

Lab Assignment-3.5

Prompt Engineering – Improving Prompts and Context Management

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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:

```
1 #Write a python code for checking a prime number.
2 def is_prime(n):
3     if n <= 1:
4         return False
5     for i in range(2, int(n**0.5) + 1):
6         if n % i == 0:
7             return False
8     return True
9 input_number = int(input("Enter a number: "))
10 if is_prime(input_number):
11     print(f"{input_number} is a prime number.")
12 else:
13     print(f"{input_number} is not a prime number.")
14
```

```

15  #Optimize the logic for better performance
16  def is_prime_optimized(n):
17      if n <= 1:
18          return False
19      if n <= 3:
20          return True
21      if n % 2 == 0 or n % 3 == 0:
22          return False
23      i = 5
24      while i * i <= n:
25          if n % i == 0 or n % (i + 2) == 0:
26              return False
27          i += 6
28      return True
29  input_number = int(input("Enter a number: "))
30  if is_prime_optimized(input_number):
31      print(f"{input_number} is a prime number.")
32  else:
33      print(f"{input_number} is not a prime number.")
34

```

Output:

```

/Users/koushik/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 $6k \pm 1$, reducing unnecessary checks. Both have $O(\sqrt{n})$ 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

```
345     class MobileDataPlanItemized:
346         def __init__(self, plan_name, data_limit_gb, cost_per_gb, service_cost, tax_rate):
347             self.plan_name = plan_name
348             self.data_limit_gb = data_limit_gb
349             self.cost_per_gb = cost_per_gb
350             self.service_cost = service_cost
351             self.tax_rate = tax_rate
352
353         def calculate_bill(self, data_used_gb):
354             if data_used_gb <= self.data_limit_gb:
355                 data_charges = data_used_gb * self.cost_per_gb
356             else:
357                 extra_data = data_used_gb - self.data_limit_gb
358                 data_charges = (self.data_limit_gb * self.cost_per_gb) + (extra_data * self.cost_per_gb * 1.5) # 50% surcharge
359             total_before_tax = data_charges + self.service_cost
360             tax_amount = total_before_tax * self.tax_rate
361             total_bill = total_before_tax + tax_amount
362             return data_charges, self.service_cost, tax_amount, total_bill
363
364         def display_itemized_bill(self, data_used_gb, plan_type, value_added_services):
365             data_charges, service_charges, tax_amount, total_bill = self.calculate_bill(data_used_gb)
366             print("\n--- Itemized Mobile Data Bill ---")
367             print(f"Plan Type: {plan_type}")
368             print(f"Plan Name: {self.plan_name}")
369             print(f"Data Usage: {data_used_gb} GB")
370             print(f"Data Charges: Rs.{data_charges:.2f}")
371             print(f"Value-added Services: {' '.join(value_added_services) if value_added_services else 'None'}")
372             print(f"Value-added Services Charges: Rs.{service_charges:.2f}")
373             print(f"Tax: Rs.{tax_amount:.2f}")
374             print(f"Total Bill Amount: Rs.{total_bill:.2f}")
375
376     # Define available plans
377     basic_plan = MobileDataPlanItemized("Basic", 5, 10, 50, 0.18)      # 5 GB, Rs.10/GB, Rs.50 services, 18% tax
378     premium_plan = MobileDataPlanItemized("Premium", 20, 8, 100, 0.18) # 20 GB, Rs.8/GB, Rs.100 services, 18% tax
379
380     # User input
381     data_used = float(input("Enter data used in GB: "))
382     plan_type = input("Select plan type (Prepaid/Postpaid): ")
383     selected_plan = input("Select plan (Basic/Premium): ")
384
385
386     # Value-added services
387     services = []
388     add_services = input("Did you use any value-added services? (yes/no): ").strip().lower()
389     if add_services == "yes":
390         while True:
391             service = input("Enter service name (or press Enter to finish): ").strip()
392             if service:
393                 services.append(service)
394             else:
395                 break
396
397     # Bill calculation and display
398     if selected_plan.lower() == "basic":
399         basic_plan.display_itemized_bill(data_used, plan_type, services)
400     elif selected_plan.lower() == "premium":
401         premium_plan.display_itemized_bill(data_used, plan_type, services)
402     else:
403         print("Invalid plan selected.")
```

Code:

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\koushik>
```

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:

```
346     def calculate_bill(self, consumption_kg):
347         gross_amount = consumption_kg * self.base_price_per_kg
348         subsidy_amount = consumption_kg * self.subsidy_per_kg
349         net_amount = gross_amount - subsidy_amount
350         tax_amount = net_amount * self.tax_rate
351         total_bill = net_amount + tax_amount
352         return gross_amount, subsidy_amount, net_amount, tax_amount, total_bill
353     def __init__(self, customer_name, customer_id, consumption_kg, connection_type):
354         self.customer_name = customer_name
355         self.customer_id = customer_id
356         self.consumption_kg = consumption_kg
357         self.connection_type = connection_type
358
359     def display_customer_info(self):
360         print(f"Customer Name: {self.customer_name}")
361         print(f"Customer ID: {self.customer_id}")
362         print(f"Consumption: {self.consumption_kg} kg")
363         print(f"Connection Type: {self.connection_type}")
364
365     def get_delivery_charge():
366         while True:
367             try:
368                 charge = float(input("Enter Delivery Charge (₹10 to ₹50): "))
369                 if 10 <= charge <= 50:
370                     return charge
371                 else:
372                     print("Delivery charge must be between ₹10 and ₹50.")
373             except ValueError:
374                 print("Please enter a valid number.")
375
376     class LPGBillingSystemDetailed:
377         def __init__(self, base_price_per_kg, subsidy_per_kg, tax_rate, delivery_charge=0):
378             self.base_price_per_kg = base_price_per_kg
379             self.subsidy_per_kg = subsidy_per_kg
380             self.tax_rate = tax_rate
381             self.delivery_charge = delivery_charge
382
383         def calculate_bill(self, consumption_kg):
384             gross_amount = consumption_kg * self.base_price_per_kg
385             subsidy_amount = consumption_kg * self.subsidy_per_kg
386             net_amount = gross_amount - subsidy_amount
387             tax_amount = net_amount * self.tax_rate
```

```

390     def display_detailed_bill(self, customer, consumption_kg):
391         gross, subsidy, net, tax, delivery, total = self.calculate_bill(consumption_kg)
392         print("\nItemized Bill:")
393         customer.display_customer_info()
394         print(f"Gross Amount: Rs.{gross:.2f}")
395         print(f"Subsidy Amount: Rs.{subsidy:.2f}")
396         print(f"Net Amount: Rs.{net:.2f}")
397         print(f"Tax Amount: Rs.{tax:.2f}")
398         print(f"Delivery Charge: Rs.{delivery:.2f}")
399         print(f"Total Bill Amount: Rs.{total:.2f}")
400
401     # --- Main billing logic ---
402     cylinder_size = float(input("Enter Cylinder Size in kg (5, 14.2, 19, 47.5): "))
403     price_per_cylinder = get_price_per_cylinder(connection_type, cylinder_size)
404     if price_per_cylinder is None:
405         print("Invalid connection type or cylinder size.")
406         exit()
407     else:
408         print(f"Price per cylinder for {cylinder_size} kg {connection_type} LPG: Rs.{price_per_cylinder:.2f}")
409
410     base_price_per_kg = price_per_cylinder / cylinder_size
411     subsidy_per_kg = 10 if connection_type.lower() == "domestic" else 0
412     tax_rate = 0.05 if connection_type.lower() == "domestic" else 0.18
413     delivery_charge = get_delivery_charge()
414
415     detailed_billing_system = LPGBillingSystemDetailed(base_price_per_kg, subsidy_per_kg, tax_rate, delivery_charge)
416     detailed_billing_system.display_detailed_bill(customer, consumption_kg)

```

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.