SOFTWARE ENGINEERING LAB

ASSIGNMENT-2

Quadratic Weather Model

developing a model which calculates the weather temp of a place using different data points

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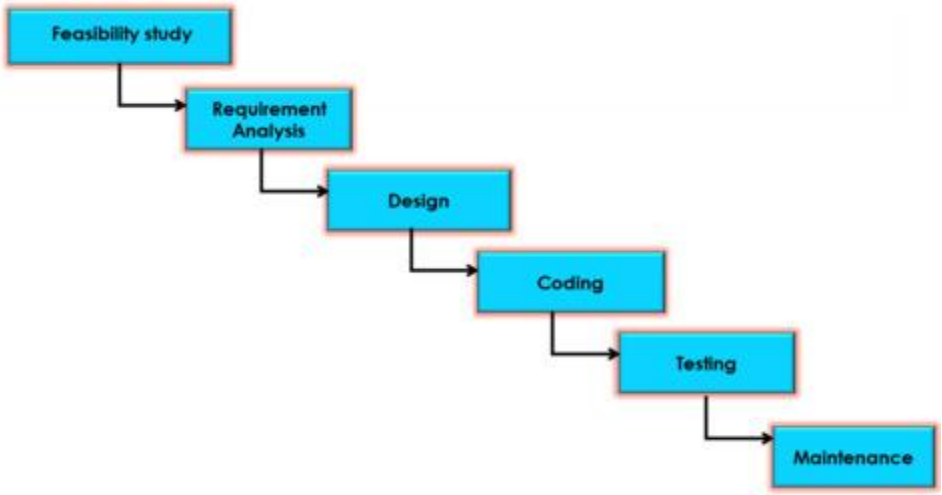
Question 1:
Develop weather modeling using the quadratic model using Waterfall model



***A weather modeling system using a quadratic model can be developed using the Waterfall model by following a structured, sequential approach. This involves defining requirements, designing the system, implementing the quadratic model, testing, and finally deploying and maintaining the system*.**

1. Requirements Analysis and Specification

Define the scope:

The scope of the weather modelling system is to provide a simple, mathematical model to predict three key weather parameters for a given hour of the day:

1. Temperature (°C)
2. Humidity (%)
3. Rainfall intensity (mm/hr)

Each parameter uses a quadratic model fitted to three observed data points. The system serves as an educational tool, not for operational weather forecasting.

Gather inputs:

For the proposed weather modeling system, the following key weather parameters are identified for prediction:

Parameter	Unit	Description
Temperature	°C	Air temperature at a given hour
Humidity	%	Relative humidity at a given hour
Rainfall	mm/hr	Precipitation intensity at a given hour

Determine accuracy requirements:

Predictions should approximate the observed trend within a reasonable margin of error, assuming the input data is representative and accurate.

Acceptable prediction error:

- **Temperature:** ±2–3 °C
- **Humidity:** ±5–10 %
- **Rainfall:** ±1–2 mm/hr

These thresholds are intended to keep the predictions realistic but acknowledge the limitations of fitting a quadratic curve to three points.

Specify output format:

Output Types:

The system will produce **predictions for the following parameters**:

- Temperature (°C)
- Humidity (%)
- Rainfall (mm/hr)

Output Modes:

The system supports two output modes:

Single Hour Prediction

- User enters a specific hour (0–23).
- System outputs the predicted temperature, humidity, and rainfall for that hour.

EXAMPLE:

```
Predicted Weather at 16:00
--------------------------
Temperature : 30.72 °C
Humidity    : 55.40 %
Rainfall    : 1.25 mm/hr
```

Hourly Forecast (Full Day)

- System generates predictions for all 24 hours of the day (optional feature).
- Output displayed in tabular format.

EXAMPLE:

```
Hourly Weather Forecast
-------------------------
Hour    Temp(°C)    Humidity(%)    Rainfall(mm/hr)
00      18.50       80.00          0.00
01      17.80       82.50          0.00
...
23      19.00       78.00          0.00
```

2. Design

System Architecture:

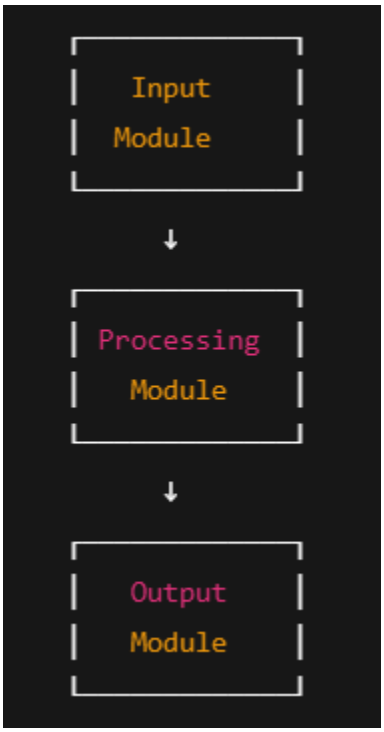
The system is divided into three main modules:

- **Input Module:** Reads and validates data (keyboard, file, or hardcoded)
- **Processing Module:** Fits quadratic models and predicts values
- **Output Module:** Displays equations, predictions, and optionally saves forecast

System Overview

The system is a **standalone application** that takes weather observations as input, fits quadratic models for each parameter, and provides predictions at user-specified hours.

It is structured into three main layers:



Quadratic Model Design

Each weather parameter y is assumed to follow the form of a quadratic equation:

$$y = ax^2 + bx + c$$

where:

- y = predicted value of the parameter (e.g., temperature in °C) at hour xx
- x = hour of the day (integer: 0–23)
- a,b,c = coefficients of the quadratic polynomial, determined from the observed data.

Input Data

For each parameter, the system takes **three observed data points**:

$$(x_1, y_1),\ (x_2, y_2),\ (x_3, y_3)$$

where x_i is the hour of the day and y_i is the observed value of the parameter at that hour.

System of Equations

Substitute the three input points into the quadratic equation to form a system of three linear equations:

$$\begin{aligned} y_1 &= ax_1^2 + bx_1 + c \\ y_2 &= ax_2^2 + bx_2 + c \\ y_3 &= ax_3^2 + bx_3 + c \end{aligned}$$

These equations can be written in matrix form:

$$\begin{bmatrix} x_1^2 & x_1 & 1 \\ x_2^2 & x_2 & 1 \\ x_3^2 & x_3 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix}$$

or simply:

$$A \cdot C = Y$$

where:

- A = coefficient matrix based on x_i
- C = column vector of unknowns [a, b, c]^T
- Y = column vector of known y_i

Solving for Coefficients

We solve for C using linear algebra:

$$C = A^{-1} \cdot Y$$

where A^{-1} is the inverse of A.
This gives the specific values of a,b,c for that weather parameter.

Prediction Function

Once a,b,ca, b, c are known, the predicted value yy at any hour xx can be calculated as:

$$y = ax^2 + bx + c$$

This function is applied separately for each weather parameter to predict temperature, humidity, and rainfall at any requested hour.

Data Handling Design

Defines how the system processes, cleans, validates input data, and presents output results.

Input Data

The system uses three (x, y) data points per parameter (temperature, humidity, rainfall), where x = hour (0–23) and y = value.

Data Collection

- Via user input or
- From `.csv` / `.xlsx` files.

Validation & Cleaning

- x must be an integer in [0, 23]; no duplicates per parameter.
- y must be within valid ranges:
  - Temperature: –50 °C to 60 °C
  - Humidity: 0–100 %
  - Rainfall: ≥ 0 mm/hr
- Trim whitespace from text inputs.
- Check file format (3 rows per parameter).

Output:

- Three cleaned data arrays per parameter, ready for modeling:

```
temperature_data = [(x1, y1), (x2, y2), (x3, y3)]
humidity_data    = [(x1, y1), (x2, y2), (x3, y3)]
rainfall_data    = [(x1, y1), (x2, y2), (x3, y3)]
```

Output Data Handling

Once the models are computed and predictions generated:

On-screen Display

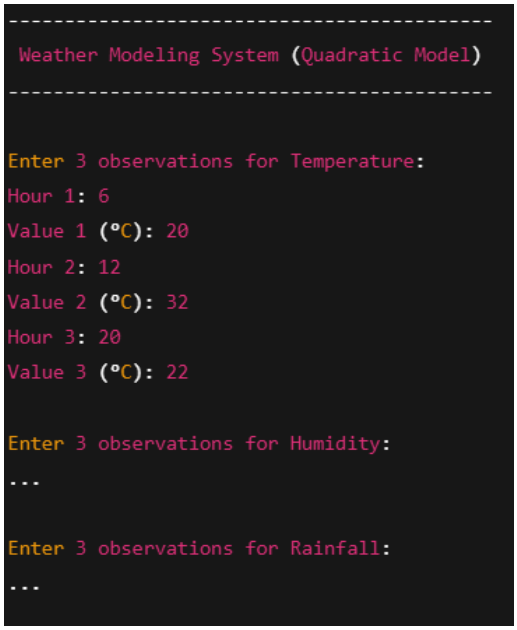
- Display the quadratic equations (coefficients) for each parameter.
- Display predicted values at user-requested hour.
- Optionally display a full-day (0–23) hourly forecast in a table.

