Institute of Geographical Information Systems

CS-212 - Object Oriented Programming LAB

Semester: Fall 2025	**Class: SCEE-IGIS - 2024**
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Submitted to: Ma'am Alvina Anjum	**Due Date: Oct 15, 2025**

LAB 06: Compositions

CLO Alignment

CLO	Description	Domain	Taxonomy Level	PLO
CLO3	Develop programs using OOP concepts such as encapsulation, composition, and abstraction.	Cognitive	3 (Application)	PLO3

Task # 1: Department → Faculty → University

Objective: To demonstrate multi-level composition and object interaction.

Requirements:

1. Create class Faculty with attributes:

- string facultyName, string designation, int publications

Function: void showFaculty()

2. Create class Department with attributes:

- string deptName
- An array of Faculty objects (size 3)

Functions:

- void inputFaculty() to input details for all faculty
- void showDepartment() to display all faculty in the department

3. **Create class University with:**

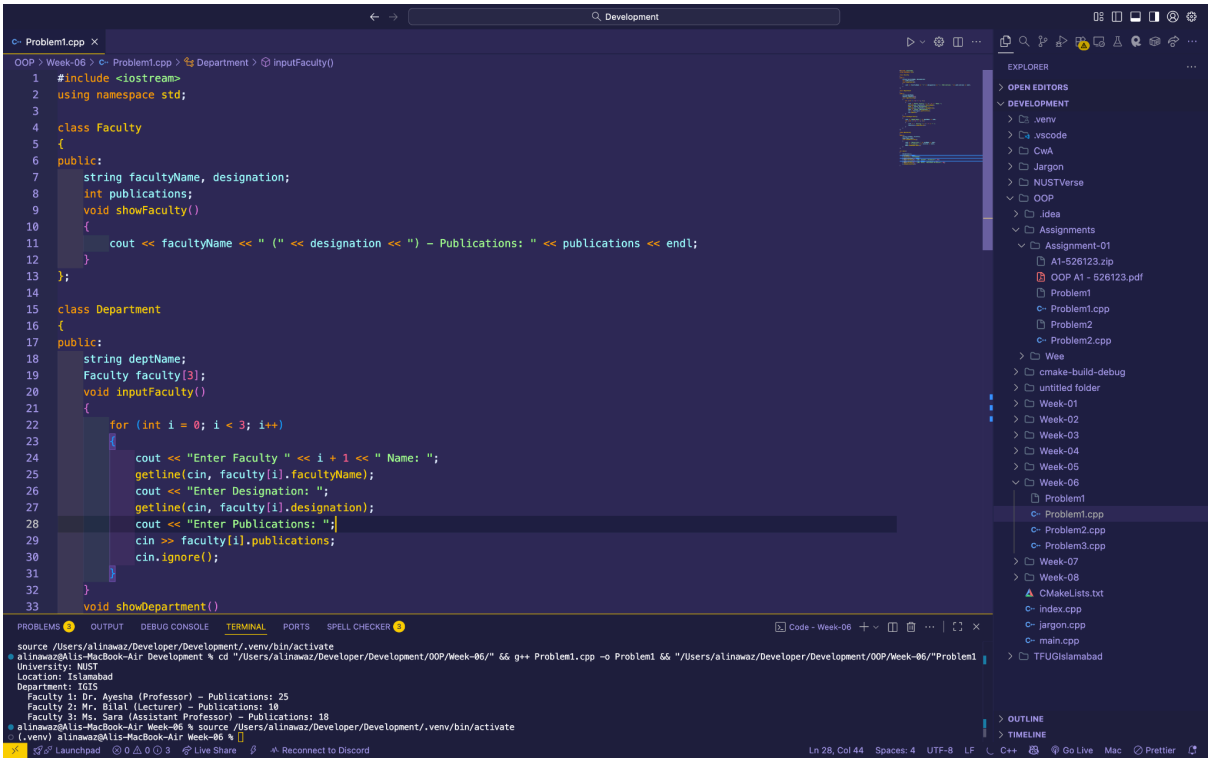
- string uniName, string location
- One Department object

Functions:

- void showUniversity() to display full info (University → Department → Faculty)

Challenge:
Implement hierarchical display using indentation:
University: NUST
Location: Islamabad
Department: IGIS
Faculty 1: Dr. Ayesha (Professor) - Publications: 25
Faculty 2: Mr. Bilal (Lecturer) - Publications: 10
Faculty 3: Ms. Sara (Assistant Professor) - Publications: 18

Screenshot:



Output:

Task # 2:

Objective:

To simulate object behavior and data dependency using composition.

