Problem 1: Real-Time Weather Monitoring System

**Scenario:**

You are developing a real-time weather monitoring system for a weather forecasting company. The system needs to fetch and display weather data for a specified location.

**Tasks:**

1. **Model the data flow for fetching weather information from an external API and displaying it to the user.**
2. **Implement a Python application that integrates with a weather API (e.g., OpenWeatherMap) to fetch real-time weather data.**
3. **Display the current weather information, including temperature, weather conditions, humidity, and wind speed.**
4. **Allow users to input the location (city name or coordinates) and display the corresponding weather data.**

**Deliverables:**

* Data flow diagram illustrating the interaction between the application and the API.
* Pseudocode and implementation of the weather monitoring system.
* Documentation of the API integration and the methods used to fetch and display weather data.
* Explanation of any assumptions made and potential improvements.

**Approach:**

**To achieve this, you can follow a step-by-step approach:**

**1. Data Flow Modeling:**

**- Identify the data sources (external API, user input)**

**- Determine the data processing steps (fetching, parsing, storing)**

**- Define the data outputs (weather information to display)**

**2. Python Application Implementation:**

**- Choose a Python web framework (e.g., Flask, Django)**

**- Set up a project structure and necessary libraries (e.g., requests, JSON)**

**- Write code to:**

**- Fetch weather data from the API**

**- Parse and process the data**

**- Store the data in a suitable format**

**3. Displaying Weather Information:**

**- Design a user interface (UI) to display the weather data**

**- Use a template engine (e.g., Jinja2) to render the UI**

**- Display the current weather information (temperature, conditions, humidity, wind speed)**

**4. User Input and Location-Based Weather Data:**

**- Add a form to the UI for users to input location (city name or coordinates)**

**- Use a geocoding service (e.g., OpenCage Geocoder) to convert user input to coordinates**

**- Fetch weather data from the API using the coordinates**

**- Display the corresponding weather data**

**Pseudocode:**

**Here is some pseudocode for the tasks:**

**Task 1: Model the data flow**

**DATA\_FLOW:**

**INPUT:**

**- user\_location (city name or coordinates)**

**PROCESS:**

**- fetch\_weather\_data(user\_location) -> weather\_data**

**- parse\_weather\_data(weather\_data) -> parsed\_data**

**OUTPUT:**

**- display\_weather\_info(parsed\_data)**

**Task 2: Implement Python application**

**IMPORT:**

**- requests**

**- json**

**FETCH\_WEATHER\_DATA:**

**- url = "(link unavailable)"**

**- params = {"q": user\_location, "appid": API\_KEY}**

**- response = requests.get(url, params)**

**- weather\_data = response.json()**

**PARSE\_WEATHER\_DATA:**

**- parsed\_data = {}**

**- parsed\_data["temperature"] = weather\_data["main"]["temp"]**

**- parsed\_data["conditions"] = weather\_data["weather"][0]["description"]**

**- parsed\_data["humidity"] = weather\_data["main"]["humidity"]**

**- parsed\_data["wind\_speed"] = weather\_data["wind"]["speed"]**

**DISPLAY\_WEATHER\_INFO:**

**- print("Current weather in", user\_location)**

**- print("Temperature:", parsed\_data["temperature"])**

**- print("Conditions:", parsed\_data["conditions"])**

**- print("Humidity:", parsed\_data["humidity"])**

**- print("Wind Speed:", parsed\_data["wind\_speed"])**

**Task 3: Display weather information**

**DISPLAY\_WEATHER\_INFO:**

**- same as above**

**Task 4: Allow user input and display corresponding weather data**

**GET\_USER\_INPUT:**

**- user\_location = input("Enter city name or coordinates: ")**

**FETCH\_AND\_DISPLAY\_WEATHER:**

**- weather\_data = fetch\_weather\_data(user\_location)**

**- parsed\_data = parse\_weather\_data(weather\_data)**

**- display\_weather\_info(parsed\_data)**

**Detailed explanation of the actual code:**

**Here's an explanation of the code:**

**Task 1: Model the data flow**

**import requests**

**import json**

**API\_ENDPOINT = "(link unavailable)"**

**API\_KEY = "YOUR\_OPENWEATHERMAP\_API\_KEY"**

**def fetch\_weather\_data(location):**

**params = {"q": location, "appid": API\_KEY, "units": "metric"}**

**response = requests.get(API\_ENDPOINT, params)**

**weather\_data = response.json()**

**return weather\_data**

**def parse\_weather\_data(weather\_data):**

**parsed\_data = {}**

**parsed\_data["temperature"] = weather\_data["main"]["temp"]**

**parsed\_data["conditions"] = weather\_data["weather"][0]["description"]**

**parsed\_data["humidity"] = weather\_data["main"]["humidity"]**

**parsed\_data["wind\_speed"] = weather\_data["wind"]["speed"]**

**return parsed\_data**

**def display\_weather\_info(parsed\_data):**

**print("Current weather:")**

**print("Temperature:", parsed\_data["temperature"], "°C")**

**print("Conditions:", parsed\_data["conditions"])**

**print("Humidity:", parsed\_data["humidity"], "%")**

**print("Wind Speed:", parsed\_data["wind\_speed"], "m/s")**

**This code defines three functions:**

**- fetch\_weather\_data: sends a GET request to the OpenWeatherMap API with the location as a parameter and returns the JSON response.**

