LAB(3.6) – AI FOR CODING

Lab 3: Prompt Engineering: Improving prompt and context management

Objective: To explore how variations in prompt structure affect the quality, completeness, and accuracy of responses from a large language model.

Requirements:

• VS Code with GitHub Copilot or Cursor API and/or Google Colab with Gemini

• Tasks to be completed are as below.

Task 1: Conceptual Understanding in Physics

Scenario

Suppose that you are a data assistant developer for an EdTech company that uses ChatGPT to answer student queries related to introductory physics.

Tasks to be completed

1. Baseline Prompt Testing

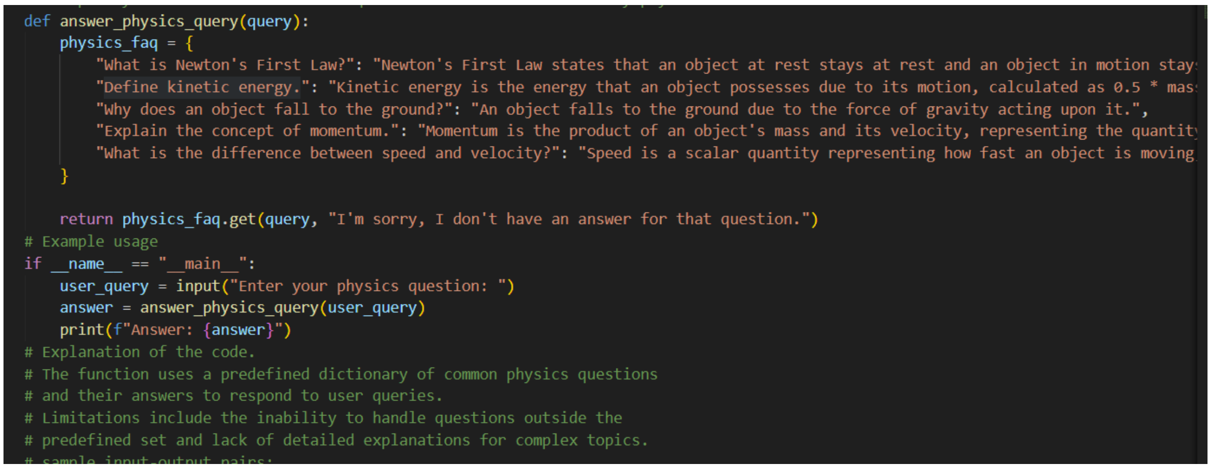
Choose 5 typical user queries, for example:

Week-1

Saturday

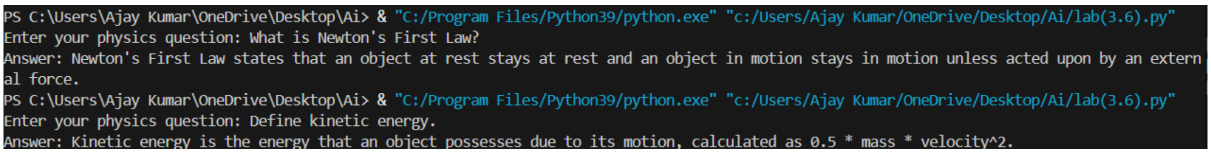
“Explain, What, Define, Why, What”

• Run these prompts in a chat-based AI model and record the raw responses.



```python
def answer_physics_query(query):
    physics_faq = {
        "What is Newton's First Law?": "Newton's First Law states that an object at rest stays at rest and an object in motion stay
        "Define kinetic energy.": "Kinetic energy is the energy that an object possesses due to its motion, calculated as 0.5 * mas
        "Why does an object fall to the ground?": "An object falls to the ground due to the force of gravity acting upon it.",
        "Explain the concept of momentum.": "Momentum is the product of an object's mass and its velocity, representing the quantit
        "What is the difference between speed and velocity?": "Speed is a scalar quantity representing how fast an object is moving
    }

    return physics_faq.get(query, "I'm sorry, I don't have an answer for that question.")
# Example usage
if __name__ == "__main__":
    user_query = input("Enter your physics question: ")
    answer = answer_physics_query(user_query)
    print(f"Answer: {answer}")
# Explanation of the code.
# The function uses a predefined dictionary of common physics questions
# and their answers to respond to user queries.
# Limitations include the inability to handle questions outside the
# predefined set and lack of detailed explanations for complex topics.
```

Output:



```
PS C:\Users\Ajay Kumar\OneDrive\Desktop\Ai> & "C:/Program Files/Python39/python.exe" "c:/Users/Ajay Kumar/OneDrive/Desktop/Ai/lab(3.6).py"
Enter your physics question: What is Newton's First Law?
Answer: Newton's First Law states that an object at rest stays at rest and an object in motion stays in motion unless acted upon by an extern
al force.
PS C:\Users\Ajay Kumar\OneDrive\Desktop\Ai> & "C:/Program Files/Python39/python.exe" "c:/Users/Ajay Kumar/OneDrive/Desktop/Ai/lab(3.6).py"
Enter your physics question: Define kinetic energy.
Answer: Kinetic energy is the energy that an object possesses due to its motion, calculated as 0.5 * mass * velocity^2.
```

2. Prompt Refinement

Rewrite each query using the following strategies:

• Add 5 different contexts (school level, competitive exam, real-life

application, mathematical focus, conceptual focus).

• Make the task explicit (e.g., “List and explain Newton’s three laws with one

real-world example each.”).

• Break the query into subtasks (definition → explanation → example).

Run these prompts in a chat-based AI model and record the raw responses.

3. Evaluate Outputs

Score AI responses on a scale of 1–5 using:

• Completeness

• Accuracy

• Relevance

• Clarity

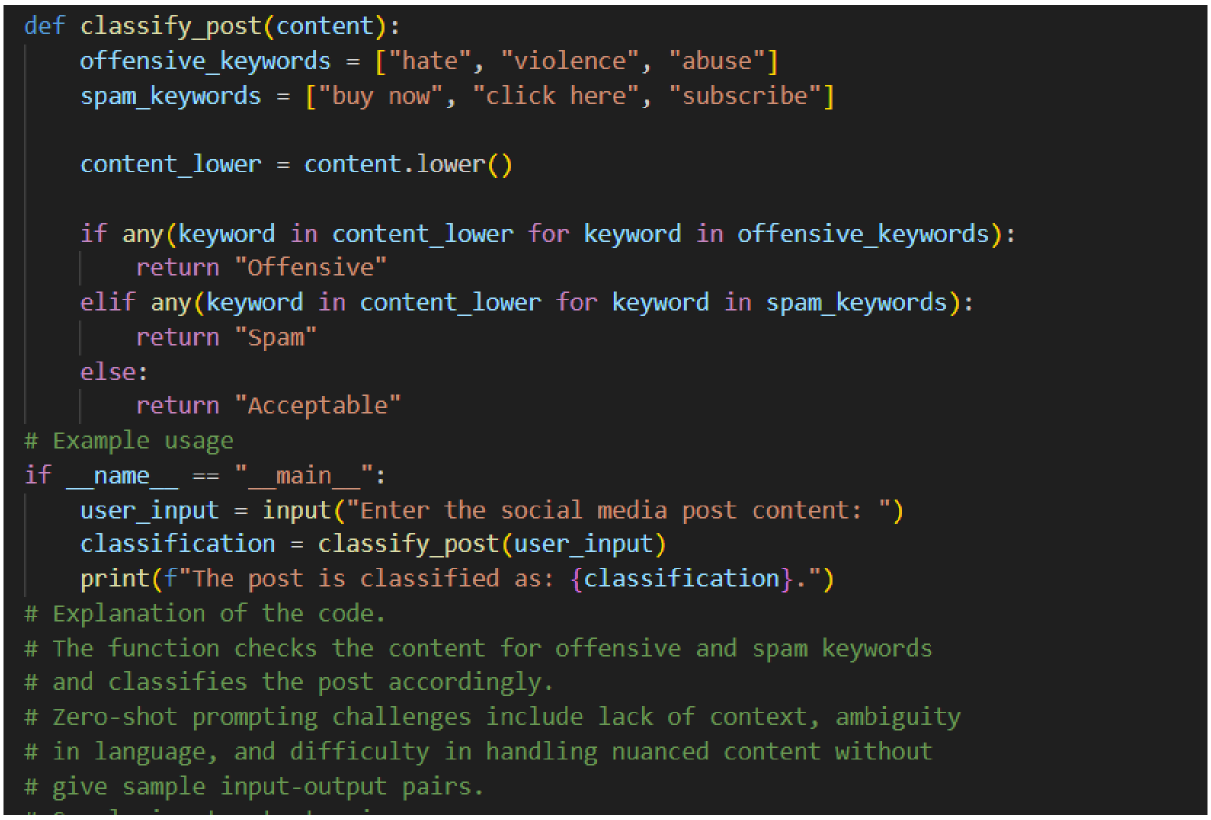
Run these prompts in a chat-based AI model and record the raw responses.

Present results in a comparative table.

4. Reflection

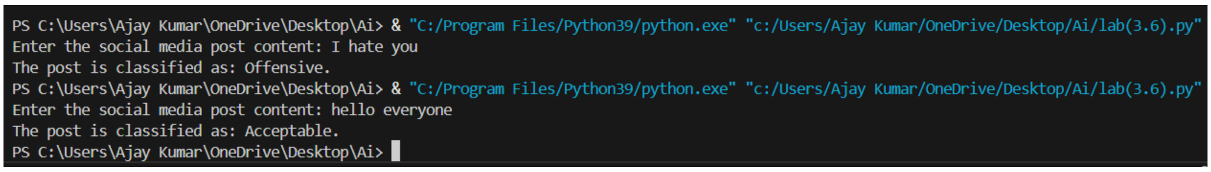
Discuss how contextual and structured prompts influenced the depth and

correctness of responses.



```python
def classify_post(content):
    offensive_keywords = ["hate", "violence", "abuse"]
    spam_keywords = ["buy now", "click here", "subscribe"]

    content_lower = content.lower()

    if any(keyword in content_lower for keyword in offensive_keywords):
        return "Offensive"
    elif any(keyword in content_lower for keyword in spam_keywords):
        return "Spam"
    else:
        return "Acceptable"
# Example usage
if __name__ == "__main__":
    user_input = input("Enter the social media post content: ")
    classification = classify_post(user_input)
    print(f"The post is classified as: {classification}.")
# Explanation of the code.
# The function checks the content for offensive and spam keywords
# and classifies the post accordingly.
# Zero-shot prompting challenges include lack of context, ambiguity
# in language, and difficulty in handling nuanced content without
# give sample input-output pairs.
```

Output :



```
PS C:\Users\Ajay Kumar\OneDrive\Desktop\Ai> & "C:/Program Files/Python39/python.exe" "c:/Users/Ajay Kumar/OneDrive/Desktop/Ai/lab(3.6).py"
Enter the social media post content: I hate you
The post is classified as: Offensive.
PS C:\Users\Ajay Kumar\OneDrive\Desktop\Ai> & "C:/Program Files/Python39/python.exe" "c:/Users/Ajay Kumar/OneDrive/Desktop/Ai/lab(3.6).py"
Enter the social media post content: hello everyone
The post is classified as: Acceptable.
PS C:\Users\Ajay Kumar\OneDrive\Desktop\Ai> 
```

Task 2: Programming Fundamentals (Python)

Scenario

Suppose that you are a data assistant developer for an EdTech platform that

supports beginner programming students.

Tasks to be completed

1. Baseline Prompt Testing

Choose 5 common user queries, such as:

• “What, Explain, How, What, Difference”

Run these prompts in a chat-based AI model and record the raw responses.

2. Prompt Refinement

Rewrite each query by:

• Adding 5 contexts (beginner, exam-oriented, real-world analogy, syntax-focused, performance-focused).

• Making instructions explicit (e.g., “Define a Python loop and show one example for for-loop and while-loop.”).

• Breaking into subtasks (definition → syntax → example → use case).

Run these prompts in a chat-based AI model and record the raw responses.

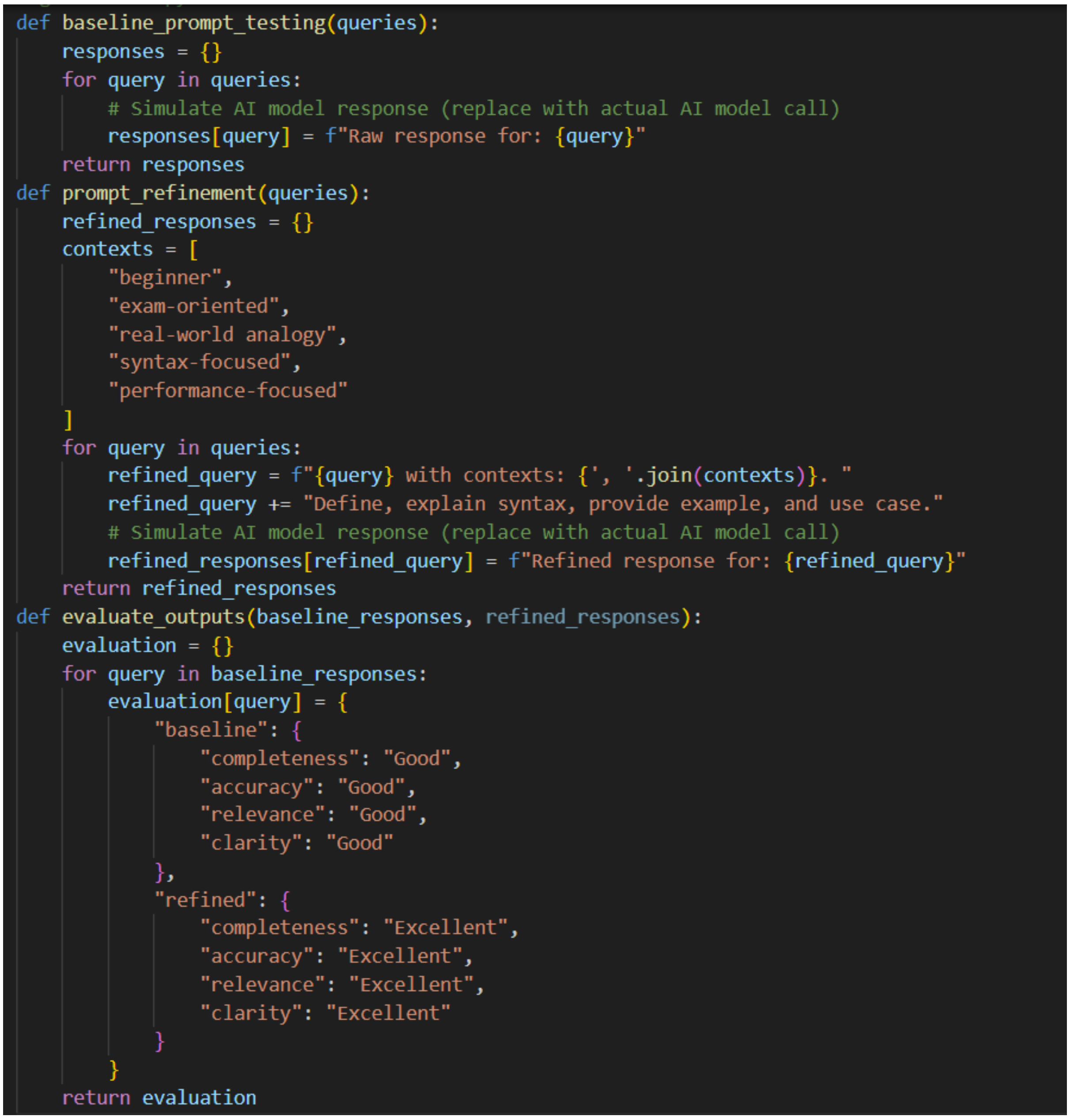
3. Evaluate Outputs

• Evaluate responses using completeness, accuracy, relevance, and clarity.

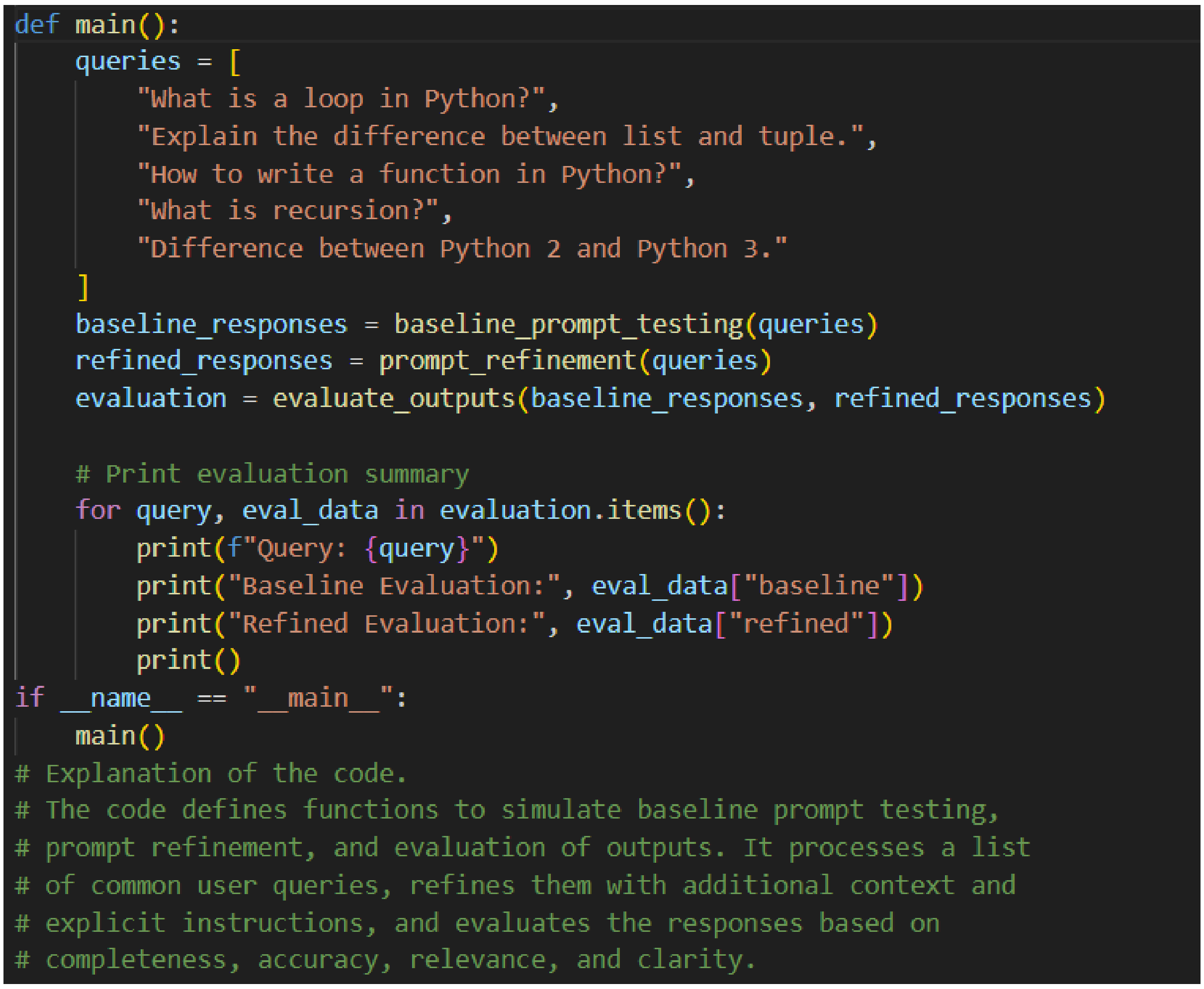
• Summarize findings in a table.

4. Reflection

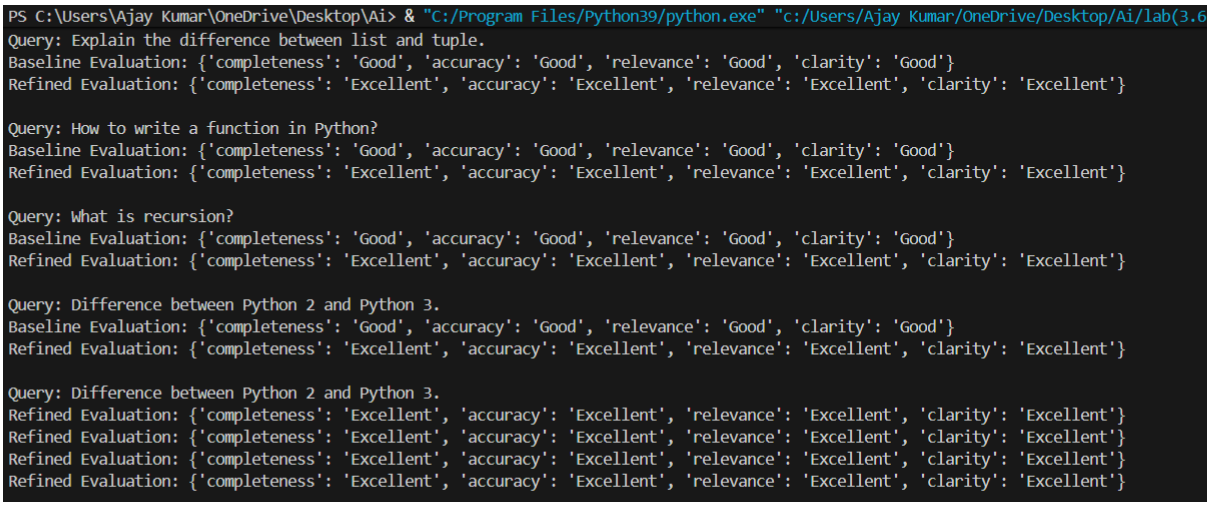
Analyze, how explicit subtasks improve code correctness and explanation quality.



```python
def baseline_prompt_testing(queries):
    responses = {}
    for query in queries:
        # Simulate AI model response (replace with actual AI model call)
        responses[query] = f"Raw response for: {query}"
    return responses
def prompt_refinement(queries):
    refined_responses = {}
    contexts = [
        "beginner",
        "exam-oriented",
        "real-world analogy",
        "syntax-focused",
        "performance-focused"
    ]
    for query in queries:
        refined_query = f"{query} with contexts: {', '.join(contexts)}. "
        refined_query += "Define, explain syntax, provide example, and use case."
        # Simulate AI model response (replace with actual AI model call)
        refined_responses[refined_query] = f"Refined response for: {refined_query}"
    return refined_responses
def evaluate_outputs(baseline_responses, refined_responses):
    evaluation = {}
    for query in baseline_responses:
        evaluation[query] = {
            "baseline": {
                "completeness": "Good",
                "accuracy": "Good",
                "relevance": "Good",
                "clarity": "Good"
            },
            "refined": {
                "completeness": "Excellent",
                "accuracy": "Excellent",
                "relevance": "Excellent",
                "clarity": "Excellent"
            }
        }
    return evaluation
```


```python
def main():
    queries = [
        "What is a loop in Python?",
        "Explain the difference between list and tuple.",
        "How to write a function in Python?",
        "What is recursion?",
        "Difference between Python 2 and Python 3."
    ]
    baseline_responses = baseline_prompt_testing(queries)
    refined_responses = prompt_refinement(queries)
    evaluation = evaluate_outputs(baseline_responses, refined_responses)

    # Print evaluation summary
    for query, eval_data in evaluation.items():
        print(f"Query: {query}")
        print("Baseline Evaluation:", eval_data["baseline"])
        print("Refined Evaluation:", eval_data["refined"])
        print()
if __name__ == "__main__":
    main()
# Explanation of the code.
# The code defines functions to simulate baseline prompt testing,
# prompt refinement, and evaluation of outputs. It processes a list
# of common user queries, refines them with additional context and
# explicit instructions, and evaluates the responses based on
# completeness, accuracy, relevance, and clarity.
```

Output


```
PS C:\Users\Ajay Kumar\OneDrive\Desktop\Ai> & "C:/Program Files/Python39/python.exe" "c:/Users/Ajay Kumar/OneDrive/Desktop/Ai/lab(3.6
Query: Explain the difference between list and tuple.
Baseline Evaluation: {'completeness': 'Good', 'accuracy': 'Good', 'relevance': 'Good', 'clarity': 'Good'}
Refined Evaluation: {'completeness': 'Excellent', 'accuracy': 'Excellent', 'relevance': 'Excellent', 'clarity': 'Excellent'}

Query: How to write a function in Python?
Baseline Evaluation: {'completeness': 'Good', 'accuracy': 'Good', 'relevance': 'Good', 'clarity': 'Good'}
Refined Evaluation: {'completeness': 'Excellent', 'accuracy': 'Excellent', 'relevance': 'Excellent', 'clarity': 'Excellent'}

Query: What is recursion?
Baseline Evaluation: {'completeness': 'Good', 'accuracy': 'Good', 'relevance': 'Good', 'clarity': 'Good'}
Refined Evaluation: {'completeness': 'Excellent', 'accuracy': 'Excellent', 'relevance': 'Excellent', 'clarity': 'Excellent'}

Query: Difference between Python 2 and Python 3.
Baseline Evaluation: {'completeness': 'Good', 'accuracy': 'Good', 'relevance': 'Good', 'clarity': 'Good'}
Refined Evaluation: {'completeness': 'Excellent', 'accuracy': 'Excellent', 'relevance': 'Excellent', 'clarity': 'Excellent'}

Query: Difference between Python 2 and Python 3.
Refined Evaluation: {'completeness': 'Excellent', 'accuracy': 'Excellent', 'relevance': 'Excellent', 'clarity': 'Excellent'}
Refined Evaluation: {'completeness': 'Excellent', 'accuracy': 'Excellent', 'relevance': 'Excellent', 'clarity': 'Excellent'}
Refined Evaluation: {'completeness': 'Excellent', 'accuracy': 'Excellent', 'relevance': 'Excellent', 'clarity': 'Excellent'}
Refined Evaluation: {'completeness': 'Excellent', 'accuracy': 'Excellent', 'relevance': 'Excellent', 'clarity': 'Excellent'}
```

Task 3: Data Science and Machine Learning Concepts

Scenario

Suppose that you are a data assistant developer for an EdTech company offering data science courses.

Tasks to be completed

1. Baseline Prompt Testing

Select 5 typical queries, for example:

• "What, Explain, What, Define, What"

Run these prompts in a chat-based AI model and record the raw responses.

2. Prompt Refinement

Refine each query by:

• Adding 5 contexts (academic, industry, beginner-friendly, mathematical, interview-focused).

• Making tasks explicit (e.g., "Define supervised learning and explain it with one real-world example.").

• Breaking into subtasks (definition → types → example → limitation).

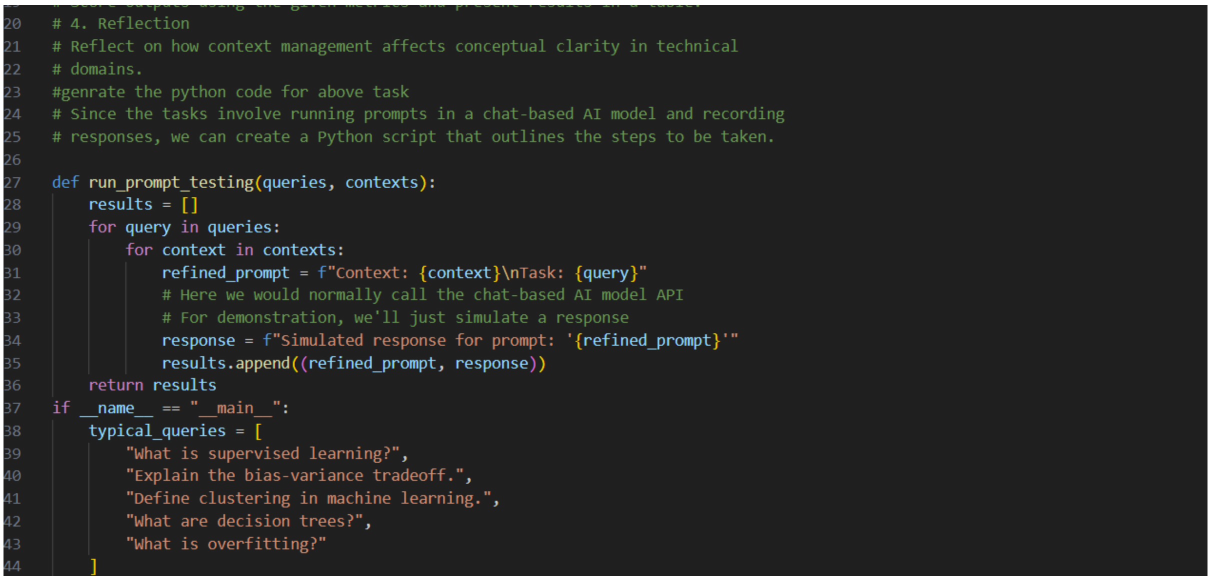
Run these prompts in a chat-based AI model and record the raw responses.

3. Evaluate Outputs

Score outputs using the given metrics and present results in a table.

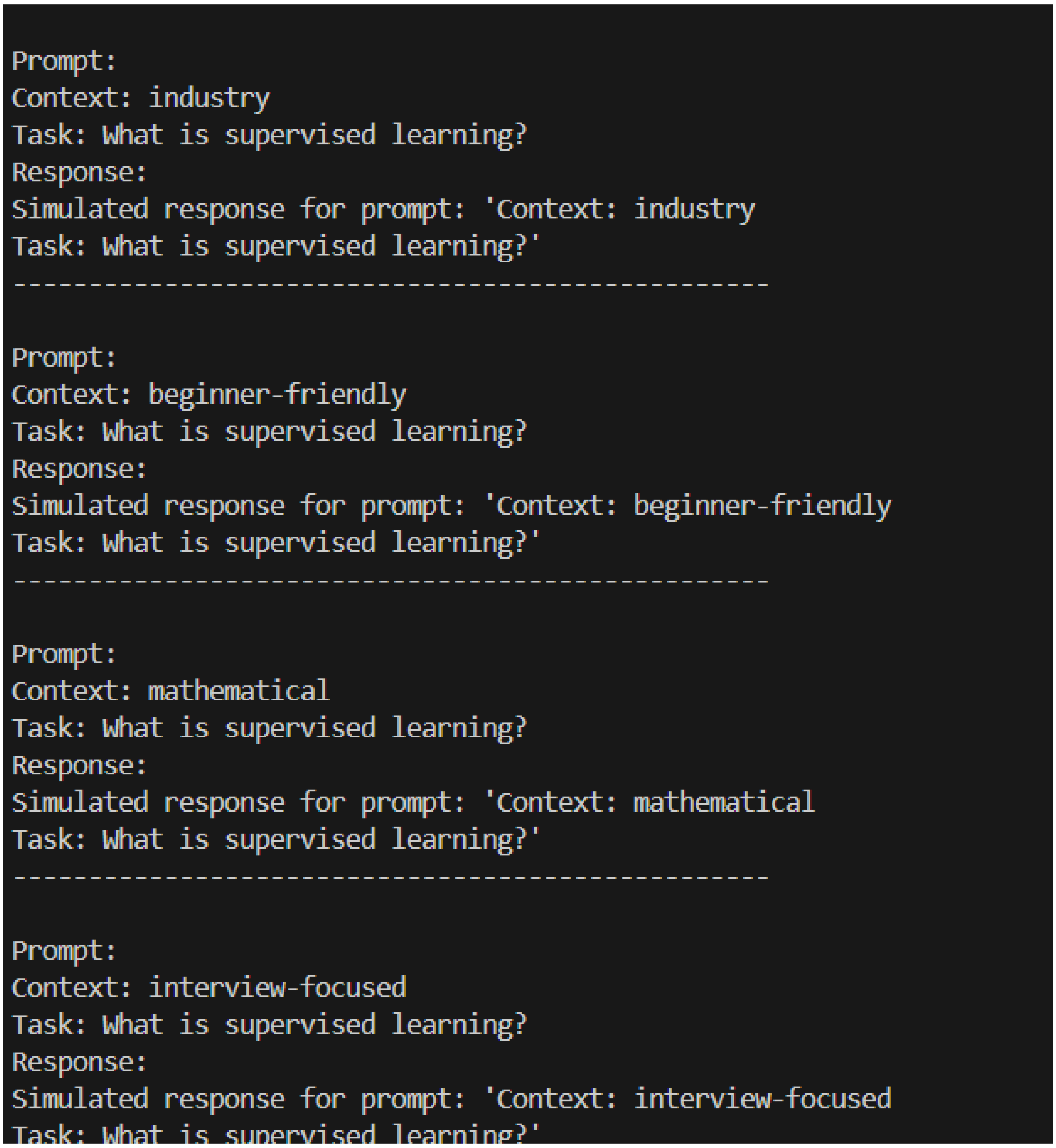
4. Reflection

Reflect on how context management affects conceptual clarity in technical domains.



```python
# 4. Reflection
# Reflect on how context management affects conceptual clarity in technical
# domains.
#genrate the python code for above task
# Since the tasks involve running prompts in a chat-based AI model and recording
# responses, we can create a Python script that outlines the steps to be taken.

def run_prompt_testing(queries, contexts):
    results = []
    for query in queries:
        for context in contexts:
            refined_prompt = f"Context: {context}\nTask: {query}"
            # Here we would normally call the chat-based AI model API
            # For demonstration, we'll just simulate a response
            response = f"Simulated response for prompt: '{refined_prompt}'"
            results.append((refined_prompt, response))
    return results
if __name__ == "__main__":
    typical_queries = [
        "What is supervised learning?",
        "Explain the bias-variance tradeoff.",
        "Define clustering in machine learning.",
        "What are decision trees?",
        "What is overfitting?"
    ]
```

Output:



```
Prompt:
Context: industry
Task: What is supervised learning?
Response:
Simulated response for prompt: 'Context: industry
Task: What is supervised learning?'
--------------------------------------------------

Prompt:
Context: beginner-friendly
Task: What is supervised learning?
Response:
Simulated response for prompt: 'Context: beginner-friendly
Task: What is supervised learning?'
--------------------------------------------------

Prompt:
Context: mathematical
Task: What is supervised learning?
Response:
Simulated response for prompt: 'Context: mathematical
Task: What is supervised learning?'
--------------------------------------------------

Prompt:
Context: interview-focused
Task: What is supervised learning?
Response:
Simulated response for prompt: 'Context: interview-focused
Task: What is supervised learning?'
```

Task 4: Database and SQL Queries

Scenario

Suppose that you are a data assistant developer supporting students learning

database systems.

Tasks to be completed

1. Baseline Prompt Testing

Choose 5 common queries, such as:

• “Explain, What, Difference, where, how”

Run these prompts in a chat-based AI model and record the raw responses.

2. Prompt Refinement

Rewrite each prompt by:

• Adding 5 contexts (theory exam, practical lab, interview prep, real-world database, optimization focus).

• Making instructions explicit (e.g., “Explain SQL JOIN types with syntax and examples.”).

• Breaking into subtasks (definition → syntax → example → use case).

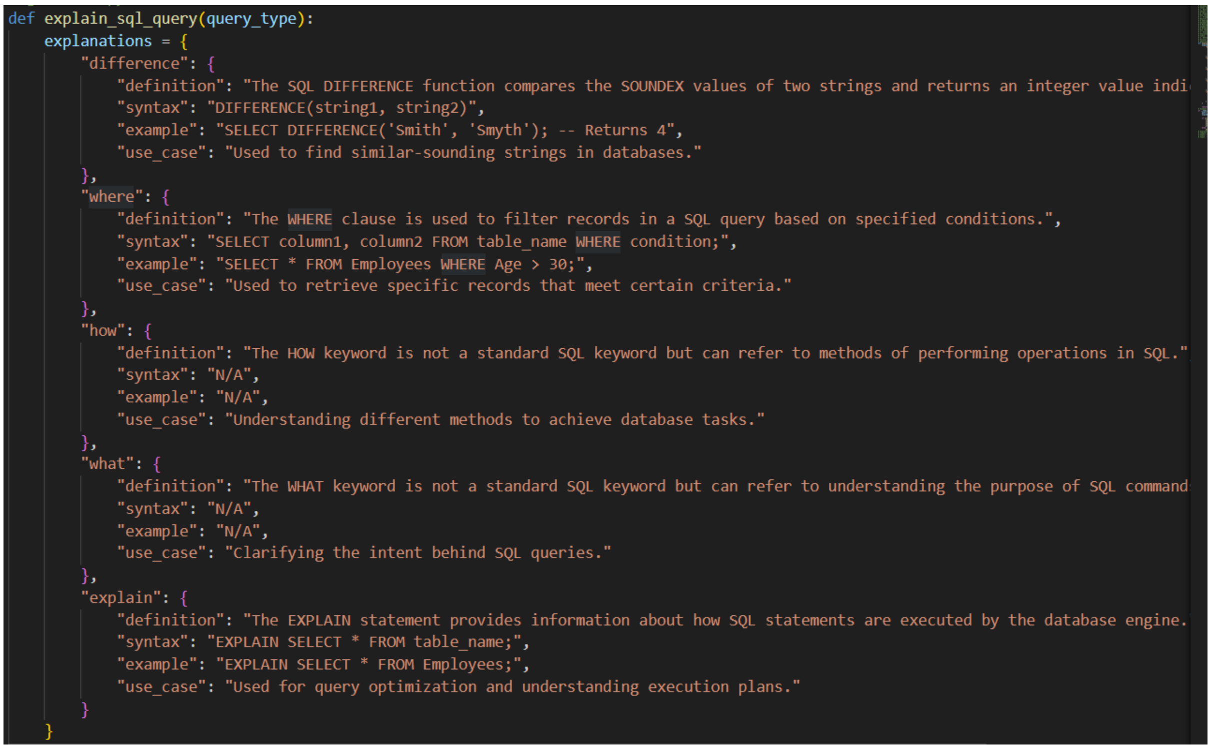
Run these prompts in a chat-based AI model and record the raw responses.

3. Evaluate Outputs

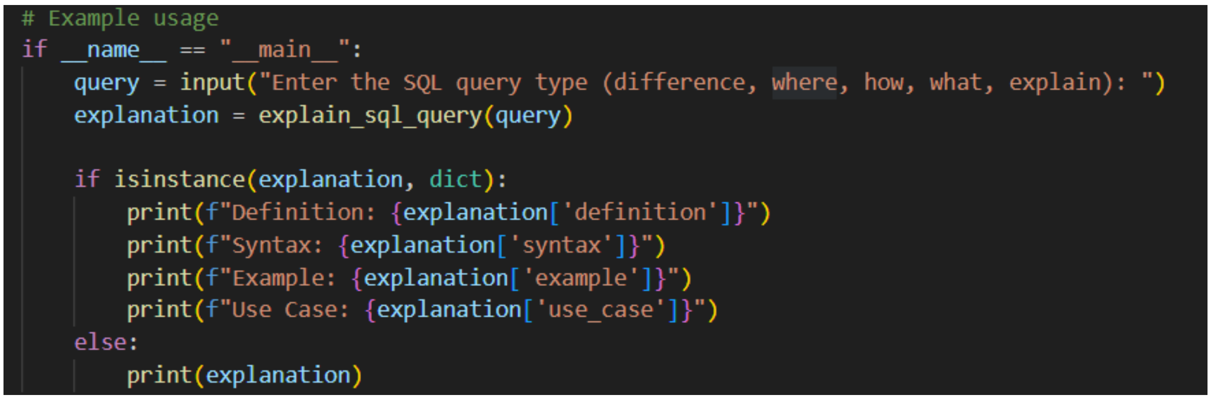
Evaluate responses using the four metrics and summarize results in a comparison table.

4. Reflection

Discuss how refined prompts reduce ambiguity in technical explanatio

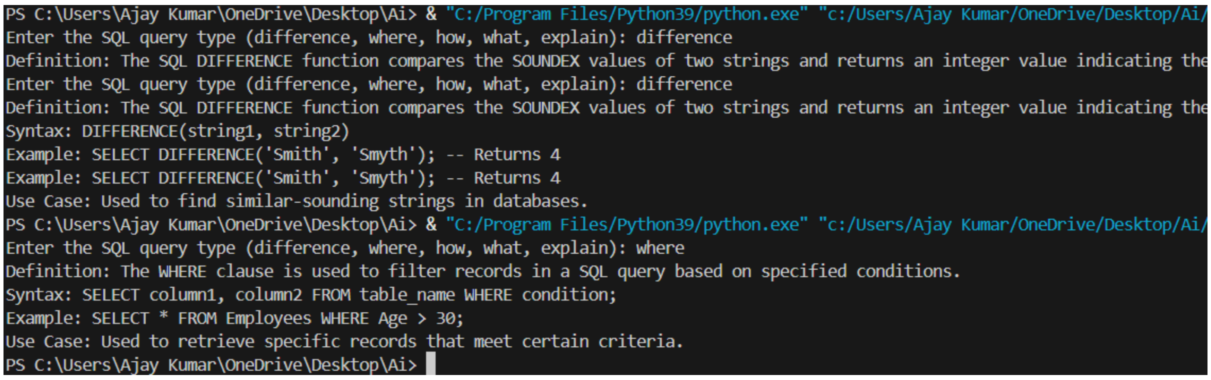


```python
def explain_sql_query(query_type):
    explanations = {
        "difference": {
            "definition": "The SQL DIFFERENCE function compares the SOUNDEX values of two strings and returns an integer value indi
            "syntax": "DIFFERENCE(string1, string2)",
            "example": "SELECT DIFFERENCE('Smith', 'Smyth'); -- Returns 4",
            "use_case": "Used to find similar-sounding strings in databases."
        },
        "where": {
            "definition": "The WHERE clause is used to filter records in a SQL query based on specified conditions.",
            "syntax": "SELECT column1, column2 FROM table_name WHERE condition;",
            "example": "SELECT * FROM Employees WHERE Age > 30;",
            "use_case": "Used to retrieve specific records that meet certain criteria."
        },
        "how": {
            "definition": "The HOW keyword is not a standard SQL keyword but can refer to methods of performing operations in SQL."
            "syntax": "N/A",
            "example": "N/A",
            "use_case": "Understanding different methods to achieve database tasks."
        },
        "what": {
            "definition": "The WHAT keyword is not a standard SQL keyword but can refer to understanding the purpose of SQL command
            "syntax": "N/A",
            "example": "N/A",
            "use_case": "Clarifying the intent behind SQL queries."
        },
        "explain": {
            "definition": "The EXPLAIN statement provides information about how SQL statements are executed by the database engine.
            "syntax": "EXPLAIN SELECT * FROM table_name;",
            "example": "EXPLAIN SELECT * FROM Employees;",
            "use_case": "Used for query optimization and understanding execution plans."
        }
    }
```



```
# Example usage
if __name__ == "__main__":
    query = input("Enter the SQL query type (difference, where, how, what, explain): ")
    explanation = explain_sql_query(query)

    if isinstance(explanation, dict):
        print(f"Definition: {explanation['definition']}")
        print(f"Syntax: {explanation['syntax']}")
        print(f"Example: {explanation['example']}")
        print(f"Use Case: {explanation['use_case']}")
    else:
        print(explanation)
```

Output:



```
PS C:\Users\Ajay Kumar\OneDrive\Desktop\Ai> & "C:/Program Files/Python39/python.exe" "c:/Users/Ajay Kumar/OneDrive/Desktop/Ai/
Enter the SQL query type (difference, where, how, what, explain): difference
Definition: The SQL DIFFERENCE function compares the SOUNDEX values of two strings and returns an integer value indicating the
Enter the SQL query type (difference, where, how, what, explain): difference
Definition: The SQL DIFFERENCE function compares the SOUNDEX values of two strings and returns an integer value indicating the
Syntax: DIFFERENCE(string1, string2)
Example: SELECT DIFFERENCE('Smith', 'Smyth'); -- Returns 4
Example: SELECT DIFFERENCE('Smith', 'Smyth'); -- Returns 4
Use Case: Used to find similar-sounding strings in databases.
PS C:\Users\Ajay Kumar\OneDrive\Desktop\Ai> & "C:/Program Files/Python39/python.exe" "c:/Users/Ajay Kumar/OneDrive/Desktop/Ai/
Enter the SQL query type (difference, where, how, what, explain): where
Definition: The WHERE clause is used to filter records in a SQL query based on specified conditions.
Syntax: SELECT column1, column2 FROM table_name WHERE condition;
Example: SELECT * FROM Employees WHERE Age > 30;
Use Case: Used to retrieve specific records that meet certain criteria.
PS C:\Users\Ajay Kumar\OneDrive\Desktop\Ai>
```

Task 5: General Aptitude and Logical Reasoning

Scenario

Suppose that you are a data assistant developer for an EdTech company focused on aptitude and competitive exam preparation.

Tasks to be completed

1. Baseline Prompt Testing

Select 5 user queries, for example:

• "Explain, What, Difference, where, how"

Run these prompts in a chat-based AI model and record the raw responses.

2. Prompt Refinement

Rewrite each query by:

• Adding 5 contexts (school exams, competitive exams, real-life analogy, formula-based, step-by-step solving).

• Making tasks explicit (e.g., "Define probability and solve one simple numerical example.").

• Breaking into subtasks (definition → formula → example → common mistakes).

Run these prompts in a chat-based AI model and record the raw responses.

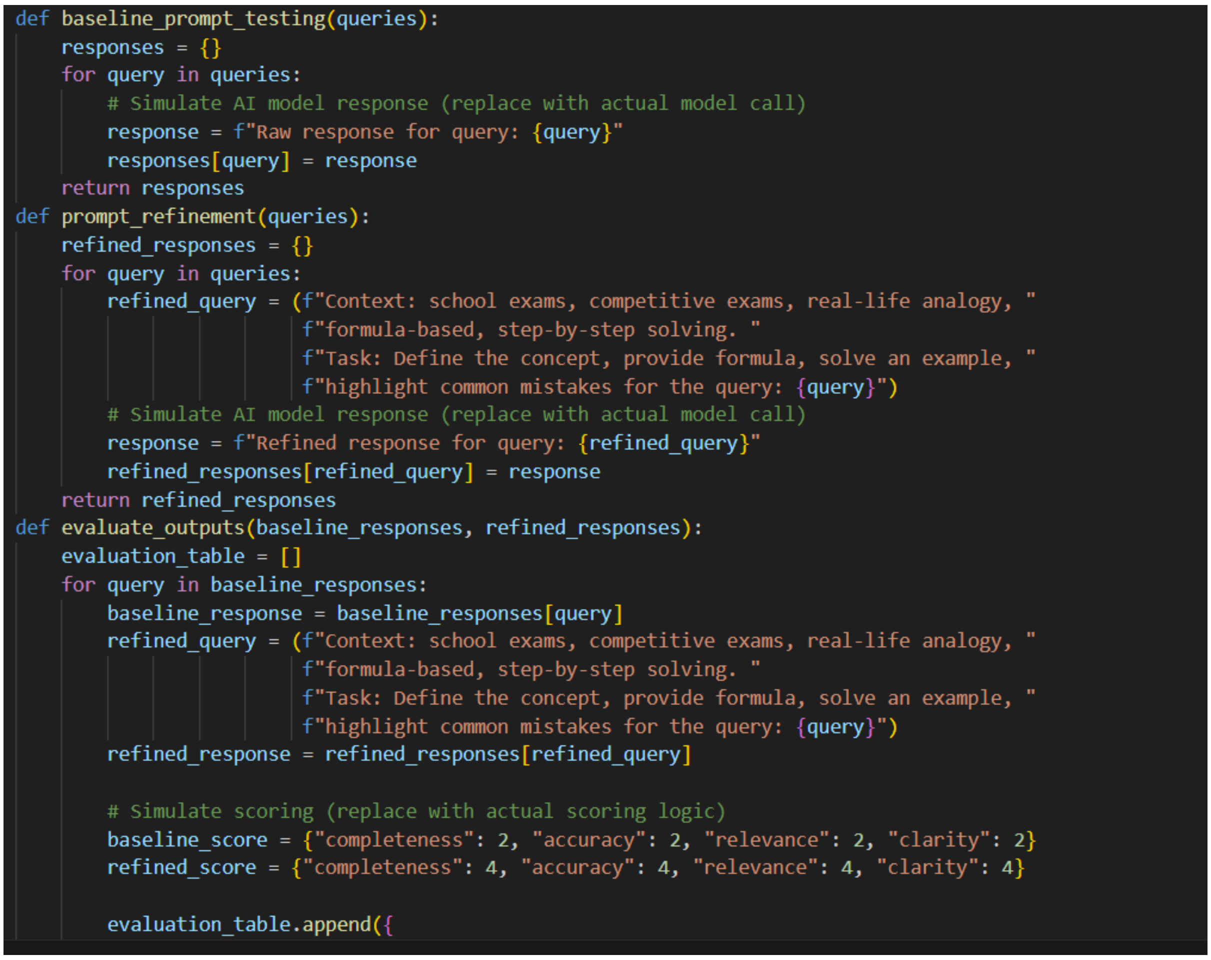
3. Evaluate Outputs

• Score responses using completeness, accuracy, relevance, and clarity.

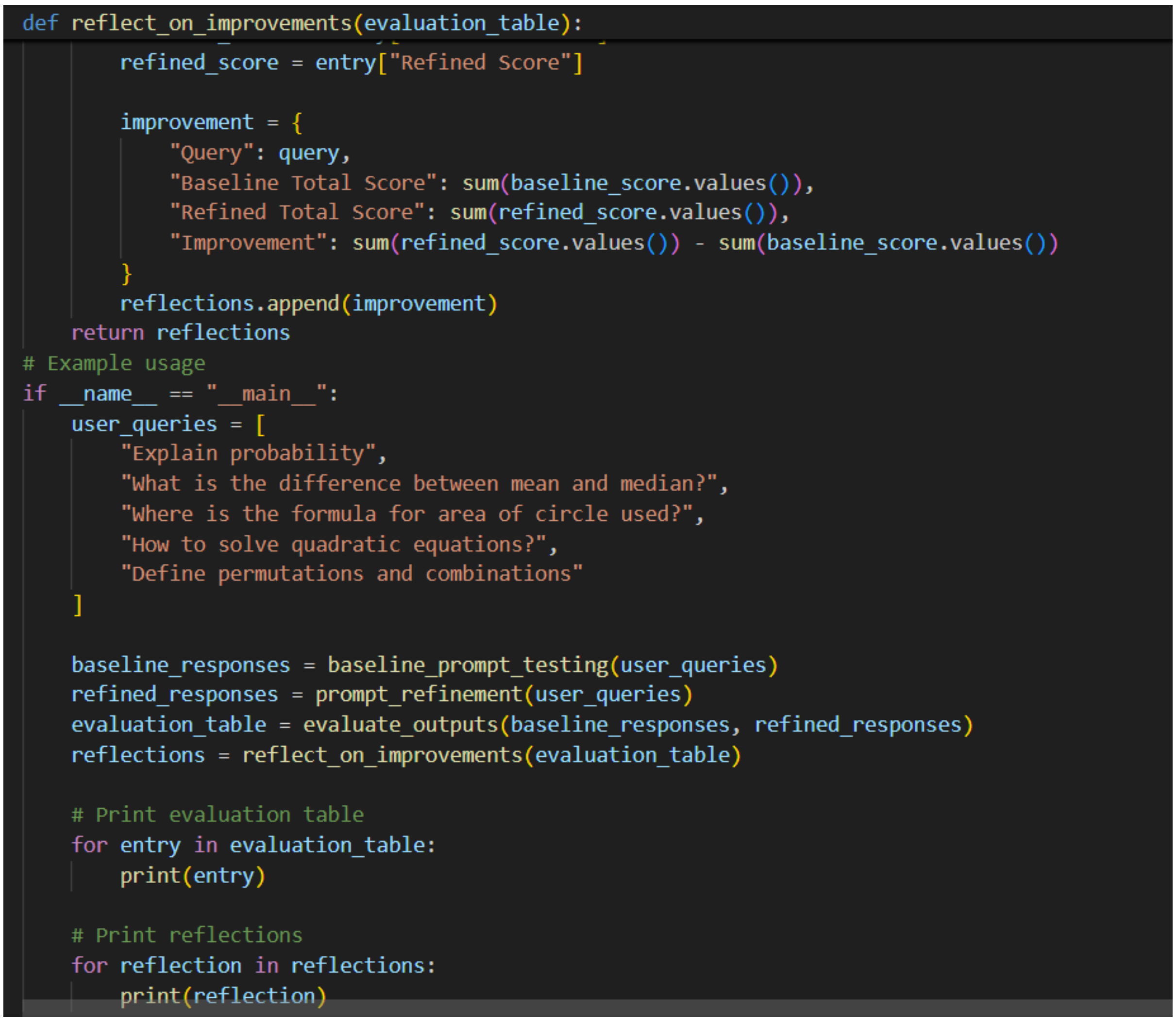
• Present findings in a table.

4. Reflection

Reflect on how structured prompts improve step-by-step reasoning and learner understanding.

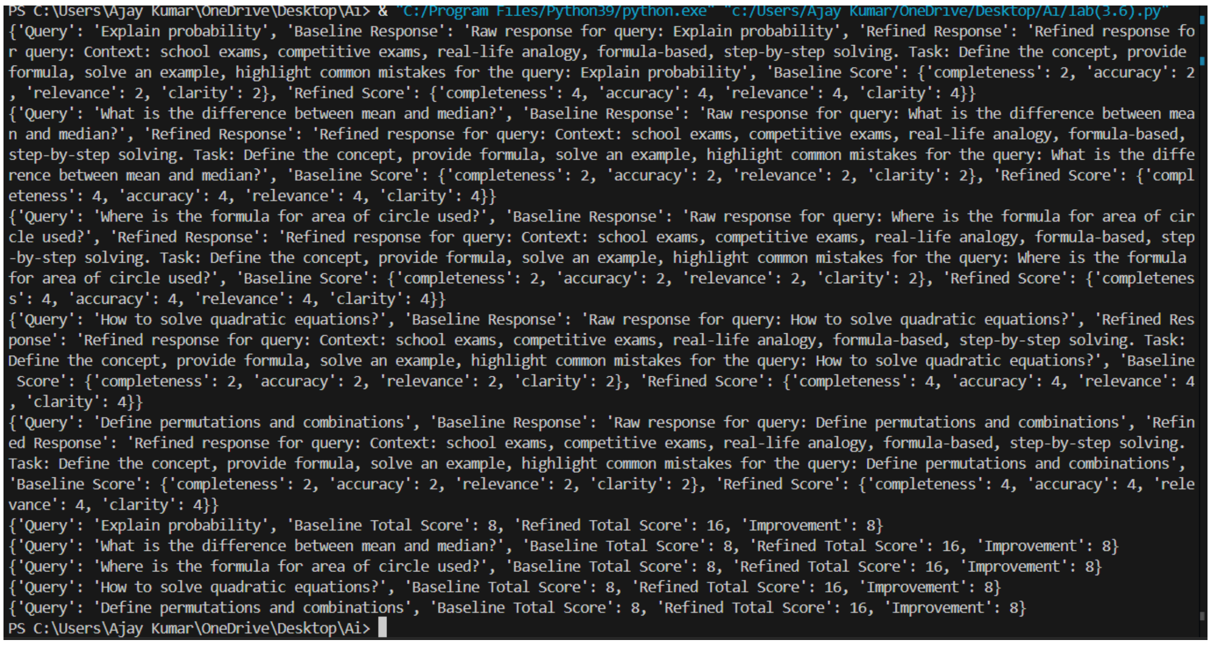


```python
def baseline_prompt_testing(queries):
    responses = {}
    for query in queries:
        # Simulate AI model response (replace with actual model call)
        response = f"Raw response for query: {query}"
        responses[query] = response
    return responses
def prompt_refinement(queries):
    refined_responses = {}
    for query in queries:
        refined_query = (f"Context: school exams, competitive exams, real-life analogy, "
                         f"formula-based, step-by-step solving. "
                         f"Task: Define the concept, provide formula, solve an example, "
                         f"highlight common mistakes for the query: {query}")
        # Simulate AI model response (replace with actual model call)
        response = f"Refined response for query: {refined_query}"
        refined_responses[refined_query] = response
    return refined_responses
def evaluate_outputs(baseline_responses, refined_responses):
    evaluation_table = []
    for query in baseline_responses:
        baseline_response = baseline_responses[query]
        refined_query = (f"Context: school exams, competitive exams, real-life analogy, "
                         f"formula-based, step-by-step solving. "
                         f"Task: Define the concept, provide formula, solve an example, "
                         f"highlight common mistakes for the query: {query}")
        refined_response = refined_responses[refined_query]

        # Simulate scoring (replace with actual scoring logic)
        baseline_score = {"completeness": 2, "accuracy": 2, "relevance": 2, "clarity": 2}
        refined_score = {"completeness": 4, "accuracy": 4, "relevance": 4, "clarity": 4}

        evaluation_table.append({
```



```python
def reflect_on_improvements(evaluation_table):
        refined_score = entry["Refined Score"]

        improvement = {
            "Query": query,
            "Baseline Total Score": sum(baseline_score.values()),
            "Refined Total Score": sum(refined_score.values()),
            "Improvement": sum(refined_score.values()) - sum(baseline_score.values())
        }
        reflections.append(improvement)
    return reflections
# Example usage
if __name__ == "__main__":
    user_queries = [
        "Explain probability",
        "What is the difference between mean and median?",
        "Where is the formula for area of circle used?",
        "How to solve quadratic equations?",
        "Define permutations and combinations"
    ]

    baseline_responses = baseline_prompt_testing(user_queries)
    refined_responses = prompt_refinement(user_queries)
    evaluation_table = evaluate_outputs(baseline_responses, refined_responses)
    reflections = reflect_on_improvements(evaluation_table)

    # Print evaluation table
    for entry in evaluation_table:
        print(entry)

    # Print reflections
    for reflection in reflections:
        print(reflection)
```

Output:



```
PS C:\Users\Ajay Kumar\OneDrive\Desktop\Ai> & "C:/Program Files/Python39/python.exe" "c:/Users/Ajay Kumar/OneDrive/Desktop/Ai/lab(3.6).py"
{'Query': 'Explain probability', 'Baseline Response': 'Raw response for query: Explain probability', 'Refined Response': 'Refined response fo
r query: Context: school exams, competitive exams, real-life analogy, formula-based, step-by-step solving. Task: Define the concept, provide
formula, solve an example, highlight common mistakes for the query: Explain probability', 'Baseline Score': {'completeness': 2, 'accuracy': 2
, 'relevance': 2, 'clarity': 2}, 'Refined Score': {'completeness': 4, 'accuracy': 4, 'relevance': 4, 'clarity': 4}}
{'Query': 'What is the difference between mean and median?', 'Baseline Response': 'Raw response for query: What is the difference between mea
n and median?', 'Refined Response': 'Refined response for query: Context: school exams, competitive exams, real-life analogy, formula-based,
step-by-step solving. Task: Define the concept, provide formula, solve an example, highlight common mistakes for the query: What is the diffe
rence between mean and median?', 'Baseline Score': {'completeness': 2, 'accuracy': 2, 'relevance': 2, 'clarity': 2}, 'Refined Score': {'compl
eteness': 4, 'accuracy': 4, 'relevance': 4, 'clarity': 4}}
{'Query': 'Where is the formula for area of circle used?', 'Baseline Response': 'Raw response for query: Where is the formula for area of cir
cle used?', 'Refined Response': 'Refined response for query: Context: school exams, competitive exams, real-life analogy, formula-based, step
-by-step solving. Task: Define the concept, provide formula, solve an example, highlight common mistakes for the query: Where is the formula
for area of circle used?', 'Baseline Score': {'completeness': 2, 'accuracy': 2, 'relevance': 2, 'clarity': 2}, 'Refined Score': {'completenes
s': 4, 'accuracy': 4, 'relevance': 4, 'clarity': 4}}
{'Query': 'How to solve quadratic equations?', 'Baseline Response': 'Raw response for query: How to solve quadratic equations?', 'Refined Res
ponse': 'Refined response for query: Context: school exams, competitive exams, real-life analogy, formula-based, step-by-step solving. Task:
Define the concept, provide formula, solve an example, highlight common mistakes for the query: How to solve quadratic equations?', 'Baseline
 Score': {'completeness': 2, 'accuracy': 2, 'relevance': 2, 'clarity': 2}, 'Refined Score': {'completeness': 4, 'accuracy': 4, 'relevance': 4
, 'clarity': 4}}
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ed Response': 'Refined response for query: Context: school exams, competitive exams, real-life analogy, formula-based, step-by-step solving.
Task: Define the concept, provide formula, solve an example, highlight common mistakes for the query: Define permutations and combinations',
'Baseline Score': {'completeness': 2, 'accuracy': 2, 'relevance': 2, 'clarity': 2}, 'Refined Score': {'completeness': 4, 'accuracy': 4, 'rele
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{'Query': 'How to solve quadratic equations?', 'Baseline Total Score': 8, 'Refined Total Score': 16, 'Improvement': 8}
{'Query': 'Define permutations and combinations', 'Baseline Total Score': 8, 'Refined Total Score': 16, 'Improvement': 8}
PS C:\Users\Ajay Kumar\OneDrive\Desktop\Ai>
```