Requirements:

1. **Create class Engine with attributes:**

- int horsepower, string type
- Function: void startEngine()

2. **Create class FuelTank with attributes:**

- float capacity, float fuelLevel

Functions:

- void refuel(float liters)
- bool consumeFuel(float amount) → returns false if insufficient fuel

3. **Create class Car with:**

- string model
- One Engine and one FuelTank

Functions:

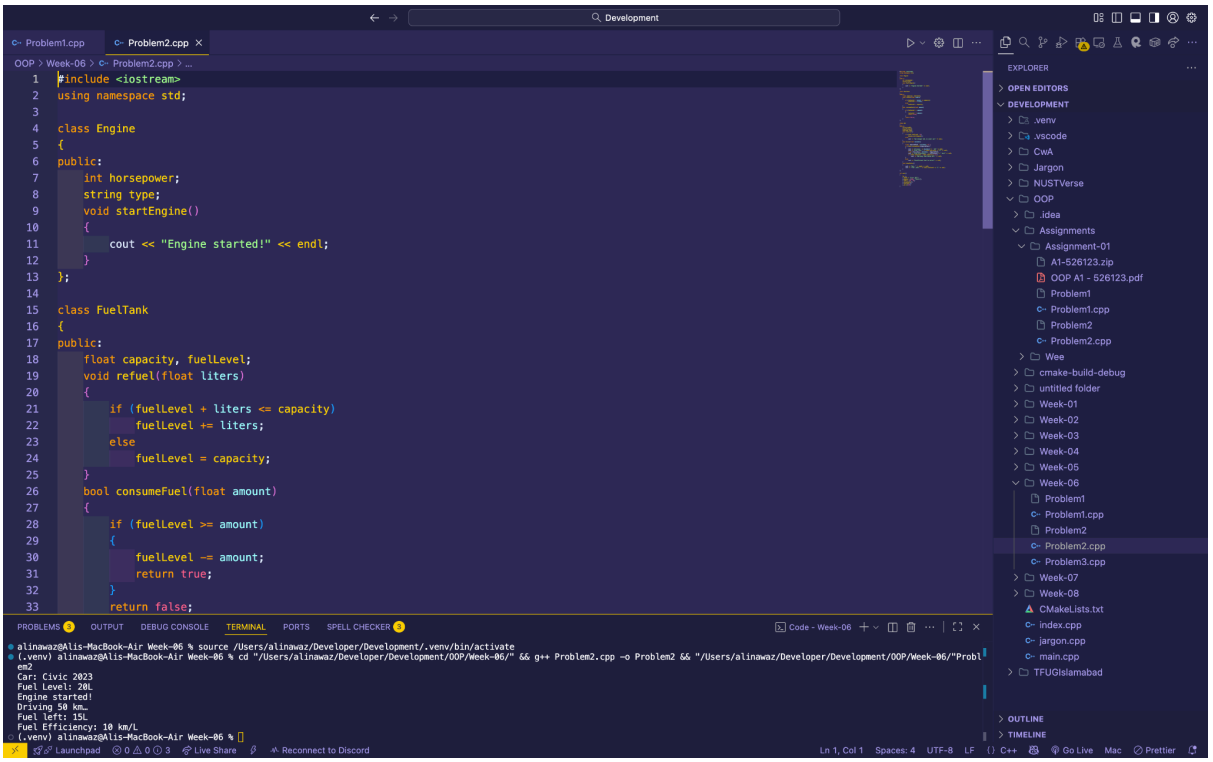
- void startCar() → check if enough fuel, then start engine
- void drive(float distance) → consumes 0.1L/km
- void showStatus()

Sample Output:

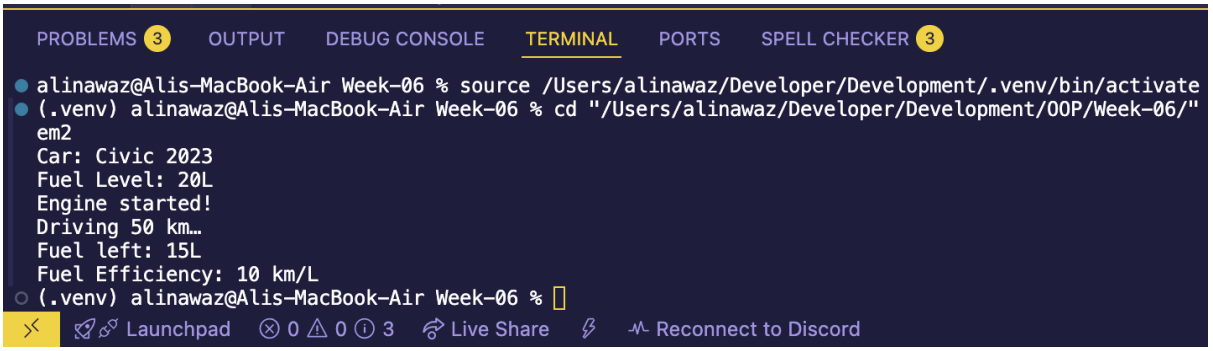
Car: Civic 2023
Fuel Level: 20L
Engine started!
Driving 50 km…
Fuel left: 15L

Challenge:
Add fuel efficiency calculation and warning when fuel < 10%.