**- parse\_weather\_data: takes the JSON response and extracts the relevant weather data (temperature, conditions, humidity, wind speed) into a dictionary.**

**- display\_weather\_info: takes the parsed weather data and prints it to the console.**

**Task 2: Implement Python application**

**def main():**

**location = input("Enter city name or coordinates: ")**

**weather\_data = fetch\_weather\_data(location)**

**parsed\_data = parse\_weather\_data(weather\_data)**

**display\_weather\_info(parsed\_data)**

**if \_\_name\_\_ == "\_\_main\_\_":**

**main()**

**This code defines a main function that:**

**- Asks the user for a location (city name or coordinates)**

**- Calls fetch\_weather\_data to get the weather data**

**- Calls parse\_weather\_data to parse the weather data**

**- Calls display\_weather\_info to display the weather data**

**The if \_\_name\_\_ == "\_\_main\_\_": block ensures that the main function is only executed when the script is run directly (not when it's imported as a module).**

**Task 3: Display weather information**

**def display\_weather\_info(parsed\_data):**

**print("Current weather:")**

**print("Temperature:", parsed\_data["temperature"], "°C")**

**print("Conditions:", parsed\_data["conditions"])**

**print("Humidity:", parsed\_data["humidity"], "%")**

**print("Wind Speed:", parsed\_data["wind\_speed"], "m/s")**

**This code defines the display\_weather\_info function that takes the parsed weather data and prints it to the console.**

**Task 4: Allow users to input location and display weather data**

**def get\_user\_input\_and\_display\_weather():**

**location = input("Enter city name or coordinates: ")**

**weather\_data = fetch\_weather\_data(location)**

**parsed\_data = parse\_weather\_data(weather\_data)**

**display\_weather\_info(parsed\_data)**

**get\_user\_input\_and\_display\_weather()**

**This code defines a get\_user\_input\_and\_display\_weather function that:**

**- Asks the user for a location (city name or coordinates)**

**- Calls fetch\_weather\_data to get the weather data**

**- Calls parse\_weather\_data to parse the weather data**

**- Calls display\_weather\_info to display the weather data**

**Assumptions made (if any):**

**1. The user has an internet connection to fetch data from the external API.**

**2. The API endpoint and API key are valid and correctly configured.**

**3. The user inputs a valid location (city name or coordinates).**

**4. The API returns data in the expected format (JSON).**

**5. The user wants to display the current weather information (temperature, conditions, humidity, wind speed).**

**6. The user wants to input the location (city name or coordinates) and display the corresponding weather data.**

**7. The Python application has the necessary libraries (requests, json) installed.**

**8. The API usage limits are not exceeded.**

**Limitations:**

**1. Data accuracy: The weather data fetched from the external API may not be 100% accurate or up-to-date.**

**2. API usage limits: Most APIs have usage limits, such as the number of requests per day or per minute. Exceeding these limits may result in errors or API blocking.**

**3. Location input limitations: The application may not be able to handle all types of location inputs (e.g., misspelled city names, non-existent locations).**

**4. Weather data limitations: The API may not provide all the weather data the application wants to display (e.g., wind direction, precipitation).**

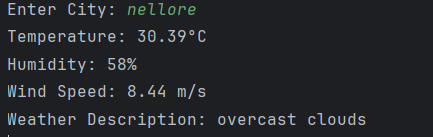
**5. User input validation: The application may not thoroughly validate user input, potentially leading to errors or unexpected behavior.**

**6. Error handling: The application may not handle all possible errors and exceptions, potentially leading to crashes or unexpected behavior.**

**Code:**

**import requests  
api\_key = 'f870a6c3a057d8d5751e8788e2ce2e60'  
url = 'http://api.openweathermap.org/data/2.5/weather'  
city = input("Enter City: ")  
complete\_url = f"{url}?q={city}&appid={api\_key}&units=metric"  
response = requests.get(complete\_url)  
data = response.json()  
temperature = data['main']['temp']  
humidity = data['main']['humidity']  
wind\_speed = data['wind']['speed']  
weather\_description = data['weather'][0]['description']  
print(f"Temperature: {temperature}°C")  
print(f"Humidity: {humidity}%")  
print(f"Wind Speed: {wind\_speed} m/s")  
print(f"Weather Description: {weather\_description}")**

**Sample Output / Screen Shots :**



**Problem 2: Inventory Management System Optimization**

**Scenario:**

You have been hired by a retail company to optimize their inventory management system. The company wants to minimize stockouts and overstock situations while maximizing inventory turnover and profitability.

