

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.

```

Comparison 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 # Value-added services
386 services = []
387 add_services = input("Did you use any value-added services? (yes/no): ").strip().lower()
388 if add_services == "yes":
389     while True:
390         service = input("Enter service name (or press Enter to finish): ").strip()
391         if service:
392             services.append(service)
393         else:
394             break
395
396 # Bill calculation and display
397 if selected_plan.lower() == "basic":
398     basic_plan.display_itemized_bill(data_used, plan_type, services)
399 elif selected_plan.lower() == "premium":
400     premium_plan.display_itemized_bill(data_used, plan_type, services)
401 else:
402     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>
```

Comparison 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)

```

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

```

Comparison 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.