Screenshot:



Output:



Task # 3: GIS Mapping System (Nested Composition with Arrays)

Objective: To design a real-world composite GIS model using nested class composition.

Requirements:

1. **Class Coordinate:**
- Attributes: float latitude, float longitude
- Function: void showCoordinate()

2. **Class Location:**
- Attributes: string name, one Coordinate
- Function: void showLocation()

3. **Class MapFeature:**
- Attributes: string featureType
- Array of Location objects (size 3)
- Function: void showFeature()

4. **Class Map:**
- Attribute: string mapName
- Array of MapFeature objects (size 2)
- Function: void displayMap()

Expected Output:

Map: Islamabad City Map
 Feature: Educational Institutes
  Location: NUST (33.643, 72.991)
  Location: COMSATS (33.736, 73.093)
  Location: Air University (33.718, 73.049)
 Feature: Hospitals
  Location: PIMS (33.716, 73.066)
  Location: Shifa (33.694, 73.035)
  Location: CDA Hospital (33.684, 73.048)

Challenge:

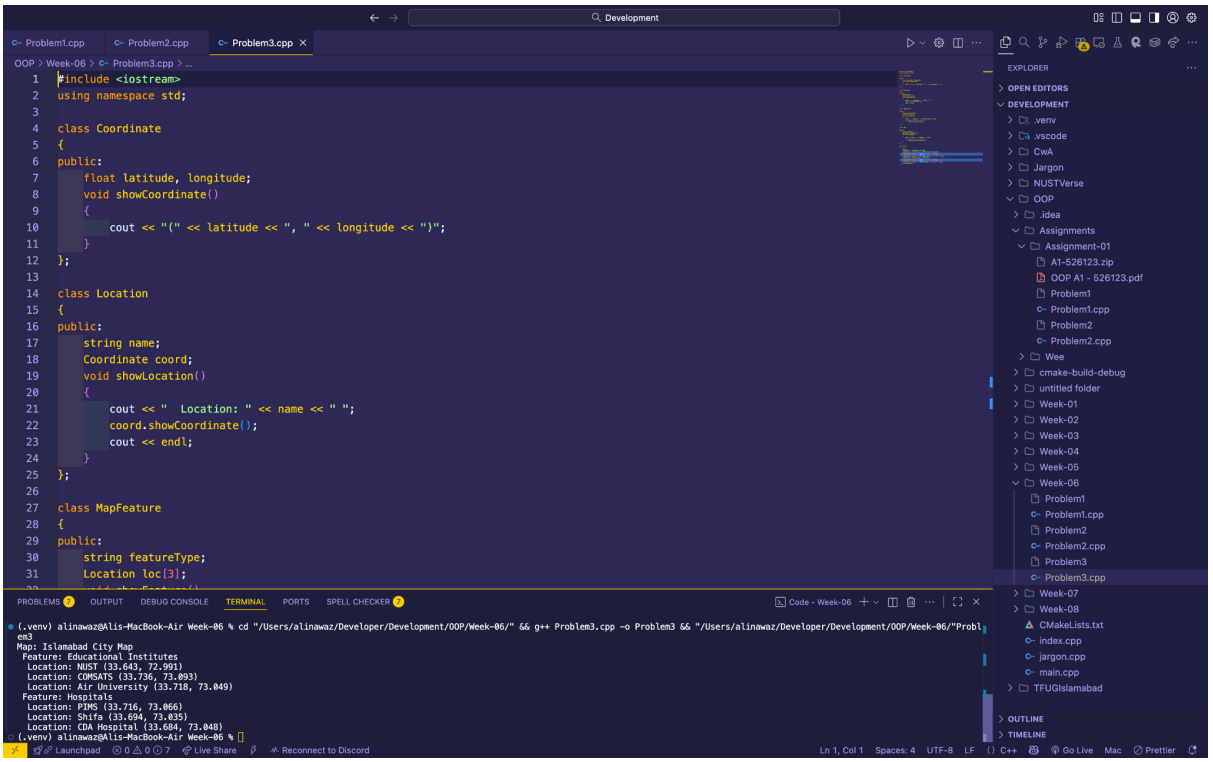
Allow user input for coordinates and dynamically count total locations on the map.

Submission Instructions

- Submit .cpp files for each task.
- Include a header comment block:

// Name: _____
// Reg. No: _____
// Section: _____
// Lab 09: Composition

Screenshot:



Output: