Lab Assignment-3.5

Prompt Engineering – Improving Prompts and Context Management

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Batch-11

Task-1: "Write a Python function to check if a number is prime."

Prompts used for best results:

#Write a python code for checking a prime number.

#Optimize the logic for better performance

Code:

```python
#Write a python code for checking a prime number.
def is_prime(n):
    if n <= 1:
        return False
    for i in range(2, int(n**0.5) + 1):
        if n % i == 0:
            return False
    return True
input_number = int(input("Enter a number: "))
if is_prime(input_number):
    print(f"{input_number} is a prime number.")
else:
    print(f"{input_number} is not a prime number.")

```

```python
#Optimize the logic for better performance
def is_prime_optimized(n):
    if n <= 1:
        return False
    if n <= 3:
        return True
    if n % 2 == 0 or n % 3 == 0:
        return False
    i = 5
    while i * i <= n:
        if n % i == 0 or n % (i + 2) == 0:
            return False
        i += 6
    return True
input_number = int(input("Enter a number: "))
if is_prime_optimized(input_number):
    print(f"{input_number} is a prime number.")
else:
    print(f"{input_number} is not a prime number.")

```

Output:

```
/Users/chari/OneDrive/Desktop/AI Assis
Enter a number: 741852963
741852963 is not a prime number.
```

Comparision of both results: The standard is_prime function checks all numbers up to the square root of n, making it simple but less efficient for large numbers. The optimized version, is_prime_optimized, quickly eliminates even numbers and multiples of 3, then only checks numbers of the form 6k±1, reducing unnecessary checks. Both have O(√n) complexity, but the optimized version is faster for large inputs. Use is_prime for clarity and is_prime_optimized for better performance with big numbers.

Task-2: Mobile Data Usage Billing Application

Prompts used:

Use Python programming and AI-assisted coding tools to create an application that simulates mobile data billing for a telecom service provider.

Generate python code such that user should have Data Consumed (in GB), Plan Type (Prepaid / Postpaid),Additional Services Used (e.g., caller tune, OTT subscription, etc.)

#Implement billing logic to calculate: DC (Data Charges) – charges based on data consumption, VC (Value-added Charges) – charges for additional services, Tax – applicable tax on the total bill.

#Display an itemized bill showing: Plan Type, Data Usage and Charges, Value-added Services and Charges, Tax, Total Bill Amount

Code:

```
class MobileDataPlanItemized:
    def __init__(self, plan_name, data_limit_gb, cost_per_gb, service_cost, tax_rate):
        self.plan_name = plan_name
        self.data_limit_gb = data_limit_gb
        self.cost_per_gb = cost_per_gb
        self.service_cost = service_cost
        self.tax_rate = tax_rate

    def calculate_bill(self, data_used_gb):
        if data_used_gb <= self.data_limit_gb:
            data_charges = data_used_gb * self.cost_per_gb
        else:
            extra_data = data_used_gb - self.data_limit_gb
            data_charges = (self.data_limit_gb * self.cost_per_gb) + (extra_data * self.cost_per_gb * 1.5)  # 50% surcharge
        total_before_tax = data_charges + self.service_cost
        tax_amount = total_before_tax * self.tax_rate
        total_bill = total_before_tax + tax_amount
        return data_charges, self.service_cost, tax_amount, total_bill

    def display_itemized_bill(self, data_used_gb, plan_type, value_added_services):
        data_charges, service_charges, tax_amount, total_bill = self.calculate_bill(data_used_gb)
        print("\n--- Itemized Mobile Data Bill ---")
        print(f"Plan Type: {plan_type}")
        print(f"Plan Name: {self.plan_name}")
        print(f"Data Usage: {data_used_gb} GB")
        print(f"Data Charges: Rs.{data_charges:.2f}")
        print(f"Value-added Services: {', '.join(value_added_services) if value_added_services else 'None'}")
        print(f"Value-added Services Charges: Rs.{service_charges:.2f}")
        print(f"Tax: Rs.{tax_amount:.2f}")
        print(f"Total Bill Amount: Rs.{total_bill:.2f}")

# Define available plans
basic_plan = MobileDataPlanItemized("Basic", 5, 10, 50, 0.18)      # 5 GB, Rs.10/GB, Rs.50 services, 18% tax
premium_plan = MobileDataPlanItemized("Premium", 20, 8, 100, 0.18) # 20 GB, Rs.8/GB, Rs.100 services, 18% tax

# User input
data_used = float(input("Enter data used in GB: "))
plan_type = input("Select plan type (Prepaid/Postpaid): ")
selected_plan = input("Select plan (Basic/Premium): ")

# Value-added services
services = []
add_services = input("Did you use any value-added services? (yes/no): ").strip().lower()
if add_services == "yes":
    while True:
        service = input("Enter service name (or press Enter to finish): ").strip()
        if service:
            services.append(service)
        else:
            break

# Bill calculation and display
if selected_plan.lower() == "basic":
    basic_plan.display_itemized_bill(data_used, plan_type, services)
elif selected_plan.lower() == "premium":
    premium_plan.display_itemized_bill(data_used, plan_type, services)
else:
    print("Invalid plan selected.")
```

Output:

```
Enter data used in GB: 3
Select plan type (Prepaid/Postpaid): postpaid
Select plan (Basic/Premium): premium
Plan Type: Premium
Data Usage: 3.0 GB
Data Charges: Rs.24.00
Value-added Services Charges: Rs.100.00
Tax: Rs.22.32
Total Bill Amount: Rs.146.32
PS C:\Users\chari>
```

Comparision of both results: This Mobile Data Usage Billing Application helps users calculate their monthly mobile data bill in a simple and interactive way. The user selects their plan type (Prepaid or Postpaid) and chooses between a Basic or Premium plan, each with its own data limits and rates. The app asks for the amount of data used and whether any value-added services (like caller tunes or OTT subscriptions) were used. It then calculates the total bill, including extra charges for exceeding the data limit, service costs, and applicable taxes. Finally, it presents a clear, itemized bill that breaks down all charges, making it easy for users to understand exactly what they're paying for. This makes managing and reviewing mobile expenses straightforward and transparent.

Task-3: Develop an LPG Billing System

Prompts used:

#Develop a Python application and utilize AI-assisted coding tools to build an application that calculates the LPG bill based on specified customer inputs and billing parameters.

#Generate python code such that user should have Customer Name, Customer ID, Consumption (in kg), Connection Type (Domestic / Commercial)

Refer to the given LPG Price List to determine the price per cylinder:

Add delivery charge input and detailed billing class with display method

Calculate per kg price from cylinder price

Code:

```
    def calculate_bill(self, consumption_kg):
        gross_amount = consumption_kg * self.base_price_per_kg
        subsidy_amount = consumption_kg * self.subsidy_per_kg
        net_amount = gross_amount - subsidy_amount
        tax_amount = net_amount * self.tax_rate
        total_bill = net_amount + tax_amount
        return gross_amount, subsidy_amount, net_amount, tax_amount, total_bill
    def __init__(self, customer_name, customer_id, consumption_kg, connection_type):
        self.customer_name = customer_name
        self.customer_id = customer_id
        self.consumption_kg = consumption_kg
        self.connection_type = connection_type

    def display_customer_info(self):
        print(f"Customer Name: {self.customer_name}")
        print(f"Customer ID: {self.customer_id}")
        print(f"Consumption: {self.consumption_kg} kg")
        print(f"Connection Type: {self.connection_type}")
```

```
def get_delivery_charge():
    while True:
        try:
            charge = float(input("Enter Delivery Charge (₹10 to ₹50): "))
            if 10 <= charge <= 50:
                return charge
            else:
                print("Delivery charge must be between ₹10 and ₹50.")
        except ValueError:
            print("Please enter a valid number.")

class LPGBillingSystemDetailed:
    def __init__(self, base_price_per_kg, subsidy_per_kg, tax_rate, delivery_charge=0):
        self.base_price_per_kg = base_price_per_kg
        self.subsidy_per_kg = subsidy_per_kg
        self.tax_rate = tax_rate
        self.delivery_charge = delivery_charge

    def calculate_bill(self, consumption_kg):
        gross_amount = consumption_kg * self.base_price_per_kg
        subsidy_amount = consumption_kg * self.subsidy_per_kg
        net_amount = gross_amount - subsidy_amount
        tax_amount = net_amount * self.tax_rate
```

```
    def display_detailed_bill(self, customer, consumption_kg):
        gross, subsidy, net, tax, delivery, total = self.calculate_bill(consumption_kg)
        print("\nItemized Bill:")
        customer.display_customer_info()
        print(f"Gross Amount: Rs.{gross:.2f}")
        print(f"Subsidy Amount: Rs.{subsidy:.2f}")
        print(f"Net Amount: Rs.{net:.2f}")
        print(f"Tax Amount: Rs.{tax:.2f}")
        print(f"Delivery Charge: Rs.{delivery:.2f}")
        print(f"Total Bill Amount: Rs.{total:.2f}")

# --- Main billing logic ---
cylinder_size = float(input("Enter Cylinder Size in kg (5, 14.2, 19, 47.5): "))
price_per_cylinder = get_price_per_cylinder(connection_type, cylinder_size)
if price_per_cylinder is None:
    print("Invalid connection type or cylinder size.")
    exit()
else:
    print(f"Price per cylinder for {cylinder_size} kg {connection_type} LPG: Rs.{price_per_cylinder:.2f}")

```

```
base_price_per_kg = price_per_cylinder / cylinder_size
subsidy_per_kg = 10 if connection_type.lower() == "domestic" else 0
tax_rate = 0.05 if connection_type.lower() == "domestic" else 0.18
delivery_charge = get_delivery_charge()

detailed_billing_system = LPGBillingSystemDetailed(base_price_per_kg, subsidy_per_kg, tax_rate, delivery_charge)
detailed_billing_system.display_detailed_bill(customer, consumption)
```

Output:

```
Itemized Bill:
Customer Name: hafgh
Customer ID: 234
Consumption: 5.0 kg
Connection Type: Domestic
Gross Amount: Rs.500.00
Subsidy Amount: Rs.100.00
Net Amount: Rs.400.00
Tax Amount: Rs.20.00
Total Bill Amount: Rs.420.00
```

Comparision of both results: This LPG Gas Billing Application makes it easy for customers to calculate their monthly gas bill. Users enter their personal details, connection type (Domestic or Commercial), cylinder size, and the amount of gas consumed. The app automatically applies the correct price per cylinder, calculates any government subsidy, adds delivery charges, and computes the applicable tax. It then presents a clear, itemized bill showing all charges, including gross amount, subsidy, net amount, tax, and delivery fees. This helps users understand exactly what they're paying for and ensures transparency in their LPG billing. The process is straightforward, making it simple for anyone to review and manage their household or business gas expenses.