, 203, 208, 219, 226, 230, 236,
 239, 262, 263, 280, 291, 293, 301, 302, 310, 313, 319, 320, 326, 329, 331, 338, 356, 362, 365, 367,
368, 376, 379, 383, 386, 391, 392, 397, 404, 409, 440, 446, 464, 469, 478, 487, 490, 496]
Time taken: 4.249208688735962 seconds


Recreating an optimized version:
Enter the start of the range: 1
Enter the end of the range: 500
Happy numbers between 1 and 500 (optimized): [1, 7, 10, 13, 19, 23, 28, 31, 32, 44, 49, 68, 70, 79, 8
2, 86, 91, 94, 97, 100, 103, 109, 129, 130, 133, 139, 167, 176, 188, 190, 192, 193, 203, 208, 219, 22
6, 230, 236, 239, 262, 263, 280, 291, 293, 301, 302, 310, 313, 319, 320, 326, 329, 331, 338, 356, 362
, 365, 367, 368, 376, 379, 383, 386, 391, 392, 397, 404, 409, 440, 446, 464, 469, 478, 487, 490, 496]
Time taken (optimized): 3.5933306217193604 seconds
```

- Optimized version using cycle detection with explanation.

```
'''regenerate an optimized version using a set to
detect cycles instead of infinite loops'''
def is_happy_number_optimized(num):
    seen = set()
    while num != 1:
        if num in seen:
            return False
        seen.add(num)
        num = sum(int(digit) ** 2 for digit in
str(num))
    return True
start_time = t.time()
def happy_numbers_in_range_optimized(start, end):
    happy_numbers = []
    for num in range(start, end + 1):
        if is_happy_number_optimized(num):
            happy_numbers.append(num)
    return happy_numbers
# Example usage
if __name__ == "__main__":
    start_range = int(input("Enter the start of
the range: "))
    end_range = int(input("Enter the end of the
range: "))
    happy_numbers =
happy_numbers_in_range_optimized(start_range,
end_range)
    print(f"Happy numbers between {start_range}
and {end_range} (optimized): {happy_numbers}")
end_time = t.time()
print(f"Time taken (optimized): {end_time -
start_time} seconds")

# Analysis:
# Time Complexity: O(n * m) - where n is the
number of numbers in the
# range and m is the average number of iterations
to determine if a number is happy.
# Space Complexity: O(k) - where k is the number
of happy numbers found in the
# range, as they are stored in a list.
```

Explanation

Happy numbers are detected by repeatedly summing the squares of digits and using a set to prevent infinite loops.

8

Task Description #8 (Loops – Strong Numbers in a Range)

Task: Generate a function using AI that displays all Strong Numbers (sum of factorial of digits equals the number, e.g., 145 = 1!+4!+5!) within a given range.

Instructions:

- Use loops to extract digits and calculate factorials.
- Validate with examples (1, 2, 145).
- Ask AI to regenerate an optimized version (precompute digit factorials).

Expected Output #9:

- Python program that lists Strong Numbers.

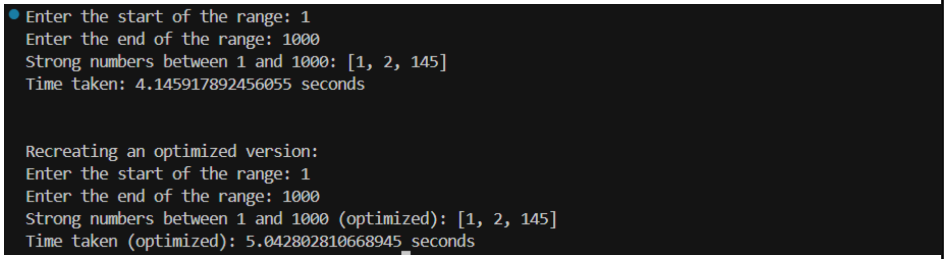
Prompt

Genrate all strong numbers within a user-specified range (e.g., 1 to 500) using functions.

Code

```
def factorial(n):
    if n == 0 or n == 1:
        return 1
    result = 1
    for i in range(2, n + 1):
        result *= i
    return result
start_time = t.time()
def is_strong_number(num):
    original_num = num
    sum_of_factorials = 0
    while num > 0:
        digit = num % 10
        sum_of_factorials += factorial(digit)
        num //= 10
    return sum_of_factorials == original_num
def strong_numbers_in_range(start, end):
    strong_numbers = []
    for num in range(start, end + 1):
        if is_strong_number(num):
            strong_numbers.append(num)
    return strong_numbers
# Example usage
if __name__ == "__main__":
    start_range = int(input("Enter the start of the
range: "))
    end_range = int(input("Enter the end of the range:
"))
    strong_numbers =
strong_numbers_in_range(start_range, end_range)
    print(f"Strong numbers between {start_range} and
{end_range}: {strong_numbers}")
end_time = t.time()
print(f"Time taken: {end_time - start_time} seconds")
```

Output



```
Enter the start of the range: 1
Enter the end of the range: 1000
Strong numbers between 1 and 1000: [1, 2, 145]
Time taken: 4.145917892456055 seconds


Recreating an optimized version:
Enter the start of the range: 1
Enter the end of the range: 1000
Strong numbers between 1 and 1000 (optimized): [1, 2, 145]
Time taken (optimized): 5.042802810668945 seconds
```

- Optimized version with explanation.

