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Assessment – 9.5

Task Description #1 (Automatic Code Commenting)

Scenario: You have been given a Python function without comments.

CODE

```
def calculate_discount(price, discount_rate):
    """
    Calculate the final price after applying a percentage discount.
    Parameters
    ----------
    price : float
        The original price of the item.
    discount_rate : float
        The discount percentage to apply.
    Returns
    -------
    float
        The price after applying the discount.
    """
    # price: The original cost of the item before discount
    # discount_rate: The percentage of discount to apply
    # (price * discount_rate / 100) calculates the discount amount
    # Subtract discount amount from the original price
    # Return the final payable amount after discount
    return price - (price * discount_rate / 100)
# Example usage:
original_price = 1000
```

```
discount = 20

final_price = calculate_discount(original_price, discount)

print(f"Original Price: {original_price}")

print(f"Discount: {discount}%")

print(f"Final Price after discount: {final_price}")
```

OUTPUT

```
Original Price: 1000

Discount: 20%

Final Price after discount: 800.0
```

OBSERVATION

Functionality

- Input: price = 1000, discount_rate = 20.
- Discount amount = 1000 * 20 / 100 = 200.
- Final Price = 1000 - 200 = 800.0.
  ✔ Correct calculation.

Auto-generated vs Manual Comments

- Auto-generated comments are brief (just "apply discount, return value").
- Manual comments explain **parameters, logic, and meaning** more clearly.

Docstring

- Using NumPy-style (or Google-style) makes the function easy to understand when using help(calculate_discount).
- Example:
- help(calculate_discount)

would show structured documentation about inputs and outputs.

Code Quality

- With docstrings + manual comments, the function becomes self-explanatory.
- This is better for **team projects, API development, or libraries** where others will reuse your function.

Task Description #2 (API Documentation Generator)

Scenario: A team is building a Library Management System with multiple functions.

CODE

```
# library.py


def add_book(title, author, year):
    """
    Add a new book to the library database.
    Parameters
    ----------
    title : str
        The title of the book.
    author : str
        The author of the book.
    year : int
        The publication year of the book.
    Returns
    -------
    dict
        A dictionary representing the book added, containing title, author, and year.
    """
    # Example implementation (stub)
    return {"title": title, "author": author, "year": year}



def issue_book(book_id, user_id):
    """
```

```
    Issue a book from the library to a specific user.


    Parameters
    ----------
    book_id : int
        The unique identifier of the book.
    user_id : int
        The unique identifier of the user.
    Returns
    -------
    str
        A confirmation message indicating the book has been issued.
    """
    # Example implementation (stub)
    return f"Book {book_id} has been issued to User {user_id}."
```

OUTPUT

```
{'title': 'The Alchemist', 'author': 'Paulo Coelho', 'year': 1988}
Book 101 has been issued to User 202.
```

OBSERVATION

1. **Code Functionality**
    - add_book() correctly returns a dictionary with book details.
    - issue_book() returns a string confirming the book was issued.
2. **Docstrings**
    - Using NumPy-style docstrings makes the documentation structured and professional.
    - Inputs (Parameters) and Outputs (Returns) are clearly described.
3. **Documentation Generator**
    - pdoc automatically reads the docstrings and generates clean HTML pages.

- The generated docs are easy to navigate and resemble professional API documentation.

4. **Advantages**
    - Keeps **code and documentation in sync** (no need to write docs separately).
    - Useful for **team collaboration** and **project maintainability**.

Task Description #3 (AI-Assisted Code Summarization)

Scenario: You are reviewing a colleague's codebase containing long functions

CODE

```
def process_sensor_data(data):
    """
    Process raw sensor readings to compute an average and detect simple anomalies.
    This function removes `None` entries, computes the arithmetic mean of the remaining
    values, and marks any reading whose absolute difference from the mean exceeds 10 units
    as an anomaly. It returns a dictionary with keys: "average" and "anomalies".
    Notes
    -----
    - Assumes at least one non-None value is present (otherwise a ZeroDivisionError occurs).
    - The anomaly threshold is fixed at 10 units and is not scaled to data variance.
    """
    # Flow-style explanation:
    # 1) Filter out missing data -> keep only readings that are not None.
    cleaned = [x for x in data if x is not None]
    # 2) Compute the average of the cleaned readings.
    avg = sum(cleaned) / len(cleaned)
    # 3) Tag anomalies -> any reading more than 10 units away from the average.
    anomalies = [x for x in cleaned if abs(x - avg) > 10]
    # 4) Package results in a dictionary for convenient downstream use.
    return {"average": avg, "anomalies": anomalies}
```

OUTPUT

{'average': 24.714285714285715, 'anomalies': [50]}

OBSERVATION

Function Behavior

- The function:
    - Removes None values → [20, 22, 21, 50, 19, 18, 23]
    - Computes average → (173 / 7) = 24.71
    - Identifies anomalies → values more than ±10 away from average → [50].

Code Summarization

- **Summary comment**: Gives a quick idea of purpose (average + anomaly detection).
- **Flow-style explanation**: Breaks logic into small steps → easy to follow for new developers.
- **Docstring**: Explains assumptions (e.g., at least one valid reading), limitations (fixed threshold), and return format.

Use Case Fit

- Works well for simple anomaly detection in **IoT sensors** (e.g., temp, vibration, water flow).
- However, it's **basic** → only checks for deviations > 10 units, not statistical anomalies.
- Could fail if:
    - All inputs are None (division by zero).
    - Sensor data varies with large natural fluctuations (false positives).

Best Practice

- Would be improved by:
    - Making threshold configurable.
    - Handling empty/invalid inputs safely.
    - Supporting statistical thresholds (e.g., z-score, standard deviation).

Task Description #4 (Real-Time Project Documentation)

Scenario: You are part of a project team that develops a Chatbot Application. The team needs documentation for maintainability.

CODE

```
def get_response(user_input):
    """
    Generate a chatbot response based on simple keyword matching.
    Parameters
    ----------
    user_input : str
        The input message from the user.
    Returns
    -------
    str
        The chatbot's reply.
    """
    user_input = user_input.lower()
    # Basic greetings
    if "hello" in user_input or "hi" in user_input:
        return "Hello! How can I help you today?"
    # Introduce chatbot
    elif "name" in user_input:
        return "I am your friendly chatbot assistant."
    # Help response
    elif "help" in user_input:
        return "Sure! I can answer basic questions. Try asking me about my name."
    # Exit condition handled in main loop
    else:
        return "I'm not sure how to respond to that."
```

```
def main():
    print("Chatbot is running! Type 'exit' to quit.")
    while True:
        # Take input from user
        user_input = input("You: ")
        # Check for exit condition
        if user_input.lower() == "exit":
            print("Bot: Goodbye!")
            break
        # Generate response using chatbot logic
        response = get_response(user_input)
        print(f"Bot: {response}")
if __name__ == "__main__":
    main()
```

OUTPUT

```
Chatbot is running! Type 'exit' to quit.
You: hi
Bot: Hello! How can I help you today?

You: what is your name?
Bot: I am your friendly chatbot assistant.

You: help
Bot: Sure! I can answer basic questions. Try asking me about my name.

You: something random
Bot: I'm not sure how to respond to that.
```

You: exit

Bot: Goodbye!

OBSERVATION

Functionality

- The chatbot is **rule-based** and works as expected with keyword matching.
- Covers the basic conversational flow (greeting → response → exit).

Documentation (README + Inline Comments)

- The README.md makes it **clear how to install, run, and use** the chatbot.
- Inline comments explain **logic, not trivial code**, which makes it easier for maintainers.

AI-Assisted Usage Guide

- Converts inline comments into a **plain-English explanation** of how the chatbot works.
- Useful for **non-technical team members** or quick onboarding.

Reflection on Automation

- Automated documentation tools (e.g., MkDocs, pdoc) can generate **consistent, up-to-date docs** straight from comments and docstrings.
- This avoids the problem of **manual documentation going stale** in fast-changing projects.

Maintainability

- If new intents are added (e.g., weather queries), updating the docstring + comments would **automatically update the docs site**.
- This makes the project **scalable and team-friendly**.