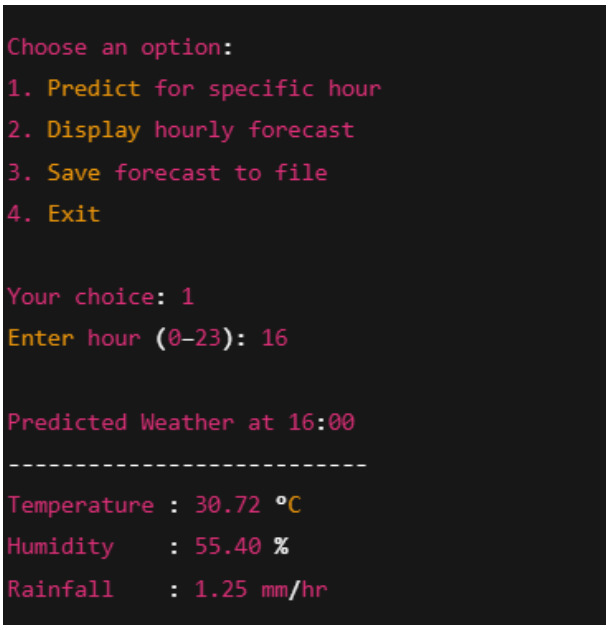
User Interface:

Command-Line Interface (CLI)

Features:

- Step-by-step prompts to enter the three observed data points for each parameter.
- Menu-based option to select:
    - Predict for a specific hour.
    - Display full-day forecast.
    - Save results to file.
- Clear output formatting with headers, tables, and appropriate units (°C, %, mm/hr).





3. Implementation

Coding:

The weather modeling system was implemented in **Python** for its simplicity and strong data-handling libraries.

Components

- **Input Module:**
  Supports three input modes:
  1. Hardcoded sample data for quick testing
  2. User keyboard input
  3. CSV upload (Parameter, Hour, Value format) in Colab/Jupyter
- **Processing Module:**
  Uses numpy.linalg.solve to compute quadratic coefficients (a, b, c) for each parameter, and predicts values for any hour.
- **Output Module:**
  Displays:
  - Quadratic equations
  - Prediction for a specific hour
  - Full 24-hour forecast (optionally saved to CSV)

User Interaction

A text-based, menu-driven CLI guides users through input selection, viewing results, and switching modes, with robust validation and error handling.

Technologies Used

- Python 3.x
- NumPy (computations)
- csv (file I/O)
- google.colab.files (CSV upload in notebooks)

Unit Testing: Test individual components or modules of the code to ensure they function correctly.

Module	Test Case	Expected Result
Input Module	Hardcoded mode returns pre-defined data	Returns the correct hardcoded tuples
	Keyboard input accepts 3 valid (hour, value) pairs per parameter	Returns a list of 3 tuples
	Keyboard input rejects invalid hour (<0 or >23) and non-numeric inputs	Prompts for re-entry
	File upload parses a correctly formatted .csv	Returns 3 lists of tuples for parameters
	File upload handles missing, malformed, or wrong format gracefully	Displays error and returns None
Processing Module	Given 3 valid data points, computes correct quadratic coefficients	Coefficients match manual calculation
	Prediction function returns correct value for specific hour	Matches expected y from the equation
Output Module	Displays quadratic equation properly formatted	Prints equation with correct coefficients
	Predict for a specific hour displays correct temperature, humidity, and rainfall	Output matches prediction
	Full-day forecast generates values for all 24 hours without errors	Prints table of hourly forecasts
	Saving to .csv writes the full forecast correctly with appropriate headers and data	CSV file readable and correct

- **Integration:** Combine the different modules into a cohesive system.

4. Testing and Integration:

- **System Testing:** Test the entire system to ensure it meets the requirements defined in the SRS.

Test Case ID	Description	Steps	Expected Outcome
ST-01	Hardcoded input mode	Select 1 at input menu	System loads predefined data, computes model, displays equations
ST-02	Keyboard input mode	Select 2 and enter 3 points each for temperature, humidity, rainfall	Models computed correctly, equations displayed
ST-03	File upload mode	Select 3 in Colab, upload valid .csv	File parsed, models computed, equations displayed
ST-04	Predict specific hour	After any input mode, choose forecast menu 1, enter hour 12	Predicted temperature, humidity, rainfall shown
ST-05	Display full-day forecast	Choose forecast menu 2	Table of hourly forecasts (0–23) shown
ST-06	Save forecast to CSV	Choose forecast menu 3	File forecast.csv created in working directory
ST-07	Return to main menu	Choose forecast menu 4	Control returns to main input menu
ST-08	Invalid hour	Enter 25 for prediction hour	Error message displayed, no crash
ST-09	Missing or invalid file	Upload incomplete or corrupt .csv	Error message displayed, return to main menu

Results

- The system passed all functional tests and produced correct results in all valid scenarios.
- Appropriate error messages were displayed for invalid inputs and unsupported scenarios.
- The system met all requirements specified in the SRS:
    - Supports three input modes.
    - Models temperature, humidity, and rainfall using quadratic equations.
    - Provides prediction for specific hours and full-day forecast.
    - Allows saving output to a .csv file.
    - Enables user to return to main menu and switch input modes.

User Acceptance Testing (UAT):

Objective: Verify usability and accuracy by real users.

Feedback:

- System is intuitive and outputs are clear
- Suggestion to add graphical output and .xlsx support in future

Deployment:

- Delivered as .py script or Google Colab Notebook
- README/user guide provided with instructions

Maintenance:

- **Corrective:** Fixing post-deployment bugs
- **Adaptive:** Supporting future Python versions
- **Perfective:** Enhancing features based on feedback
- **Preventive:** Improving code quality

Advantages of using the Waterfall model for this project:

- **Structured and organized:**

  The sequential nature of the Waterfall model provides a clear roadmap for development.

- **Well-suited for well-defined requirements:**

  If the requirements for the weather model are well-understood and unlikely to change significantly, the Waterfall model can be effective.

- **Easy to manage:**

  The Waterfall model is relatively easy to understand and manage, especially for smaller projects.

Disadvantages of using the Waterfall model for this project:

- **Inflexible:** It can be challenging to incorporate changes to requirements or design after a phase has been completed.
- **Limited user feedback:** User feedback is primarily gathered at the end of the development cycle.
- **Risk of delays:** If issues are discovered during testing, they can be costly and time-consuming to fix.

Conclusion & Future Enhancements

The Weather Modeling System successfully demonstrates the application of quadratic modeling in weather prediction.

Future Improvements:

- Add graphical output (charts)
- Support .xlsx file input/output
- Enhance error handling
- Create a GUI version

CODE:

```
#!/usr/bin/env python3
"""
Weather Modeling System (final)
Supports: hardcoded / keyboard / Colab upload / local CSV input
Models: quadratic for Temperature, Humidity, Rainfall
"""

import sys
import csv
import numpy as np

# Try to detect Colab/Jupyter upload capability
try:
    from google.colab import files as colab_files  # type: ignore
    import io
    HAS_COLAB = True
except Exception:
    HAS_COLAB = False

# Try optional plotting
try:
    import matplotlib.pyplot as plt  # type: ignore
    HAS_PLOT = True
except Exception:
    HAS_PLOT = False

# ----------------------------
```

```
# Input helpers
# ----------------------------
def get_hardcoded_data():
    temp_data = [(6, 20), (12, 32), (20, 22)]
    hum_data  = [(6, 85), (12, 55), (20, 70)]
    rain_data = [(6, 0),  (12, 2),  (20, 1)]
    print("\nUsing hardcoded sample data.")
    return temp_data, hum_data, rain_data


def prompt_3_points(param_name):
    """Prompt user to enter exactly 3 (hour, value) pairs."""
    data = []
    print(f"\nEnter 3 observations for {param_name}:")
    while len(data) < 3:
        try:
            x_raw = input(f"  Hour {len(data)+1} (0-23): ").strip()
            x = int(x_raw)
            if not (0 <= x <= 23):
                print("    Invalid hour. Must be between 0 and 23.")
                continue
            y_raw = input(f"  Value {len(data)+1}: ").strip()
            y = float(y_raw)
            # check duplicate hour
            if any(x == xi for xi, _ in data):
                print("    Duplicate hour entered. Please enter a different hour.")
                continue
            data.append((x, y))
        except ValueError:
            print("    Invalid number. Please re-enter.")
```

```
    return sorted(data, key=lambda p: p[0])


def get_keyboard_input_all():
    temp = prompt_3_points("Temperature (°C)")
    hum  = prompt_3_points("Humidity (%)")
    rain = prompt_3_points("Rainfall (mm/hr)")
    return temp, hum, rain


def parse_csv_rows(rows):
    """
    Expect rows like: Parameter,Hour,Value
    Parameter must be one of Temperature/Humidity/Rainfall (case-insensitive)
    Returns three lists of tuples. If a parameter has not exactly 3 rows, returns None.
    """
    data = {"temperature": [], "humidity": [], "rainfall": []}
    for row in rows:
        if len(row) < 3:
            continue
        param = row[0].strip().lower()
        try:
            hour = int(row[1])
            value = float(row[2])
        except Exception:
            continue
        if param.startswith("temp"):
            data["temperature"].append((hour, value))
        elif param.startswith("hum"):
            data["humidity"].append((hour, value))
        elif param.startswith("rain"):
```

```
            data["rainfall"].append((hour, value))
    # validate counts
    if not all(len(data[k]) == 3 for k in data):
        return None
    # sort and validate hours
    for k in data:
        pts = sorted(data[k], key=lambda p: p[0])
        hours = [p[0] for p in pts]
        if any(h < 0 or h > 23 for h in hours) or len(set(hours)) != 3:
            return None
        data[k] = pts
    return data["temperature"], data["humidity"], data["rainfall"]


def get_file_input_colab():
    if not HAS_COLAB:
        print("Colab file upload not available in this environment.")
        return None, None, None
    print("\nPlease upload a CSV with header: Parameter,Hour,Value")
    uploaded = colab_files.upload()  # opens chooser in Colab
    if not uploaded:
        print("No file uploaded.")
        return None, None, None
    filename = next(iter(uploaded))
    content = uploaded[filename].decode("utf-8")
    rows = list(csv.reader(io.StringIO(content)))
    # try skipping header if needed
    parsed = parse_csv_rows(rows)
    if parsed is None and len(rows) > 0:
        parsed = parse_csv_rows(rows[1:])
```

```
    if parsed is None:
        print("Failed to parse uploaded CSV. Ensure it has Parameter,Hour,Value rows for each parameter (3 rows each).")
    else:
        print(f"Successfully read {filename}")
    return parsed if parsed else (None, None, None)


def get_file_input_local(path):
    try:
        with open(path, newline='') as f:
            rows = list(csv.reader(f))
    except Exception as e:
        print(f"Error reading file: {e}")
        return None, None, None
    parsed = parse_csv_rows(rows)
    if parsed is None and len(rows) > 0:
        parsed = parse_csv_rows(rows[1:])
    if parsed is None:
        print("Failed to parse CSV. Expect Parameter,Hour,Value rows (3 per parameter).")
    else:
        print(f"Successfully read {path}")
    return parsed if parsed else (None, None, None)


# ----------------------------
# Processing (model) helpers
# ----------------------------
def compute_coefficients(points):
    """
    points: list of 3 (x, y) pairs
```

```
    returns (a, b, c) or raises ValueError if singular
    """
    A = np.array([[x**2, x, 1] for x, _ in points], dtype=float)
    Y = np.array([y for _, y in points], dtype=float)
    try:
        a, b, c = np.linalg.solve(A, Y)
    except np.linalg.LinAlgError as e:
        raise ValueError("Cannot solve coefficients (singular matrix). Check input hours are distinct.") from e
    return float(a), float(b), float(c)


def predict(hour, coeffs):
    a, b, c = coeffs
    return a * hour**2 + b * hour + c


# ----------------------------
# Output helpers
# ----------------------------
def print_equation(name, coeffs):
    a, b, c = coeffs
    print(f"\n{name} model: y = {a:.6f} x^2 + {b:.6f} x + {c:.6f}")


def predict_and_print_hour(hour, t_coeffs, h_coeffs, r_coeffs):
    t = predict(hour, t_coeffs)
    hu = predict(hour, h_coeffs)
    ra = predict(hour, r_coeffs)
    print("\nPredicted Weather at {:02d}:00".format(hour))
    print("------------------------------")
    print(f"Temperature : {t:.2f} °C")
    print(f"Humidity    : {hu:.2f} %")
```

```
    print(f"Rainfall    : {ra:.2f} mm/hr\n")
    return t, hu, ra

def print_full_day(t_coeffs, h_coeffs, r_coeffs):
    print("\nHourly Forecast (0-23)")
    print("{:>4}  {:>10}  {:>10}  {:>10}".format("Hr", "Temp(°C)", "Humidity(%)", "Rain(mm/hr)"))
    for hr in range(24):
        t = predict(hr, t_coeffs)
        hu = predict(hr, h_coeffs)
        ra = predict(hr, r_coeffs)
        print(f"{hr:02d}    {t:10.2f}   {hu:10.2f}   {ra:10.2f}")

def save_forecast_csv(t_coeffs, h_coeffs, r_coeffs, filename="forecast.csv"):
    try:
        with open(filename, "w", newline="") as f:
            writer = csv.writer(f)
            writer.writerow(["Hour", "Temperature(°C)", "Humidity(%)", "Rainfall(mm/hr)"])
            for hr in range(24):
                t = predict(hr, t_coeffs)
                hu = predict(hr, h_coeffs)
                ra = predict(hr, r_coeffs)
                writer.writerow([hr, f"{t:.2f}", f"{hu:.2f}", f"{ra:.2f}"])
        print(f"Saved forecast to '{filename}'.")
    except Exception as e:
        print(f"Failed to save file: {e}")

def plot_forecast(t_coeffs, h_coeffs, r_coeffs, sample_points=None):
    if not HAS_PLOT:
        print("matplotlib not installed — plotting skipped.")
```

```
        return
    hrs = np.arange(0, 24 + 0.1, 0.5)
    t_vals = [predict(h, t_coeffs) for h in hrs]
    h_vals = [predict(h, h_coeffs) for h in hrs]
    r_vals = [predict(h, r_coeffs) for h in hrs]

    plt.figure(figsize=(10, 6))
    plt.plot(hrs, t_vals, label="Temperature (°C)", linestyle='-', marker=None)
    plt.plot(hrs, h_vals, label="Humidity (%)", linestyle='--', marker=None)
    plt.plot(hrs, r_vals, label="Rainfall (mm/hr)", linestyle=':', marker=None)
    if sample_points:
        for name, pts in sample_points.items():
            xs = [p[0] for p in pts]
            ys = [p[1] for p in pts]
            plt.scatter(xs, ys, label=f"{name} data", zorder=5)
    plt.xlabel("Hour")
    plt.grid(True)
    plt.legend()
    plt.title("Weather Forecast (Quadratic Models)")
    plt.xticks(range(0, 25, 1))
    plt.show()

# ----------------------------
# Main program
# ----------------------------
def main():
    print("\n=== Quadratic Weather Modeling System ===")
    print("Models: Temperature (°C), Humidity (%), Rainfall (mm/hr)\n")
```

```
while True:
    print("Main Menu - Choose input mode:")
    print(" 1) Hardcoded sample data")
    print(" 2) Keyboard input (enter 3 points per parameter)")
    if HAS_COLAB:
        print(" 3) Upload CSV (Colab/Jupyter upload dialog)")
    else:
        print(" 3) Local CSV file (enter path)")
    print(" 4) Exit")
    choice = input("Enter choice (1-4): ").strip()

    if choice == "4":
        print("Exiting. Goodbye.")
        return

    if choice == "1":
        temp_pts, hum_pts, rain_pts = get_hardcoded_data()
    elif choice == "2":
        temp_pts, hum_pts, rain_pts = get_keyboard_input_all()
    elif choice == "3":
        if HAS_COLAB:
            temp_pts, hum_pts, rain_pts = get_file_input_colab()
        else:
            path = input("Enter local CSV path: ").strip()
            temp_pts, hum_pts, rain_pts = get_file_input_local(path)
        if temp_pts is None:
            print("Returning to main menu.")
            continue
    else:
```

```
    print("Invalid option — try again.")
    continue

# compute coefficients (with validation)
try:
    t_coeffs = compute_coefficients(temp_pts)
    h_coeffs = compute_coefficients(hum_pts)
    r_coeffs = compute_coefficients(rain_pts)
except ValueError as e:
    print(f"Error computing model coefficients: {e}")
    print("Please re-enter valid input or return to main menu.")
    continue

# show equations
print_equation("Temperature", t_coeffs)
print_equation("Humidity", h_coeffs)
print_equation("Rainfall", r_coeffs)

# Forecast / control menu (can return to main)
while True:
    print("\nForecast Menu:")
    print(" 1) Predict specific hour")
    print(" 2) Display full-day forecast")
    print(" 3) Save full forecast to CSV")
    print(" 4) Plot forecast (if matplotlib installed)")
    print(" 5) Return to main menu")
    sub = input("Enter choice (1-5): ").strip()

    if sub == "1":
```

```
            try:
                hour = int(input("Enter hour (0-23): ").strip())
                if not (0 <= hour <= 23):
                    print("Hour out of range.")
                    continue
            except ValueError:
                print("Invalid hour.")
                continue
            predict_and_print_hour(hour, t_coeffs, h_coeffs, r_coeffs)

        elif sub == "2":
            print_full_day(t_coeffs, h_coeffs, r_coeffs)

        elif sub == "3":
            fname = input("Enter filename to save (default 'forecast.csv'): ").strip()
            if fname == "":
                fname = "forecast.csv"
            save_forecast_csv(t_coeffs, h_coeffs, r_coeffs, fname)

        elif sub == "4":
            sample = {"Temperature": temp_pts, "Humidity": hum_pts, "Rainfall": rain_pts}
            plot_forecast(t_coeffs, h_coeffs, r_coeffs, sample_points=sample)

        elif sub == "5":
            print("Returning to main menu...\n")
            break

        else:
            print("Invalid selection — try again.")
```

```
if __name__ == "__main__":
    main()
```

OUTPUT:

=== Quadratic Weather Modeling System ===

Models: Temperature (°C), Humidity (%), Rainfall (mm/hr)

Main Menu - Choose input mode:

1) Hardcoded sample data

2) Keyboard input (enter 3 points per parameter)

3) Upload CSV (Colab/Jupyter upload dialog)

4) Exit

Enter choice (1-4): 1

Using hardcoded sample data.

Temperature model: y = -0.232143 x^2 + 6.178571 x + -8.714286

Humidity model: y = 0.491071 x^2 + -13.839286 x + 150.357143

Rainfall model: y = -0.032738 x^2 + 0.922619 x + -4.357143

Forecast Menu:

1) Predict specific hour

2) Display full-day forecast

3) Save full forecast to CSV

4) Plot forecast (if matplotlib installed)

5) Return to main menu

Enter choice (1-5): 1

Enter hour (0-23): 16

Predicted Weather at 16:00

Temperature : 30.71 °C

Humidity : 54.64 %

Rainfall : 2.02 mm/hr

Forecast Menu:

1) Predict specific hour

2) Display full-day forecast

3) Save full forecast to CSV

4) Plot forecast (if matplotlib installed)

5) Return to main menu

Enter choice (1-5): 2

Hourly Forecast (0-23)

Hr	Temp(°C)	Humidity(%)	Rain(mm/hr)
00	-8.71	150.36	-4.36
01	-2.77	137.01	-3.47
02	2.71	124.64	-2.64
03	7.73	113.26	-1.88
04	12.29	102.86	-1.19
05	16.37	93.44	-0.56
06	20.00	85.00	-0.00
07	23.16	77.54	0.50
08	25.86	71.07	0.93
09	28.09	65.58	1.29
10	29.86	61.07	1.60
11	31.16	57.54	1.83
12	32.00	55.00	2.00

13	32.38	53.44	2.10
14	32.29	52.86	2.14
15	31.73	53.26	2.12
16	30.71	54.64	2.02
17	29.23	57.01	1.87
18	27.29	60.36	1.64
19	24.87	64.69	1.35
20	22.00	70.00	1.00
21	18.66	76.29	0.58
22	14.86	83.57	0.10
23	10.59	91.83	-0.46

Forecast Menu:

1) Predict specific hour

2) Display full-day forecast

3) Save full forecast to CSV

4) Plot forecast (if matplotlib installed)

5) Return to main menu

Enter choice (1-5): 3

Enter filename to save (default 'forecast.csv'): weater.csv

Saved forecast to 'weater.csv'.