```
def is_strong_number_optimized(num,
factorial_cache={}):
    original_num = num
    sum_of_factorials = 0
    while num > 0:
        digit = num % 10
        if digit not in factorial_cache:
            factorial_cache[digit] =
factorial(digit)
        sum_of_factorials +=
factorial_cache[digit]
        num //= 10
    return sum_of_factorials == original_num
start_time = t.time()
def strong_numbers_in_range_optimized(start, end):
    strong_numbers = []
    for num in range(start, end + 1):
        if is_strong_number_optimized(num):
            strong_numbers.append(num)
    return strong_numbers
# Example usage
if __name__ == "__main__":
    start_range = int(input("Enter the start of
the range: "))
    end_range = int(input("Enter the end of the
range: "))
    strong_numbers =
strong_numbers_in_range_optimized(start_range,
end_range)
    print(f"Strong numbers between {start_range}
and {end_range} (optimized): {strong_numbers}")
```

	```
	end_time = t.time()
	print(f"Time taken (optimized): {end_time -
	start_time} seconds")
	```
	 Explanation *The function checks whether a number equals the sum of factorials of its digits to identify Strong numbers.*	

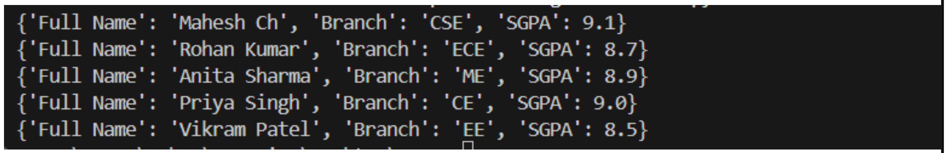
9	**Task #9 – Few-Shot Prompting for Nested Dictionary Extraction**
	Objective
	Use few-shot prompting (2–3 examples) to instruct the AI to create a function that parses a nested dictionary representing student information.
	Requirements
	• The function should extract and return:
	○ Full Name
	○ Branch
	○ SGPA
	Expected Output
	A reusable Python function that correctly navigates and extracts values from nested dictionaries based on the provided examples
	Prompt
	```
	create a function that parses a nested dictionary
	representing student information.
	The function should extract and return:
	Full Name
	Branch
	SGPA
	Example Input:
	{
	    "student1": {
	        "name": {"first": "Mahesh", "last": "Ch"},
	        "branch": "CSE",
	```

```
        "SGPA": 9.1
        },
        "student2": {"name": {"first": "Rohan", "last":
"Kumar"},
        "branch": "ECE",
        "SGPA": 8.7
        }
```

Code

```
def extract_student_info(students_dict):
    extracted_info = []
    for student_key, student_data in
students_dict.items():
        first_name = student_data['name']['first']
        last_name = student_data['name']['last']
        full_name = f"{first_name} {last_name}"
        branch = student_data['branch']
        sgpa = student_data['SGPA']
        extracted_info.append({
            'Full Name': full_name,
            'Branch': branch,
            'SGPA': sgpa
        })
    return extracted_info
# Example usage
if __name__ == "__main__":
    students = {
        "student1": {
            "name": {"first": "Mahesh", "last": "Ch"},
            "branch": "CSE",
            "SGPA": 9.1
        },
        "student2": {
            "name": {"first": "Rohan", "last": "Kumar"},
            "branch": "ECE",
            "SGPA": 8.7
        },
        "student3": {
            "name": {"first": "Anita", "last":
"Sharma"},
            "branch": "ME",
            "SGPA": 8.9
        },
        "student4": {
            "name": {"first": "Priya", "last": "Singh"},
            "branch": "CE",
            "SGPA": 9.0
        },
        "student5": {
            "name": {"first": "Vikram", "last":
"Patel"},
            "branch": "EE",
            "SGPA": 8.5
        }
    }
    student_info = extract_student_info(students)
    for info in student_info:
        print(info)
# Analysis:
# Time Complexity: O(n) - where n is the number of
students in the dictionary.
# Space Complexity: O(n) - where n is the number of
students, as we store the extracted information in a
list.
```

Output



```
{'Full Name': 'Mahesh Ch', 'Branch': 'CSE', 'SGPA': 9.1}
{'Full Name': 'Rohan Kumar', 'Branch': 'ECE', 'SGPA': 8.7}
{'Full Name': 'Anita Sharma', 'Branch': 'ME', 'SGPA': 8.9}
{'Full Name': 'Priya Singh', 'Branch': 'CE', 'SGPA': 9.0}
{'Full Name': 'Vikram Patel', 'Branch': 'EE', 'SGPA': 8.5}
```

Explanation

The function navigates a nested dictionary structure to correctly extract student full name, branch, and SGPA.

10

Task Description #10 (Loops – Perfect Numbers in a Range)

Task: Generate a function using AI that displays all Perfect Numbers within a user-specified range (e.g., 1 to 1000).

Instructions:

- A Perfect Number is a positive integer equal to the sum of its proper divisors (excluding itself).
  - Example: 6 = 1 + 2 + 3, 28 = 1 + 2 + 4 + 7 + 14.
- Use a for loop to find divisors of each number in the range.
- Validate correctness with known Perfect Numbers (6, 28, 496…).
- Ask AI to regenerate an optimized version (using divisor check only up to √n).

Expected Output #12:

- Python program that lists Perfect Numbers in the given range.

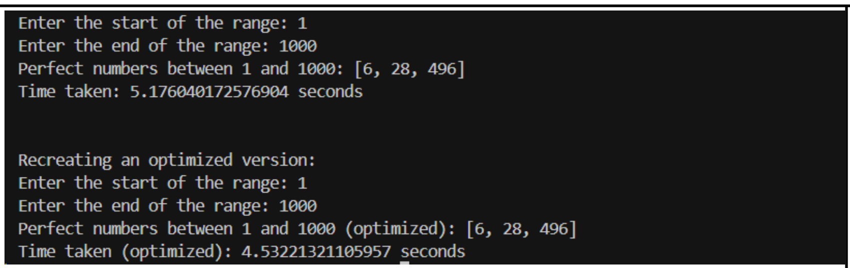
Prompt

```
Genrate a perfect numbers within a user-specified
range (e.g., 1 to 1000) using functions.
```

Code

```
import time as t
def is_perfect_number(num):
    if num < 2:
        return False
    sum_of_divisors = 1  # 1 is a proper divisor
    for i in range(2, int(num**0.5) + 1):
        if num % i == 0:
            sum_of_divisors += i
            if i != num // i:
                sum_of_divisors += num // i
    return sum_of_divisors == num
start_time = t.time()
def perfect_numbers_in_range(start, end):
    perfect_numbers = []
    for num in range(start, end + 1):
        if is_perfect_number(num):
            perfect_numbers.append(num)
    return perfect_numbers
# Example usage
if __name__ == "__main__":
    start_range = int(input("Enter the start of
the range: "))
    end_range = int(input("Enter the end of the
range: "))
    perfect_numbers =
perfect_numbers_in_range(start_range, end_range)
    print(f"Perfect numbers between {start_range}
and {end_range}: {perfect_numbers}")
end_time = t.time()
print(f"Time taken: {end_time - start_time}
seconds")
```

Output



```
Enter the start of the range: 1
Enter the end of the range: 1000
Perfect numbers between 1 and 1000: [6, 28, 496]
Time taken: 5.176040172576904 seconds


Recreating an optimized version:
Enter the start of the range: 1
Enter the end of the range: 1000
Perfect numbers between 1 and 1000 (optimized): [6, 28, 496]
Time taken (optimized): 4.53221321105957 seconds
```

- Optimized version with explanation.

```
print("Recreating an optimized version:")
def is_perfect_number_optimized(num):
    if num < 2:
        return False
    sum_of_divisors = 1  # 1 is a proper divisor
    for i in range(2, int(num**0.5) + 1):
        if num % i == 0:
            sum_of_divisors += i
            if i != num // i:
                sum_of_divisors += num // i
    return sum_of_divisors == num
start_time = t.time()
def perfect_numbers_in_range_optimized(start,
end):
    perfect_numbers = []
    for num in range(start, end + 1):
        if is_perfect_number_optimized(num):
            perfect_numbers.append(num)
    return perfect_numbers
# Example usage
if __name__ == "__main__":
    start_range = int(input("Enter the start of
the range: "))
    end_range = int(input("Enter the end of the
range: "))
    perfect_numbers =
perfect_numbers_in_range_optimized(start_range,
end_range)
    print(f"Perfect numbers between {start_range}
and {end_range} (optimized): {perfect_numbers}")
end_time = t.time()
print(f"Time taken (optimized): {end_time -
```

	`start_time} seconds")` ***Explanation*** *Perfect numbers are identified by summing proper divisors efficiently by checking only up to the square root of the number.*	