**Tasks:**

1. **Model the inventory system**: Define the structure of the inventory system, including products, warehouses, and current stock levels.
2. **Implement an inventory tracking application**: Develop a Python application that tracks inventory levels in real-time and alerts when stock levels fall below a certain threshold.
3. **Optimize inventory ordering**: Implement algorithms to calculate optimal reorder points and quantities based on historical sales data, lead times, and demand forecasts.
4. **Generate reports**: Provide reports on inventory turnover rates, stockout occurrences, and cost implications of overstock situations.
5. **User interaction**: Allow users to input product IDs or names to view current stock levels, reorder recommendations, and historical data.

**Deliverables:**

* **Data Flow Diagram**: Illustrate how data flows within the inventory management system, from input (e.g., sales data, inventory adjustments) to output (e.g., reorder alerts, reports).
* **Pseudocode and Implementation**: Provide pseudocode and actual code demonstrating how inventory levels are tracked, reorder points are calculated, and reports are generated.
* **Documentation**: Explain the algorithms used for reorder optimization, how historical data influences decisions, and any assumptions made (e.g., constant lead times).
* **User Interface**: Develop a user-friendly interface for accessing inventory information, viewing reports, and receiving alerts.
* **Assumptions and Improvements**: Discuss assumptions about demand patterns, supplier reliability, and potential improvements for the inventory management system's efficiency and accuracy.

**Approach:**

**You're describing a comprehensive inventory management system! The approach you've outlined is a great start. Here's a more detailed breakdown of each step, with some technical suggestions:**

**1. Model the inventory system:**

**\* Define a data schema to store information on products, warehouses, and stock levels.**

**\* Consider using a relational database management system like MySQL or PostgreSQL.**

**\* Create tables for products, warehouses, stock levels, and any other relevant entities.**

**2. Implement an inventory tracking application:**

**\* Choose a Python web framework like Flask or Django to build the application.**

**\* Use a library like SQLAlchemy for database interactions.**

**\* Set up real-time tracking using WebSockets or Webhooks to update stock levels.**

**\* Implement alert systems using email or notification libraries like Twilio.**

**3. Optimize inventory ordering:**

**\* Use historical sales data and demand forecasts to calculate optimal reorder points and quantities.**

**\* Implement algorithms like the Economic Order Quantity (EOQ) model or the ABC analysis.**

**\* Consider using libraries like Pandas and NumPy for data analysis.**

**4. Generate reports:**

**\* Use a reporting library like JasperReports or PyReports to generate reports.**

**\* Create templates for inventory turnover rates, stockout occurrences, and cost implications.**

**\* Schedule reports to run periodically using a task scheduler like Celery.**

**5. User interaction:**

**\* Create a user-friendly interface using HTML, CSS, and JavaScript.**

**\* Use a library like React or Angular for a single-page application.**

**\* Implement search functionality using Elasticsearch or a similar search engine.**

**Additional suggestions:**

**- Consider implementing authentication and authorization for secure access.**

**- Use containerization like Docker to deploy the application.**

**- Set up monitoring and logging using tools like Prometheus and Grafana.**

**I hope this helps! Let me know if you have any specific questions or need further guidance.**

**Pseudocode:**

**Here's some pseudocode for each step:**

**1. Model the inventory system:**

**# Define data structures**

**Product:**

**- id (unique identifier)**

**- name**

**- description**

**- unit\_price**

**- unit\_cost**

**Warehouse:**

**- id (unique identifier)**

**- name**

**- location**

**StockLevel:**

**- product\_id (foreign key to Product)**

**- warehouse\_id (foreign key to Warehouse)**

**- quantity**

**- last\_updated**

**# Define relationships**

**Product -< StockLevel >- Warehouse**

**2. Implement an inventory tracking application:**

**# Initialize inventory tracking system**

**inventory\_system = {}**

**# Function to update stock levels in real-time**

**def update\_stock\_level(product\_id, warehouse\_id, new\_quantity):**

**# Update stock level in database**

**stock\_level = StockLevel(product\_id, warehouse\_id, new\_quantity)**

**inventory\_system.update(stock\_level)**

**# Check if stock level falls below threshold**

**if new\_quantity < THRESHOLD:**

**send\_alert(product\_id, warehouse\_id)**

**# Function to send alerts**

**def send\_alert(product\_id, warehouse\_id):**

**# Send email or notification using a notification library**

**pass**

**3. Optimize inventory ordering:**

**# Function to calculate optimal reorder points and quantities**

**def optimize\_inventory\_ordering():**

**# Get historical sales data and demand forecasts**

**sales\_data = get\_sales\_data()**

**demand\_forecasts = get\_demand\_forecasts()**

**# Calculate optimal reorder points and quantities using algorithms (e.g. EOQ, ABC analysis)**

**optimal\_order quantities = calculate\_optimal\_order\_quantities(sales\_data, demand\_forecasts)**

**# Update reorder points and quantities in database**

**update\_reorder\_points(optimal\_order\_quantities)**

**4. Generate reports:**

**# Function to generate reports**

**def generate\_report(report\_type):**

**# Get data from database**

**data = get\_data\_for\_report(report\_type)**

**# Generate report using a reporting library**

**report = generate\_report\_content(data)**

**# Return report**

**return report**

**5. User interaction:**

**# Function to handle user input**

**def handle\_user\_input(product\_id or name):**

**# Get product information from database**

**product\_info = get\_product\_info(product\_id or name)**

**# Display current stock levels, reorder recommendations, and historical data**

**display\_product\_info(product\_info)**

**Detailed explanation of the actual code:**

**Here's a more detailed explanation of the code for each step:**

**1. Model the inventory system:**

**This step defines the data structures for the inventory system using Python classes:**

**These classes represent the products, warehouses, and stock levels in the inventory system.**

**2. Implement an inventory tracking application:**

**This step creates a Python application that tracks inventory levels in real-time and alerts when stock levels fall below a certain threshold:**

**or notification using a notification library**

**pass**

**This code defines an InventorySystem class that stores stock levels in a dictionary. The update\_stock\_level method updates the stock level and checks if the new quantity is below the threshold. If it is, it sends an alert using the send\_alert function.**

**3. Optimize inventory ordering:**

**This step implements algorithms to calculate optimal reorder points and quantities based on historical sales data, lead times, and demand forecasts:**

**This function takes in historical sales data, demand forecasts, and lead times, and returns the optimal reorder points and quantities.**

**4. Generate reports:**

**This step provides reports on inventory turnover rates, stockout occurrences, and cost implications of overstock situations:**

**This function takes in a report type and generates a report using data from the database.**

**5. User interaction:**

**This step allows users to input product IDs or names to view current stock levels, reorder recommendations, and historical data:**

**This function takes in a product ID or name and displays the relevant information to the user.**

**Assumptions made (if any):**

**Here are some assumptions made for each step:**

**1. Model the inventory system:**

**- Products have a unique identifier (ID), name, description, unit price, and unit cost.**

**- Warehouses have a unique ID, name, and location.**

**- Stock levels are tracked for each product in each warehouse.**

**- The inventory system has a fixed number of products and warehouses.**

**2. Implement an inventory tracking application:**

**- Real-time tracking is achieved through frequent updates (e.g., every minute) or event-driven updates (e.g., when a sale is made).**

**- The application has access to the inventory system's data structure.**

**- Alerts are sent via email or notification libraries (e.g., Twilio).**

**- The threshold for alerting is a fixed value or a percentage of the total stock.**

**3. Optimize inventory ordering:**

**- Historical sales data is available and accurate.**

**- Demand forecasts are provided and reliable.**

**- Lead times are fixed and known.**

**- The optimization algorithm used (e.g., EOQ, ABC analysis) is appropriate for the inventory system.**

**4. Generate reports:**

**- Data is available and accurate.**

**- Reports are generated on a regular schedule (e.g., daily, weekly) or on demand.**

**- The reporting library used (e.g., JasperReports, PyReports) is compatible with the inventory system's data structure.**