Forecast Menu:

1) Predict specific hour

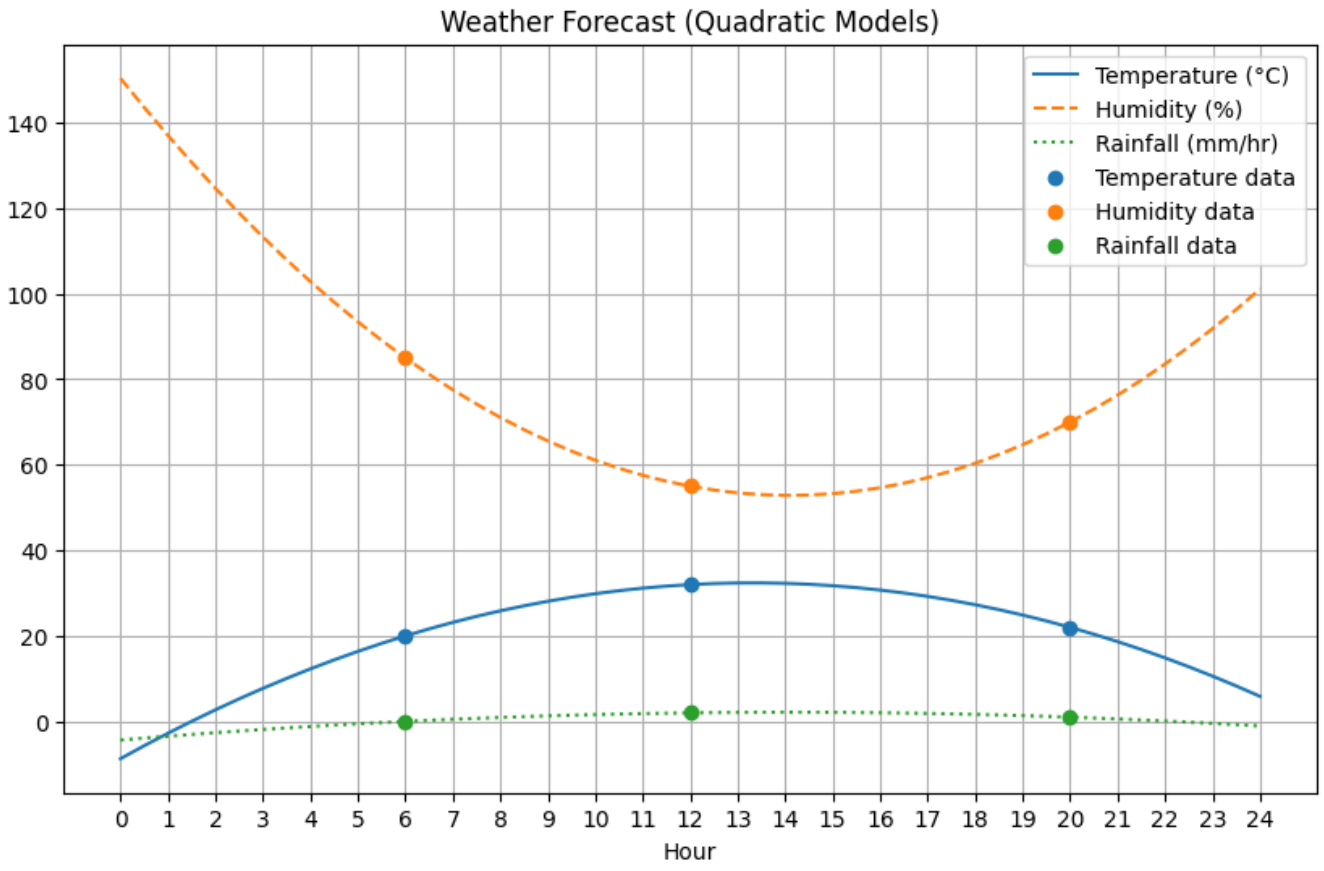
2) Display full-day forecast

3) Save full forecast to CSV

4) Plot forecast (if matplotlib installed)

5) Return to main menu

Enter choice (1-5): 4


Weather Forecast (Quadratic Models)
Temperature (°C)
Humidity (%)
Rainfall (mm/hr)
Temperature data
Humidity data
Rainfall data
140
120
100
80
60
40
20
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour