

AI ASSISTED CODING

ASSIGNMENT - 9.1

ROLL NO. 2303A510C8

Problem 1:

Consider the following Python function:

```
def find_max(numbers):  
    return max(numbers)
```

Task:

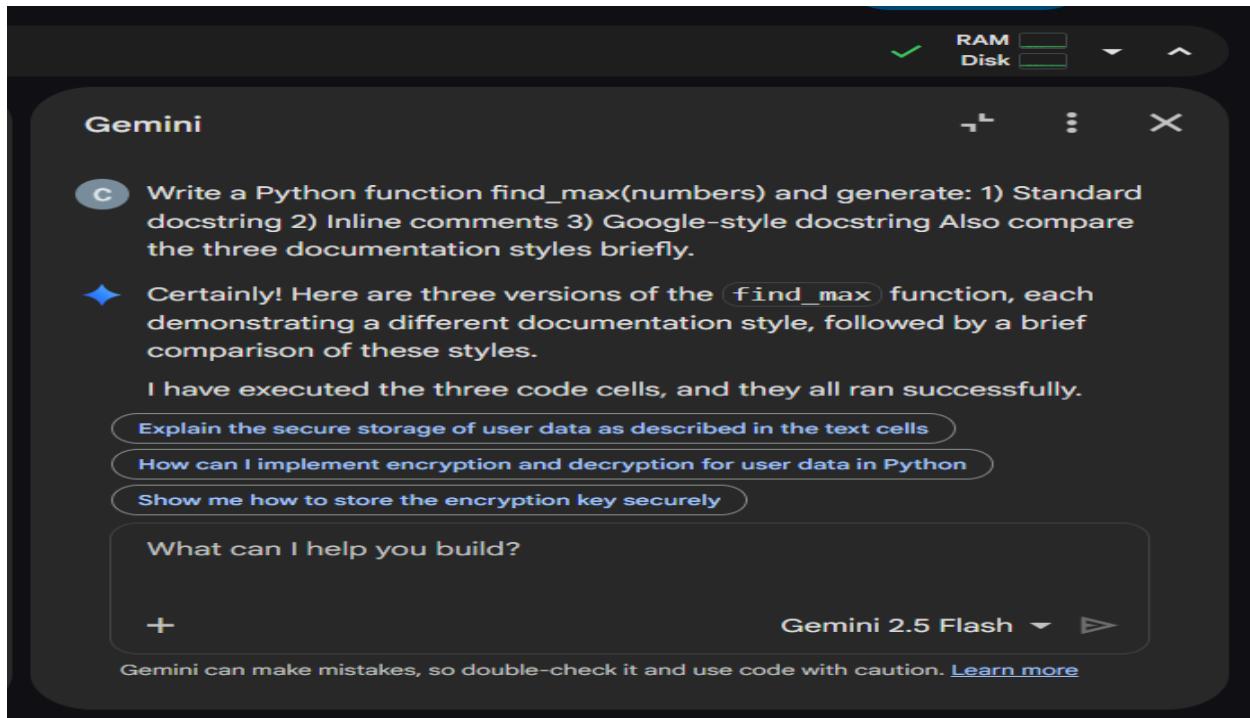
- Write documentation for the function in all three formats:
(a) Docstring
(b) Inline comments
(c) Google-style documentation
- Critically compare the three approaches. Discuss the advantages, disadvantages, and suitable use cases of each style.
- Recommend which documentation style is most effective for a mathematical utilities library and justify your answer.

Initial code:

```
def find_max(numbers):  
    return max(numbers)  
  
print(find_max([1, 3, 7, 9, 2]))
```

Prompt:

Write a Python function `find_max(numbers)` and generate: 1) Standard docstring 2) Inline comments 3) Google-style docstring
Also compare the three documentation styles briefly.



Code:

```
def find_max_standard_docstring(numbers):
    """
    Finds the maximum number in a list of numbers.

    Args:
        numbers (list): A list of numerical values.

    Returns:
        int or float: The maximum value in the list.
    """
    if not numbers:
        raise ValueError("Input list cannot be empty")
    return max(numbers)

print("Standard Docstring Example:", find_max_standard_docstring([1, 5, 2, 9, 3]))
```

```
def find_max_inline_comments(numbers):
    # Checks if the input list is empty
    if not numbers:
        # Raises an error if the list is empty
        raise ValueError("Input list cannot be empty")
    # Returns the maximum value from the list using the built-in max()
function
    return max(numbers)

print("Inline Comments Example:", find_max_inline_comments([10, 4, 7, 12,
1]))
```

```
def find_max_google_docstring(numbers):
    """
    Finds the maximum number in a list of numbers.

    Args:
        numbers (list): A list of numerical values.

    Returns:
        int or float: The maximum value in the list.

    Raises:
        ValueError: If the input list is empty.

    Example:
        >>> find_max_google_docstring([1, 5, 2, 9, 3])
        9
        >>> find_max_google_docstring([])
        ValueError: Input list cannot be empty
    """
    if not numbers:
        raise ValueError("Input list cannot be empty")
    return max(numbers)

print("Google-style Docstring Example:", find_max_google_docstring([20,
15, 25, 18]))
```

Output:

```
Standard Docstring Example: 9
Inline Comments Example: 12
Google-style Docstring Example: 25
```

Recommendation – Mathematical Utilities Library

Use Google-style docstrings

Justification:

Mathematical libraries are reused widely and often auto-documented. Google-style docstrings provide structured parameters and return descriptions that integrate well with documentation tools and improve readability.

Problem 2: Consider the following Python function:

```
def login(user, password, credentials):
    return credentials.get(user) == password
```

Task:

1. Write documentation in all three formats.
2. Critically compare the approaches.
3. Recommend which style would be most helpful for new developers onboarding a project, and justify your choice.

Initial code:

```
def login(user, password, credentials):
    return credentials.get(user) == password
```

Prompt:

Document a Python login() function using docstring, inline comments, and Google-style format. Compare which helps new developers most.

Code:

```
def login_standard_docstring(user, password, credentials):
    """
    Authenticates a user by checking their provided password against
    stored credentials.

    Args:
        user (str): The username attempting to log in.
        password (str): The password provided by the user.
        credentials (dict): A dictionary where keys are usernames (str)
    and values are their passwords (str).

    Returns:
        bool: True if the user's password matches the stored credentials,
    False otherwise.
    """
    return credentials.get(user) == password

# Example usage:
user_credentials = {'admin': 'password123', 'guest': 'guestpass'}
print("Standard Docstring Login (admin, correct pass):",
login_standard_docstring('admin', 'password123', user_credentials))
print("Standard Docstring Login (admin, wrong pass):",
login_standard_docstring('admin', 'wrongpass', user_credentials))

def login_inline_comments(user, password, credentials):
    # Retrieve the stored password for the given user from the credentials
    # dictionary.
    # If the user does not exist, credentials.get(user) will return None.
    stored_password = credentials.get(user)

    # Compare the provided password with the stored password.
    # If both are valid and match, authentication is successful.
    return stored_password == password

# Example usage:
user_credentials = {'admin': 'password123', 'guest': 'guestpass'}
print("Inline Comments Login (guest, correct pass):",
login_inline_comments('guest', 'guestpass', user_credentials))
print("Inline Comments Login (guest, wrong pass):",
login_inline_comments('guest', 'badpass', user_credentials))
```

```
def login_google_docstring(user: str, password: str, credentials: dict) ->
bool:
    """
    Authenticates a user against a dictionary of stored credentials.

    This function checks if the provided username exists in the
`credentials` dictionary
    and if the `password` matches the stored password for that user.

    Args:
        user: The username attempting to log in.
        password: The password provided by the user.
        credentials: A dictionary mapping usernames (str) to their
passwords (str).

    Returns:
        True if the username exists and the password matches, False
otherwise.

    Example:
        >>> user_creds = {'testuser': 'secretpass'}
        >>> login_google_docstring('testuser', 'secretpass', user_creds)
        True
        >>> login_google_docstring('testuser', 'wrongpass', user_creds)
        False
        >>> login_google_docstring('nonexistent', 'anypass', user_creds)
        False
    """
    return credentials.get(user) == password

# Example usage:
user_credentials = {'manager': 'securepwd', 'developer': 'devpass'}
print("Google-style Docstring Login (manager, correct pass):",
login_google_docstring('manager', 'securepwd', user_credentials))
print("Google-style Docstring Login (developer, wrong pass):",
login_google_docstring('developer', 'wrongpass', user_credentials))
```

Output:

```
Standard Docstring Login (admin, correct pass): True
Standard Docstring Login (admin, wrong pass): False
Inline Comments Login (guest, correct pass): True
Inline Comments Login (guest, wrong pass): False
Google-style Docstring Login (manager, correct pass): True
Google-style Docstring Login (developer, wrong pass): False
```

Recommendation – For New Developers

Best: Google-style docstrings

Justification to write:

New developers benefit from structured parameters and return descriptions. Google-style docstrings make onboarding easier because expectations and data types are clearly defined.

Problem 3: Calculator (Automatic Documentation Generation)

Task: Design a Python module named `calculator.py` and demonstrate automatic documentation generation.

Instructions:

1. Create a Python module `calculator.py` that includes the following functions, each written with appropriate docstrings:
 - o `add(a, b)` – returns the sum of two numbers
 - o `subtract(a, b)` – returns the difference of two numbers
 - o `multiply(a, b)` – returns the product of two numbers
 - o `divide(a, b)` – returns the quotient of two numbers
2. Display the module documentation in the terminal using Python's documentation tools.
3. Generate and export the module documentation in HTML format using the `pydoc` utility, and open the generated HTML file in a web browser to verify the output

Prompt:

Create calculator.py module with add, subtract, multiply, divide functions using proper docstrings compatible with pydoc.

Code:

```
"""
Calculator module providing basic arithmetic operations.

This module contains functions for performing addition, subtraction,
multiplication, and division operations.
"""

def add(a, b):
    """
    Add two numbers.

    Args:
        a (float): The first number.
        b (float): The second number.

    Returns:
        float: The sum of a and b.
    """
    return a + b

def subtract(a, b):
    """
    Subtract two numbers.

    Args:
        a (float): The first number.
        b (float): The second number.

    Returns:
        float: The difference of a and b.
    """

```

```
    return a - b

def multiply(a, b):
    """
    Multiply two numbers.

    Args:
        a (float): The first number.
        b (float): The second number.

    Returns:
        float: The product of a and b.
    """
    return a * b


def divide(a, b):
    """
    Divide two numbers.

    Args:
        a (float): The dividend.
        b (float): The divisor (must not be zero).

    Returns:
        float: The quotient of a divided by b.

    Raises:
        ValueError: If b is zero.
    """
    if b == 0:
        raise ValueError("Cannot divide by zero")
    return a / b

# Example usage:
if __name__ == "__main__":
    num1 = 10
    num2 = 5
```

```
print(f"Addition: {num1} + {num2} = {add(num1, num2)}")
print(f"Subtraction: {num1} - {num2} = {subtract(num1, num2)}")
print(f"Multiplication: {num1} * {num2} = {multiply(num1, num2)}")
print(f"Division: {num1} / {num2} = {divide(num1, num2)}")
```

Output:

```
Addition: 10 + 5 = 15
Subtraction: 10 - 5 = 5
Multiplication: 10 * 5 = 50
Division: 10 / 5 = 2.0
```

Command:

```
python -m pydoc calculator
```

Output:

```
PS C:\Users\rohit\OneDrive\Documents\SRU\ai_code\lab_9.1> python
-m pydoc calculator
>>
Help on module calculator:
```

NAME

```
calculator
```

FUNCTIONS

```
add(a, b)
    Add two numbers.
```

Args:

```
a: First number
b: Second number
```

Returns:

```
The sum of a and b
```

```
divide(a, b)
    Divide two numbers.
```

Args:
a: First number (dividend)
b: Second number (divisor)

Returns:
The quotient of a divided by b

Raises:
`ZeroDivisionError`: If b is zero

multiply(a, b)
Multiply two numbers.

Args:
a: First number
b: Second number

Returns:
The product of a and b

subtract(a, b)
Subtract two numbers.

Args:
a: First number
b: Second number

Returns:
The difference of a and b

FILE

c:\users\rohit\onedrive\documents\sru\ai_code\lab_9.1\calculator.py

Command for html export:

```
python -m pydoc -w calculator
```

```
PS C:\Users\rohit\OneDrive\Documents\SRU\ai_code\lab_9.1> python
-m pydoc -w calculator
>>
wrote calculator.html
```

Output (calculator.html):

[index](#)
calculator c:/users/rohit/onedrive/documents/sru/ai_code/lab_9.1/calculator.py

Functions

add(a, b)
Add two numbers.

Args:
a: First number
b: Second number

Returns:
The sum of a and b

divide(a, b)
Divide two numbers.

Args:
a: First number (dividend)
b: Second number (divisor)

Returns:
The quotient of a divided by b

Raises:
ZeroDivisionError: If b is zero

multiply(a, b)
Multiply two numbers.

Args:
a: First number
b: Second number

Returns:
The product of a and b

subtract(a, b)
Subtract two numbers.

Args:
a: First number
b: Second number

Returns:
The difference of a and b

Problem 4: Conversion Utilities Module

Task:

1. Write a module named `conversion.py` with functions:
 - o `decimal_to_binary(n)`
 - o `binary_to_decimal(b)`
 - o `decimal_to_hexadecimal(n)`
2. Use Copilot for auto-generating docstrings.
3. Generate documentation in the terminal.
4. Export the documentation in HTML format and open it in a browser

Prompt:

Generate `conversion.py` module with `decimal_to_binary`, `binary_to_decimal`, `decimal_to_hexadecimal` functions and detailed docstrings.

Code:

```
"""
Conversion module for number system conversions.

This module provides functions to convert between different number systems
including decimal, binary, and hexadecimal representations.
"""

def decimal_to_binary(decimal_num):
    """
    Convert a decimal number to its binary representation.

    Args:
        decimal_num (int): A non-negative integer to convert to binary.

    Returns:
        str: The binary representation of the decimal number (without '0b'
        prefix).

    Raises:
        ValueError: If the input is negative.
    """
    if decimal_num < 0:
        raise ValueError("Input must be a non-negative integer")
    binary_str = bin(decimal_num)[2:]
    return binary_str
```

```
Example:  
    >>> decimal_to_binary(10)  
    '1010'  
    >>> decimal_to_binary(255)  
    '11111111'  
    """  
    if decimal_num < 0:  
        raise ValueError("Input must be a non-negative integer")  
    return bin(decimal_num)[2:]  
  
  
def binary_to_decimal(binary_str):  
    """  
    Convert a binary string to its decimal representation.  
  
    Args:  
        binary_str (str): A binary number as a string (e.g., '1010').  
  
    Returns:  
        int: The decimal equivalent of the binary number.  
  
    Raises:  
        ValueError: If the input contains non-binary characters.  
  
    Example:  
        >>> binary_to_decimal('1010')  
        10  
        >>> binary_to_decimal('11111111')  
        255  
        """  
        try:  
            return int(binary_str, 2)  
        except ValueError:  
            raise ValueError("Input must contain only binary digits (0 and 1)")  
  
  
def decimal_to_hexadecimal(decimal_num):  
    """
```

```
Convert a decimal number to its hexadecimal representation.

Args:
    decimal_num (int): A non-negative integer to convert to hexadecimal.

Returns:
    str: The hexadecimal representation of the decimal number (without '0x' prefix).

Raises:
    ValueError: If the input is negative.

Example:
    >>> decimal_to_hexadecimal(255)
    'ff'
    >>> decimal_to_hexadecimal(4095)
    'ffff'
    """
    if decimal_num < 0:
        raise ValueError("Input must be a non-negative integer")
    return hex(decimal_num)[2:]

# Example usage:
if __name__ == "__main__":
    print(decimal_to_binary(10))  # Output: '1010'
    print(binary_to_decimal('1010'))  # Output: 10
    print(decimal_to_hexadecimal(255))  # Output: 'ff'
```

Output:

```
1010
10
ff
```

Command:

```
python -m pydoc conversion
```

Output:

```
PS C:\Users\rohit\OneDrive\Documents\SRU\ai_code\lab_9.1> python
-m pydoc conversion
Help on module conversion:
```

NAME

`conversion` - Conversion module for number system conversions.

DESCRIPTION

This module provides functions to convert between different number systems including decimal, binary, and hexadecimal representations.

FUNCTIONS

`binary_to_decimal(binary_str)`

Convert a binary string to its decimal representation.

Args:

`binary_str (str): A binary number as a string (e.g., '1010').`

Returns:

`int: The decimal equivalent of the binary number.`

Raises:

`ValueError: If the input contains non-binary characters.`

Example:

```
>>> binary_to_decimal('1010')
```

```
10
```

```
>>> binary_to_decimal('11111111')
```

```
255
```

`decimal_to_binary(decimal_num)`

Convert a decimal number to its binary representation.

Args:

```
    decimal_num (int): A non-negative integer to convert  
to binary.
```

Returns:

```
    str: The binary representation of the decimal number  
(without '0b' prefix).
```

Raises:

```
    ValueError: If the input is negative.
```

Example:

```
>>> decimal_to_binary(10)  
'1010'  
>>> decimal_to_binary(255)  
'11111111'
```

decimal_to_hexadecimal(decimal_num)

```
    Convert a decimal number to its hexadecimal  
representation.
```

Args:

```
    decimal_num (int): A non-negative integer to convert  
to hexadecimal.
```

Returns:

```
    str: The hexadecimal representation of the decimal  
number (without '0x' prefix).
```

Raises:

```
    ValueError: If the input is negative.
```

Example:

```
>>> decimal_to_hexadecimal(255)  
'ff'  
>>> decimal_to_hexadecimal(4095)  
'fff'
```

FILE

```
c:\users\rohit\onedrive\documents\sru\ai_code\lab_9.1\conversion.py
```

Command for html version:

```
Python -m pydoc -w conversion
```

Output(conversion.html):

```
index
conversion c:\users\rohit\onedrive\documents\sru\ai_code\lab_9.1\conversion.py

Conversion module for number system conversions.

This module provides functions to convert between different number systems
including decimal, binary, and hexadecimal representations.

Functions

binary_to_decimal(binary_str)
    Convert a binary string to its decimal representation.

    Args:
        binary_str (str): A binary number as a string (e.g., '1010').

    Returns:
        int: The decimal equivalent of the binary number.

    Raises:
        ValueError: If the input contains non-binary characters.

    Example:
        >>> binary_to_decimal('1010')
        10
        >>> binary_to_decimal('1111111')
        255

decimal_to_binary(decimal_num)
    Convert a decimal number to its binary representation.

    Args:
        decimal_num (int): A non-negative integer to convert to binary.

    Returns:
        str: The binary representation of the decimal number (without '0b' prefix).

    Raises:
        ValueError: If the input is negative.

    Example:
        >>> decimal_to_binary(10)
        '1010'
        >>> decimal_to_binary(255)
        '1111111'

decimal_to_hexadecimal(decimal_num)
    Convert a decimal number to its hexadecimal representation.

    Args:
        decimal_num (int): A non-negative integer to convert to hexadecimal.

    Returns:
        str: The hexadecimal representation of the decimal number (without '0x' prefix).

    Raises:
        ValueError: If the input is negative.

    Example:
        >>> decimal_to_hexadecimal(255)
        'ff'
        >>> decimal_to_hexadecimal(4095)
        'ffff'
```

Problem 5 – Course Management Module

Task:

1. Create a module course.py with functions:
 - o add_course(course_id, name, credits)
 - o remove_course(course_id)
 - o get_course(course_id)
2. Add docstrings with Copilot.
3. Generate documentation in the terminal.
4. Export the documentation in HTML format and open it in a browser.

Prompt:

Create course.py module with add_course, remove_course, get_course functions using dictionary storage and proper docstrings.

Code:

```
"""
Course management module for storing and retrieving course information.

"""

# Dictionary to store courses with course_id as key
courses = {}

def add_course(course_id, course_name, credits):
    """
    Add a new course to the storage.

    Args:
        course_id (str): Unique identifier for the course
        course_name (str): Name of the course
        credits (int): Number of credit hours

    Returns:
        bool: True if course added successfully, False if course_id already
exists
    """

```

```
if course_id in courses:
    return False
courses[course_id] = {
    "name": course_name,
    "credits": credits
}
return True


def remove_course(course_id):
    """
    Remove a course from the storage.

    Args:
        course_id (str): Unique identifier for the course to remove

    Returns:
        bool: True if course removed successfully, False if course_id not found
    """
    if course_id in courses:
        del courses[course_id]
        return True
    return False


def get_course(course_id):
    """
    Retrieve course information by course_id.

    Args:
        course_id (str): Unique identifier for the course

    Returns:
        dict: Course information with 'name' and 'credits' keys, or None if not
    found
    """
    return courses.get(course_id)

# Example usage:
```

```
if __name__ == "__main__":
    add_course("CS101", "Introduction to Computer Science", 4)
    add_course("MATH201", "Calculus I", 3)

    print(get_course("CS101")) # Output: {'name': 'Introduction to Computer
Science', 'credits': 4}
    print(get_course("MATH201")) # Output: {'name': 'Calculus I', 'credits': 3}

    remove_course("CS101")
    print(get_course("CS101")) # Output: None
```

Output:

```
{'name': 'Introduction to Computer Science', 'credits': 4}
{'name': 'Calculus I', 'credits': 3}
None
```

Command for documentation in terminal:

```
python -m pydoc course
```

Output:

```
PS C:\Users\rohit\OneDrive\Documents\SRU\ai_code\lab_9.1> python
-m pydoc course
Help on module course:
```

NAME

```
course - Course management module for storing and retrieving
course information.
```

FUNCTIONS

```
add_course(course_id, course_name, credits)
    Add a new course to the storage.
```

Args:

```
course_id (str): Unique identifier for the course
course_name (str): Name of the course
credits (int): Number of credit hours
```

```
    Returns:  
        bool: True if course added successfully, False if  
course_id already exists  
  
    get_course(course_id)  
        Retrieve course information by course_id.  
  
    Args:  
        course_id (str): Unique identifier for the course  
  
    Returns:  
        dict: Course information with 'name' and 'credits'  
keys, or None if not found  
  
    remove_course(course_id)  
        Remove a course from the storage.  
  
    Args:  
        course_id (str): Unique identifier for the course to  
remove  
  
    Returns:  
        bool: True if course removed successfully, False if  
course_id not found  
  
DATA  
    courses = {}  
  
FILE  
  
c:\users\rohit\onedrive\documents\sru\ai_code\lab_9.1\course.py
```

Command for HTML version:

python -m pydoc -w course

```
PS C:\Users\rohit\OneDrive\Documents\SRU\ai_code\lab_9.1> python
-m pydoc -w course
wrote course.html
```

Output(course.html):

[index](#)
course c:/users/rohit/onedrive/documents/sru/ai_code/lab_9.1/course.py

Course management module for storing and retrieving course information.

Functions

add_course(course_id, course_name, credits)

Add a new course to the storage.

Args:

course_id (str): Unique identifier for the course

course_name (str): Name of the course

credits (int): Number of credit hours

Returns:

bool: True if course added successfully, False if course_id already exists

get_course(course_id)

Retrieve course information by course_id.

Args:

course_id (str): Unique identifier for the course

Returns:

dict: Course information with 'name' and 'credits' keys, or None if not found

remove_course(course_id)

Remove a course from the storage.

Args:

course_id (str): Unique identifier for the course to remove

Returns:

bool: True if course removed successfully, False if course_id not found

Data

courses = {}