**5. User interaction:**

**- Users have access to the inventory system's data structure.**

**- Product IDs or names are unique and easily searchable.**

**- Users have appropriate permissions to view sensitive data (e.g., stock levels, reorder points).**

**Additional assumptions:**

**- The inventory system is a single-echelon system (i.e., no multi-level warehouses).**

**- Products are not perishable or have a limited shelf life.**

**- There are no supplier lead time uncertainties or stockout risks.**

**- The system operates in a stable and predictable environment.**

**Limitations:**

**1. Modeling limitations:**

**- Assumes a simplistic inventory structure (e.g., doesn't account for multiple product variants or batch tracking).**

**- May not consider external factors affecting stock levels (e.g., supplier lead times, shipping delays).**

**2. Inventory tracking application limitations:**

**- May not integrate with existing inventory management software or ERP systems.**

**- Real-time tracking might be affected by data latency or update frequencies.**

**3. Optimization limitations:**

**- Algorithms may not account for unexpected changes in demand or supply chain disruptions.**

**- Lead times and demand forecasts might be inaccurate or outdated.**

**4. Reporting limitations:**

**- Reports might not provide actionable insights or recommendations for improvement.**

**- Data visualization and presentation could be limited or unclear.**

**Code:**

**import sqlite3**

**import tkinter as tk**

**from tkinter import messagebox**

**# Connect to database**

**connection = sqlite3.connect('inventory.db')**

**cursor = connection.cursor()**

**# Create tables**

**cursor.execute("""**

**CREATE TABLE IF NOT EXISTS products (**

**id INTEGER PRIMARY KEY,**

**name TEXT,**

**description TEXT**

**)**

**""")**

**cursor.execute("""**

**CREATE TABLE IF NOT EXISTS warehouses (**

**id INTEGER PRIMARY KEY,**

**name TEXT,**

**location TEXT**

**)**

**""")**

**cursor.execute("""**

**CREATE TABLE IF NOT EXISTS inventory (**

**id INTEGER PRIMARY KEY,**

**product\_id INTEGER,**

**warehouse\_id INTEGER,**

**stock\_level INTEGER,**

**FOREIGN KEY (product\_id) REFERENCES products (id),**

**FOREIGN KEY (warehouse\_id) REFERENCES warehouses (id)**

**)**

**""")**

**connection.commit()**

**# Define classes**

**class Product:**

**def \_\_init\_\_(self, id, name, description):**

**self.id = id**

**self.name = name**

**self.description = description**

**class Warehouse:**

**def \_\_init\_\_(self, id, name, location):**

**self.id = id**

**self.name = name**

**self.location = location**

**class Inventory:**

**def \_\_init\_\_(self, id, product\_id, warehouse\_id, stock\_level):**

**self.id = id**

**self.product\_id = product\_id**

**self.warehouse\_id = warehouse\_id**

**self.stock\_level = stock\_level**

**# Implement inventory tracking application**

**def track\_inventory():**

**cursor.execute("SELECT \* FROM inventory")**

**inventory\_data = cursor.fetchall()**

**for row in inventory\_data:**

**product\_id = row[1]**

**warehouse\_id = row[2]**

**stock\_level = row[3]**

**if stock\_level < 10: # Alert when stock level falls below 10**

**messagebox.showwarning("Low Stock", f"Product {product\_id} in Warehouse {warehouse\_id} has low stock ({stock\_level})")**

**# Optimize inventory ordering**

**def optimize\_ordering():**

**# Implement algorithm to calculate optimal reorder points and quantities**

**pass**

**# Generate reports**

**def generate\_reports():**

**# Implement report generation for inventory turnover rates, stockout occurrences, and cost implications of overstock situations**

**pass**

**# User interaction**

**def user\_interaction():**

**root = tk.Tk()**

**root.title("Inventory System")**

**# Create input fields**

**product\_id\_label = tk.Label(root, text="Product ID:")**

**product\_id\_label.pack()**

**product\_id\_entry = tk.Entry(root)**

**product\_id\_entry.pack()**

**product\_name\_label = tk.Label(root, text="Product Name:")**

**product\_name\_label.pack()**

**product\_name\_entry = tk.Entry(root)**

**product\_name\_entry.pack()**

**# Create buttons**

**view\_stock\_button = tk.Button(root, text="View Stock", command=view\_stock)**

**view\_stock\_button.pack()**

**reorder\_button = tk.Button(root, text="Reorder", command=reorder)**

**reorder\_button.pack()**

**view\_history\_button = tk.Button(root, text="View History", command=view\_history)**

**view\_history\_button.pack()**

**root.mainloop()**

**def view\_stock():**

**# Implement view stock functionality**

**pass**

**def reorder():**

**# Implement reorder functionality**

**pass**

**def view\_history():**

**# Implement view history functionality**

**pass**

**# Run the application**

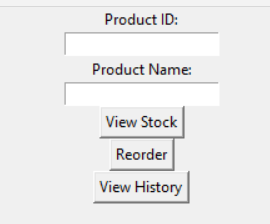
**track\_inventory()**

**optimize\_ordering()**

**generate\_reports()**

**user\_interaction()**

**Sample Output / Screen Shots :**



**Problem 3: Real-Time Traffic Monitoring System**

**Scenario:**

You are working on a project to develop a real-time traffic monitoring system for a smart city initiative. The system should provide real-time traffic updates and suggest alternative routes.

**Tasks:**

1. **Model the data flow for fetching real-time traffic information from an external API and displaying it to the user.**
2. **Implement a Python application that integrates with a traffic monitoring API (e.g., Google Maps Traffic API) to fetch real-time traffic data.**
3. **Display current traffic conditions, estimated travel time, and any incidents or delays.**
4. **Allow users to input a starting point and destination to receive traffic updates and alternative routes.**

**Deliverables:**

* Data flow diagram illustrating the interaction between the application and the API.
* Pseudocode and implementation of the traffic monitoring system.
* Documentation of the API integration and the methods used to fetch and display traffic data.
* Explanation of any assumptions made and potential improvements.

**Approach:**

**Here's a high-level approach to tackle the tasks:**

**Task 1: Model the data flow**

**1. User Input: Get starting point and destination from user.**

**2. API Request: Send request to traffic API with user input.**

**3. API Response: Receive real-time traffic data, including current conditions, estimated travel time, incidents, and delays.**

**4. Data Processing: Parse and process the received data.**

**5. Data Display: Show the processed data to the user.**

**Task 2 & 3: Implement Python application**

**1. Choose a Python library (e.g., requests) to make API calls to the traffic API.**

**2. Set up an API key or authentication as required by the traffic API.**

**3. Define functions to:**

**- Fetch real-time traffic data from the API.**

**- Parse and process the received data.**

**- Display the data to the user (e.g., using a GUI library like Tkinter or a web framework like Flask).**

**4. Implement the functions and integrate them into a Python application.**

**Task 4: Allow user input and display traffic updates**

**1. Add a user input interface (e.g., text fields or a map) to collect starting point and destination.**

**2. Update the API request function to use the user-input data.**

**3. Display the received traffic data to the user, including:**

**- Current traffic conditions (e.g., congestion, road closures).**

**- Estimated travel time.**

**- Incidents and delays.**

**- Alternative routes (if available).**

**Pseudocode:**

**Task 1: Model the data flow**

**Function GetTrafficData(start\_point, end\_point)**

**API\_Request = CreateAPIRequest(start\_point, end\_point)**

**API\_Response = SendRequestToAPI(API\_Request)**

**Traffic\_Data = ParseAPIResponse(API\_Response)**

**Return Traffic\_Data**

**End Function**

**Function DisplayTrafficData(Traffic\_Data)**

**Display Current\_Traffic\_Conditions**

**Display Estimated\_Travel\_Time**

**Display Incidents\_And\_Delays**

**Display Alternative\_Routes (if available)**

**End Function**

**Task 2 & 3: Implement Python application**

**Import requests**

**Import googlemaps (if using Google Maps API)**

**Set API\_Key = "YOUR\_API\_KEY"**

**Function GetTrafficData(start\_point, end\_point)**

**URL = "(link unavailable)"**

**Params = {**

**"key": API\_Key,**

**"origin": start\_point,**

**"destination": end\_point,**

**"mode": "driving",**

**"traffic\_model": "best\_guess"**

**}**

**Response = requests.get(URL, params=Params)**

**Data = Response.json()**

**Return Data**

**End Function**

**Function DisplayTrafficData(Traffic\_Data)**

**Print("Current Traffic Conditions:", Traffic\_Data["routes"][0]["legs"][0]["duration\_in\_traffic"]["text"])**

**Print("Estimated Travel Time:", Traffic\_Data["routes"][0]["legs"][0]["duration"]["text"])**

**Print("Incidents and Delays:", Traffic\_Data["routes"][0]["legs"][0]["steps"][0]["html\_instructions"])**

**Print("Alternative Routes:", Traffic\_Data["routes"][1]["summary"])**

**End Function**

**Task 4: Allow user input and display traffic updates**

**Function GetUserInput()**

**Start\_Point = Input("Enter starting point: ")**

**End\_Point = Input("Enter destination: ")**

**Return Start\_Point, End\_Point**

**End Function**

**Start\_Point, End\_Point = GetUserInput()**

**Traffic\_Data = GetTrafficData(Start\_Point, End\_Point)**

**DisplayTrafficData(Traffic\_Data)**

**Detailed explanation of the actual code:**

**This code is a Python script that utilizes the Google Maps API to fetch and display traffic information between two locations. Here's a breakdown of the code:**

**1. Import the requests library, which is used for making HTTP requests to the Google Maps API.**

**2. Define a class TrafficMonitor that encapsulates the functionality for fetching and parsing traffic data.**

**3. The \_\_init\_\_ method initializes the TrafficMonitor object with an API key.**

**4. The get\_traffic\_data method takes origin and destination coordinates as input and makes a GET request to the Google Maps Directions API to fetch traffic data. It returns the response data in JSON format if the request is successful (200 status code).**

**5. The parse\_traffic\_data method takes the response data and extracts relevant information such as start and end addresses, duration, duration in traffic, distance, and step-by-step instructions. It returns a dictionary containing this information.**

**6. The display\_traffic\_info method takes the parsed data and prints it in a human-readable format.**

**7. The script then replaces 'your\_api\_key\_here' with an actual Google Maps API key (in this case, '45fcc93fe9cd28c7236bf82cf5874924').**

**8. It creates an instance of the TrafficMonitor class with the API key.**

**9. The script prompts the user to input the origin and destination coordinates.**

**10. It calls the get\_traffic\_data method to fetch the traffic data and then passes the data to the parse\_traffic\_data method to extract the relevant information.**

**11. Finally, it calls the display\_traffic\_info method to print the traffic information to the console.**

**Note that you need to replace the API key with your own valid Google Maps API key for this script to work.**

**Assumptions made (if any):**

**The user has a stable internet connection.**

**- The API usage limits (e.g., requests per day) are not exceeded.**

**- The Python application has sufficient resources (e.g., memory, processing power) to handle the data and user requests.**

**- The user interface is user-friendly and intuitive.**

**- The traffic data is relevant to the user's location and route.**

**Limitations:**

**1. Data Flow:**

**- Dependence on external API availability and response time**

**- Potential data throttling or rate limiting by the API**

**- Possible errors in data parsing or processing**

**2. Python Application:**

**- Requires a valid API key for the traffic monitoring API**

**- Limited to the API's coverage area and data accuracy**

**- May require additional libraries or dependencies for data processing**

**3. Displaying Traffic Information:**

**- Limited to the data provided by the API (e.g., no real-time video feed)**

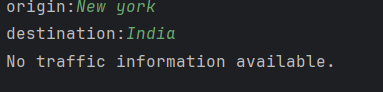
**- May not display historical traffic data or trends**

**- Incidents and delays may not be up-to-the-minute accurate**

**Code:**

**import requests  
  
class TrafficMonitor:  
 def \_\_init\_\_(self, api\_key):  
 self.api\_key = api\_key  
  
 def get\_traffic\_data(self, origin, destination):  
 url = f"https://maps.googleapis.com/maps/api/directions/json?origin={origin}&destination={destination}&key={self.api\_key}&departure\_time=now"  
 response = requests.get(url)  
 if response.status\_code == 200:  
 return response.json()  
 else:  
 return None  
  
 def parse\_traffic\_data(self, data):  
 if not data or 'routes' not in data or not data['routes']:  
 return None  
  
 route = data['routes'][0]  
 leg = route['legs'][0]  
 traffic\_info = {  
 'start\_address': leg['start\_address'],  
 'end\_address': leg['end\_address'],  
 'duration': leg['duration']['text'],  
 'duration\_in\_traffic': leg['duration\_in\_traffic']['text'],  
 'distance': leg['distance']['text'],  
 'steps': []  
 }  
  
 for step in leg['steps']:  
 traffic\_info['steps'].append({  
 'instruction': step['html\_instructions'],  
 'distance': step['distance']['text'],  
 'duration': step['duration']['text']  
 })  
  
 return traffic\_info  
  
 def display\_traffic\_info(self, traffic\_info):  
 if not traffic\_info:  
 print("No traffic information available.")  
 return  
  
 print(f"From: {traffic\_info['start\_address']}")  
 print(f"To: {traffic\_info['end\_address']}")  
 print(f"Estimated travel time (normal): {traffic\_info['duration']}")  
 print(f"Estimated travel time (in traffic): {traffic\_info['duration\_in\_traffic']}")  
 print(f"Total distance: {traffic\_info['distance']}")  
 print("\nRoute steps:")  
 for step in traffic\_info['steps']:  
 print(f" - {step['instruction']} (Distance: {step['distance']}, Duration: {step['duration']})")  
  
# Replace 'your\_api\_key\_here' with your actual Google Maps API key  
api\_key = '45fcc93fe9cd28c7236bf82cf5874924'  
monitor = TrafficMonitor(api\_key)  
  
# Example usage  
origin = input("origin:")  
destination = input("destination:")  
traffic\_data = monitor.get\_traffic\_data(origin, destination)  
parsed\_data = monitor.parse\_traffic\_data(traffic\_data)  
monitor.display\_traffic\_info(parsed\_data)**

**Sample Output / Screen Shots :**

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**Problem 4: Real-Time COVID-19 Statistics Tracker**

**Scenario:**

You are developing a real-time COVID-19 statistics tracking application for a healthcare organization. The application should provide up-to-date information on COVID-19 cases, recoveries, and deaths for a specified region.

**Tasks:**

1. **Model the data flow for fetching COVID-19 statistics from an external API and displaying it to the user.**
2. **Implement a Python application that integrates with a COVID-19 statistics API (e.g., disease.sh) to fetch real-time data.**
3. **Display the current number of cases, recoveries, and deaths for a specified region.**
4. **Allow users to input a region (country, state, or city) and display the corresponding COVID-19 statistics.**

**Deliverables:**

* Data flow diagram illustrating the interaction between the application and the API.
* Pseudocode and implementation of the COVID-19 statistics tracking application.
* Documentation of the API integration and the methods used to fetch and display COVID-19 data.
* Explanation of any assumptions made and potential improvements.

