

Assignment

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Assignment Title: Lab 9 – Documentation Generation: Automatic Documentation and Code Comments

Task 1: Automatic Code Commenting

The main goal of Task 1 is to learn how to add inline comments and docstrings to explain code clearly, making it more understandable and maintainable. It also compares auto-generated vs manually written comments.

PROMPT:

Add clear inline comments and docstrings to the AI-generated code, explaining its purpose, inputs, and logic. Make the code easier to understand and maintain. Then compare your manual comments with the AI-generated ones, highlighting differences in clarity, detail, and usefulness.

Code/Output:

```
Lab8-t1 X
Lab8-t1 > calculate_discount_numpy
1 """
2 Lab 9 Task 1
3 Automatic Code Commenting & Documentation
4 """
5 def calculate_discount_ai(price, discount_rate):
6     discount = price * discount_rate / 100
7     final_price = price - discount
8     return final_price
9
10 def calculate_discount_manual(price, discount_rate):
11     discount = price * discount_rate / 100
12     final_price = price - discount
13     return final_price
14
15 def calculate_discount_google(price, discount_rate):
16     """
17     Calculate the final price after applying a discount.
18
19     Args:
20         price (float): The original price of the item.
21         discount_rate (float): The discount rate as a percentage.
22
23     Returns:
24         float: The final price after applying the discount.
25     """
26     discount = price * discount_rate / 100
27     final_price = price - discount
28     return final_price
29
30 def calculate_discount_numpy(price, discount_rate):
31     """
32     Calculate the final price after applying a discount using NumPy.
33
34     Args:
35         price (float): The original price of the item.
36         discount_rate (float): The discount rate as a percentage.
37
38     Returns:
39         float: The final price after applying the discount.
40     """
41     discount = price * discount_rate / 100
42     final_price = price - discount
43     return final_price
44
45 if __name__ == '__main__':
46     price = 1000
47     discount_rate = 10
48     ai_final_price = calculate_discount_ai(price, discount_rate)
49     manual_final_price = calculate_discount_manual(price, discount_rate)
50     google_final_price = calculate_discount_google(price, discount_rate)
51     numpy_final_price = calculate_discount_numpy(price, discount_rate)
52
53     print(f"Original Price: {price}")
54     print(f"Discount Rate: {discount_rate} %")
55     print(f"Discount Amount: {discount}")
56     print(f"AI Version Final Price: {ai_final_price}")
57     print(f"Manual Version Final Price: {manual_final_price}")
58     print(f"Google Docstring Final Price: {google_final_price}")
59     print(f"NumPy Docstring Final Price: {numpy_final_price}")
60
61 PS D:\AIAC>
```

EXPLANATION:

involves adding inline comments and Python docstrings to explain the logic, parameters, and return values of functions. This improves code clarity and maintainability. You'll also compare manual documentation with AI-generated comments to assess which better supports code understanding and future development in Python projects.

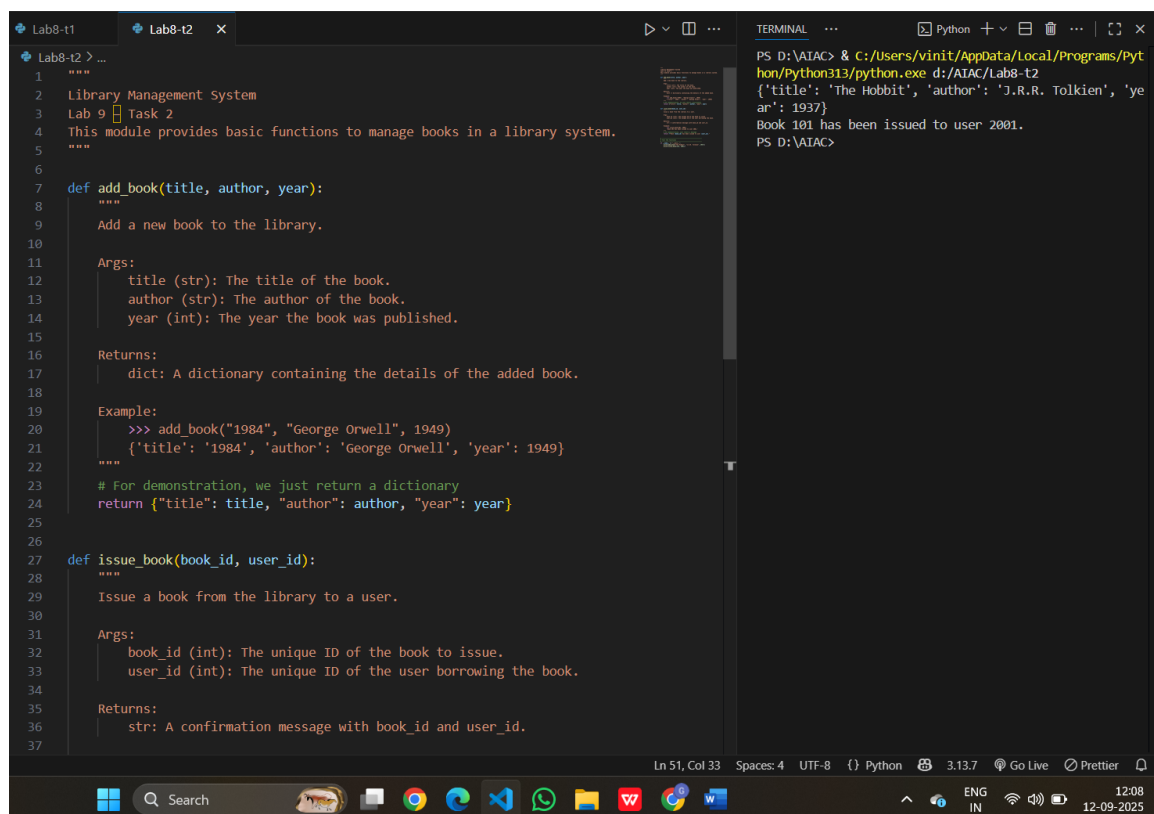
Task 2: API Documentation Generator

The main goal of Task 2 is to practice writing docstrings for functions and using auto-documentation tools like Sphinx or MkDocs to generate structured API documentation.

PROMPT:

Write detailed docstrings for each function, explaining what they do, their inputs, and outputs. Then use tools like Sphinx or MkDocs to automatically generate clean, well-structured API documentation from these docstrings. Focus on making the docs clear and easy for others to use.

Code/Output:



```
1  """
2  Library Management System
3  Lab 9 Task 2
4  This module provides basic functions to manage books in a library system.
5  """
6
7  def add_book(title, author, year):
8      """
9      Add a new book to the library.
10
11      Args:
12          title (str): The title of the book.
13          author (str): The author of the book.
14          year (int): The year the book was published.
15
16      Returns:
17          dict: A dictionary containing the details of the added book.
18
19      Example:
20          >>> add_book("1984", "George Orwell", 1949)
21          {'title': '1984', 'author': 'George Orwell', 'year': 1949}
22      """
23      # For demonstration, we just return a dictionary
24      return {"title": title, "author": author, "year": year}
25
26
27  def issue_book(book_id, user_id):
28      """
29      Issue a book from the library to a user.
30
31      Args:
32          book_id (int): The unique ID of the book to issue.
33          user_id (int): The unique ID of the user borrowing the book.
34
35      Returns:
36          str: A confirmation message with book_id and user_id.
37  """
```

```
PS D:\AIAC> & C:/Users/vinit/AppData/Local/Programs/Python/Python313/python.exe d:/AIAC/Lab8-t2
{'title': 'The Hobbit', 'author': 'J.R.R. Tolkien', 'year': 1937}
Book 101 has been issued to user 2001.
PS D:\AIAC>
```

EXPLANATION:

about writing clear, standardized docstrings for Python functions, classes, and modules, which describe their purpose, parameters, return values, and exceptions. You will then use auto-documentation tools like Sphinx or MkDocs to generate structured, professional API documentation from those docstrings. This task builds essential skills for creating maintainable and scalable documentation in real-world software projects. It emphasizes consistency, readability, and ease of navigation for developers who interact with your code. By automating

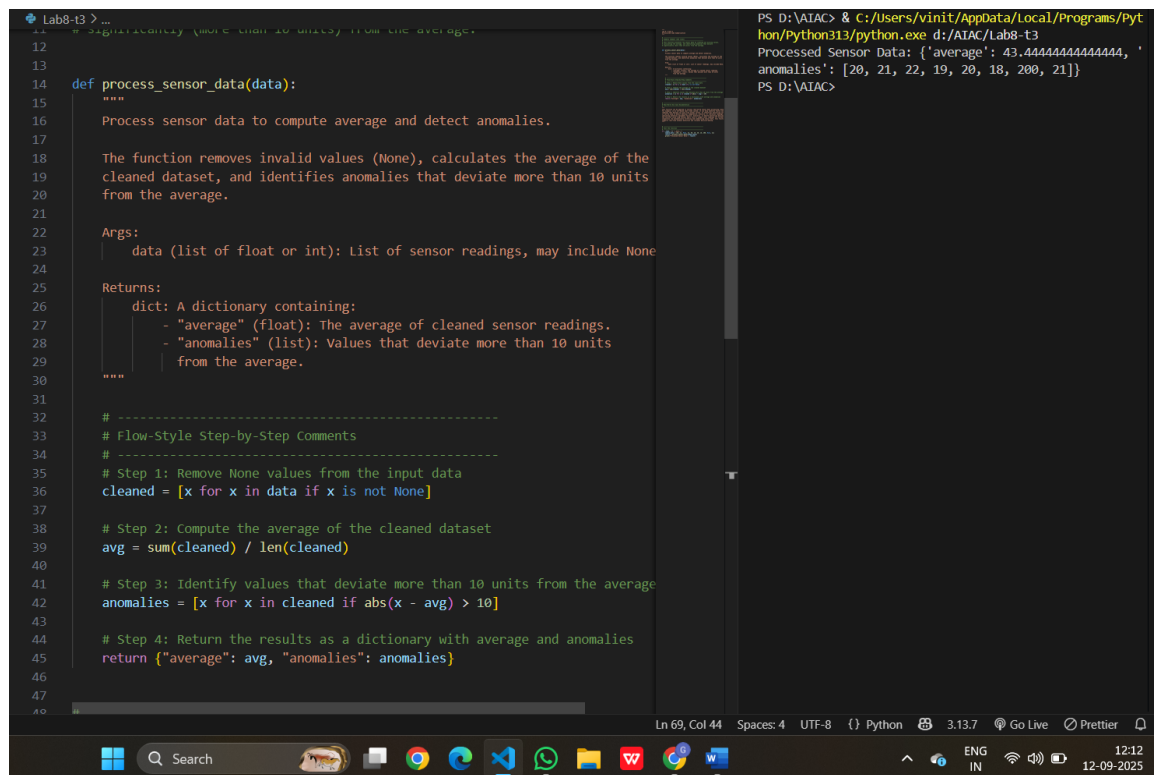
documentation from the source code, you ensure updates are easier to manage and reduce the risk of outdated or incomplete developer-facing documentation.

Task 3: AI-Assisted Code Summarization

The goal of Task 3 is to practice summarizing functions using concise comments, step-by-step flow explanations, and documenting real-world use cases.

PROMPT: Write brief comments summarizing each function's goal. Clearly explain each step, like reading data, cleaning it, or outputting results. Include real-world use cases—for example, how the function processes user data or generates reports. Keep it practical and easy for developers to follow

Code/Output:



```
11 # > significantly more than 10 units from the average.
12
13
14 def process_sensor_data(data):
15     """
16     Process sensor data to compute average and detect anomalies.
17
18     The function removes invalid values (None), calculates the average of the
19     cleaned dataset, and identifies anomalies that deviate more than 10 units
20     from the average.
21
22     Args:
23     | data (list of float or int): List of sensor readings, may include None
24
25     Returns:
26     | dict: A dictionary containing:
27     |   - "average" (float): The average of cleaned sensor readings.
28     |   - "anomalies" (list): Values that deviate more than 10 units
29     |     from the average.
30     """
31
32     # -----
33     # Flow-Style Step-by-Step Comments
34     # -----
35     # Step 1: Remove None values from the input data
36     cleaned = [x for x in data if x is not None]
37
38     # Step 2: Compute the average of the cleaned dataset
39     avg = sum(cleaned) / len(cleaned)
40
41     # Step 3: Identify values that deviate more than 10 units from the average
42     anomalies = [x for x in cleaned if abs(x - avg) > 10]
43
44     # Step 4: Return the results as a dictionary with average and anomalies
45     return {"average": avg, "anomalies": anomalies}
46
47
48
```

```
PS D:\AIAC> & C:/Users/vinit/AppData/Local/Programs/Python/Python313/python.exe d:/AIAC/Lab8-t3
Processed Sensor Data: {'average': 43.44444444444444, '
anomalies': [20, 21, 22, 19, 20, 18, 200, 21]}
PS D:\AIAC>
```

EXPLANATION: designed to improve code clarity by summarizing the purpose of functions using concise comments. You will explain the logic of each function step-by-step, helping others follow the flow of execution easily. Additionally, you'll document real-world use cases to show how the function can be applied in practical scenarios, such as handling user input, automating tasks, or processing data. This practice strengthens your ability to write readable, maintainable code and produce documentation that supports collaboration, onboarding, and debugging. The

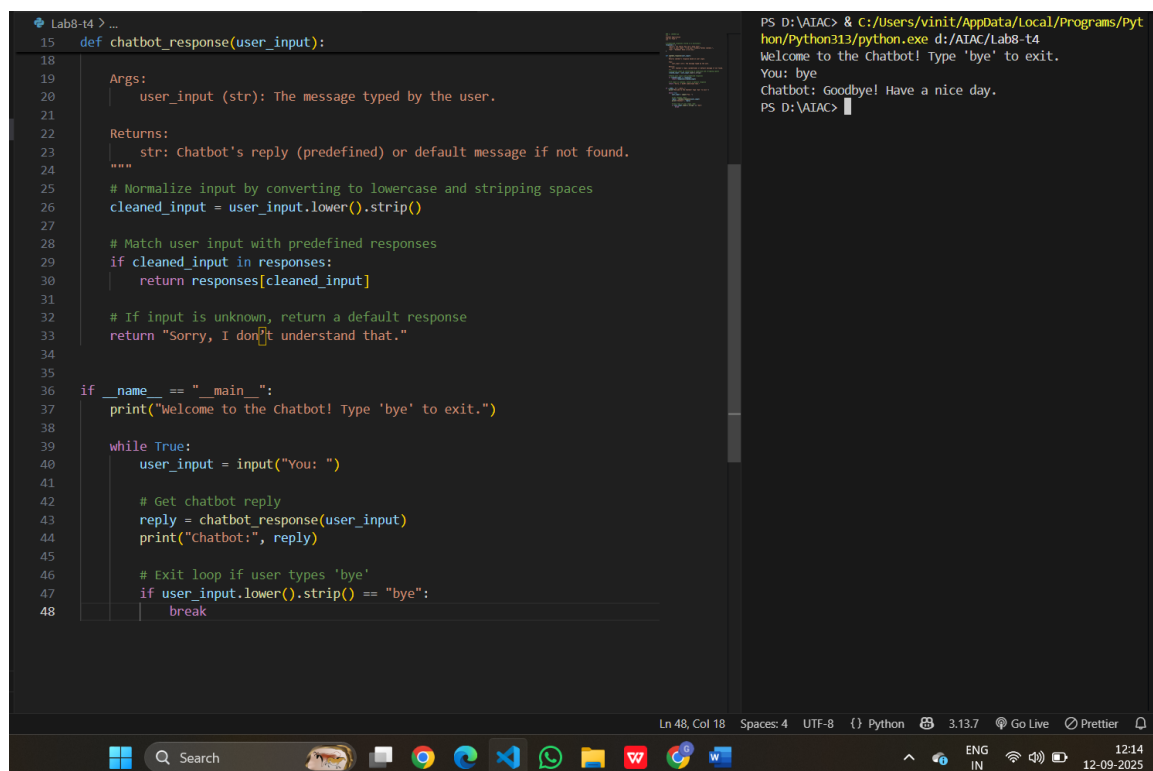
goal is to make your code self-explanatory, practical, and valuable to developers and end users alike.

Task 4: Real-Time Project Documentation

The main goal of Task 4 is to practice creating real-time project documentation with README, inline comments, AI-assisted guides, and reflection on automated documentation.

PROMPT: Produce real-time project documentation by creating a detailed README covering setup and usage, writing precise inline comments explaining complex code sections, and generating AI-assisted user guides. Evaluate the accuracy and completeness of automated documentation tools compared to manual documentation, emphasizing maintainability and developer onboarding

Code/Output:



```
Lab8-t4 > ...
15 def chatbot_response(user_input):
16
17     Args:
18         user_input (str): The message typed by the user.
19
20     Returns:
21         str: Chatbot's reply (predefined) or default message if not found.
22     """
23     # Normalize input by converting to lowercase and stripping spaces
24     cleaned_input = user_input.lower().strip()
25
26     # Match user input with predefined responses
27     if cleaned_input in responses:
28         return responses[cleaned_input]
29
30     # If input is unknown, return a default response
31     return "Sorry, I don't understand that."
32
33 if __name__ == "__main__":
34     print("Welcome to the Chatbot! Type 'bye' to exit.")
35
36     while True:
37         user_input = input("You: ")
38
39         # Get chatbot reply
40         reply = chatbot_response(user_input)
41         print("Chatbot:", reply)
42
43         # Exit loop if user types 'bye'
44         if user_input.lower().strip() == "bye":
45             break
46
47 PS D:\AIAC> & C:/Users/vinit/AppData/Local/Programs/Python/Python313/python.exe d:/AIAC/Lab8-t4
Welcome to the Chatbot! Type 'bye' to exit.
You: bye
Chatbot: Goodbye! Have a nice day.
PS D:\AIAC>
```

EXPLANATION:

involves creating comprehensive, real-time project documentation. This includes writing a clear README that covers project overview, installation steps, and usage instructions. You'll also add inline comments to explain important code sections for better understanding. Using AI-assisted

tools, you'll generate user guides to complement your manual documentation. Finally, you'll reflect on the quality and usefulness of automated documentation compared to your own efforts. This task emphasizes producing accessible, well-structured documentation that helps developers and users navigate the project, supports collaboration, and ensures maintainability over time.

EXPLANATION:

In this lab, I learned the importance of inline comments, docstrings, and documentation tools. Automated documentation keeps code easy to maintain, while manual notes provide context. Combining both approaches helps in building reliable and maintainable projects.