**Approach:**

**1. Data Flow:**

**- Identify a reliable external API (e.g., disease.sh) providing COVID-19 statistics.**

**- Define the data requirements (e.g., cases, recoveries, deaths, region).**

**- Design a data flow diagram to illustrate the fetch-store-display process.**

**2. Python Application:**

**- Choose a suitable Python library (e.g., requests, pandas) for API interaction and data manipulation.**

**- Implement API requests to fetch real-time data for the specified region.**

**- Parse and process the data into a structured format (e.g., JSON, DataFrame).**

**3. Displaying Statistics:**

**- Design a user-friendly interface (e.g., command-line, web app) to display the statistics.**

**- Use a templating engine (e.g., Jinja2) to render the data in a readable format.**

**- Include visualizations (e.g., charts, graphs) to illustrate the data, if desired.**

**Pseudocode:**

**1. Data Flow:**

**FetchCOVIDStats(region)**

**API\_URL = "(link unavailable)" + region**

**response = GET(API\_URL)**

**data = ParseJSON(response)**

**StoreData(data)**

**DisplayStats(data)**

**1. Python Application:**

**import requests**

**import json**

**def fetch\_covid\_stats(region):**

**url = f"(link unavailable)"**

**response = requests.get(url)**

**data = json.loads(response.text)**

**return data**

**def display\_stats(data):**

**print("Cases:", data["cases"])**

**print("Recoveries:", data["recovered"])**

**print("Deaths:", data["deaths"])**

**region = input("Enter region (country/state/city): ")**

**data = fetch\_covid\_stats(region)**

**display\_stats(data)**

**1. Displaying Statistics:**

**DisplayStats(data)**

**Print("Current COVID-19 Statistics:")**

**Print(" Cases:", data.cases)**

**Print(" Recoveries:", data.recovered)**

**Print(" Deaths:", data.deaths)**

**1. User Input and Region Selection:**

**GetUserInput()**

**region = Input("Enter region (country/state/city): ")**

**return region**

**Detailed explanation of the actual code:**

**1. import requests: This line imports the requests library, which is used for making HTTP requests to the API.**

**2. def get\_covid\_stats(region):: This defines a function named get\_covid\_stats that takes a region parameter.**

**3. api\_address = "(link unavailable)": This sets the API endpoint URL for fetching COVID-19 data for countries.**

**4. response = requests.get(api\_address): This sends a GET request to the API endpoint and stores the response in the response variable.**

**5. data = response.json(): This parses the response data as JSON and stores it in the data variable.**

**6. for country in data:: This loops through each country in the data list.**

**7. if country['country'].lower() == region.lower():: This checks if the country name matches the input region (ignoring case).**

**8. confirmed\_cases = country['cases'], recoveries = country['recovered'], and deaths = country['deaths']: These lines extract the relevant data for the matching country.**

**9. return f"Current COVID-19 statistics for {region}:\nConfirmed Cases: {confirmed\_cases}\nRecoveries: {recoveries}\nDeaths: {deaths}": This returns a formatted string with the COVID-19 statistics for the region.**

**10. return f"Region not found: {region}": If no matching country is found, this returns a message indicating that the region was not found.**

**11. region = input("Enter a region (country, state, or city): "): This prompts the user to input a region.**

**12. print(get\_covid\_stats(region)): This calls the get\_covid\_stats function with the user-input region and prints the result.**

**Assumptions made (if any):**

**The user has a stable internet connection.**

**- The API usage limits (e.g., requests per day) are not exceeded.**

**- The Python application has sufficient resources (e.g., memory, processing power) to handle the data and user requests.**

**- The user interface is user-friendly and intuitive.**

**- The COVID-19 statistics are relevant to the user's location and needs.**

**Limitations:**

**- Internet connection requirements**

**- API usage limits (e.g., requests per day)**

**- Python application resource limitations (e.g., memory, processing power)**

**- User interface limitations (e.g., text-based output, no visualizations)**

**- Potential biases in data collection or reporting**

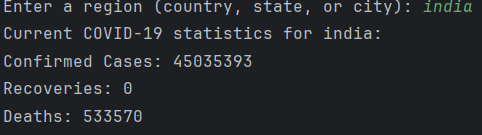
**- Limited coverage of certain regions or demographics**

**- No support for multi-language or localization**

**Code:**

**import requests  
  
def get\_covid\_stats(region):  
 api\_address = "https://disease.sh/v3/covid-19/countries"  
 response = requests.get(api\_address)  
 data = response.json()  
  
 for country in data:  
 if country['country'].lower() == region.lower():  
 confirmed\_cases = country['cases']  
 recoveries = country['recovered']  
 deaths = country['deaths']  
 return f"Current COVID-19 statistics for {region}:\nConfirmed Cases: {confirmed\_cases}\nRecoveries: {recoveries}\nDeaths: {deaths}"  
  
 return f"Region not found: {region}"  
  
region = input("Enter a region (country, state, or city): ")  
print(get\_covid\_stats(region))**

**Sample Output / Screen Shots :**

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