**Week 4 Lesson Plan: Applied Problem Solving & Final Projects**

**1. Overview:**

This final session brings together all the skills learned in Weeks 1-3, allowing students to apply AI-assisted programming, debugging, and algorithmic thinking to solve real-world problems. Students will work on guided final projects and reflect on AI’s role in structured problem-solving.

**2. Learning Goals & Key Principles:**

By the end of this session, students will be able to:

* Apply AI-assisted code generation and debugging in real-world scenarios.
* Develop structured problem-solving workflows.
* Present and iterate on AI-generated solutions.
* Reflect on the benefits and limitations of AI-assisted programming.

Key principles include:

* **Practical Application** – Bridging AI-assisted learning with real-world problem-solving.
* **Iterative Improvement** – Refining solutions based on feedback and efficiency considerations.
* **AI’s Strengths & Weaknesses** – Evaluating AI’s role in programming workflows.

**3. Mini-Lecture: Real-World AI Applications & Structured Workflows (Step-by-Step)**

**(20 min total)**

1. **Translating AI-Assisted Learning to Practical Applications** (5 min)
   * AI’s role in modern programming & automation.
   * Examples of AI-assisted development in data science & software engineering.
2. **Structured Workflows for AI-Assisted Problem Solving** (10 min)
   * Best practices for incorporating AI-generated solutions.
   * Ensuring accuracy, efficiency, and ethical considerations.
3. **Guiding Principles for Project Execution** (5 min)
   * Breaking complex problems into iterative steps.
   * Verifying AI-generated outputs before implementation.

**4. Hands-on Final Project Activities**

**(60 min total, divided into structured project phases)**

**Phase 1: Project Selection & AI-Assisted Problem Solving (20 min)**

* Students select or are assigned real-world problems.
* **AI-assisted brainstorming:** Prompt AI for initial coding solutions.
* **Instructor guidance:** Refining AI-generated project structures.

**Phase 2: Iterative Development & Debugging (20 min)**

* Students refine AI-generated solutions based on structured debugging techniques.
* Apply performance optimizations & efficiency improvements.
* **Discussion:** How AI improves or limits development workflows.

**Phase 3: Presentation & Peer Review (20 min)**

* Students present their AI-assisted solutions.
* Peer review & feedback on strengths and areas for improvement.
* **Group discussion:** What worked well? What needs improvement?

**5. Wrap-Up & Reflection (10 min)**

* **Final Discussion:** AI’s evolving role in programming.
* **Key Takeaways:** Structured problem-solving & AI best practices.
* **Future Applications:** How students can continue refining AI-assisted workflows beyond the course.

**Appendix: Additional Exercises**

**AI in Collaborative Development**

1. **AI-Assisted Pair Programming:**
   * Students work in pairs using AI as a coding assistant.
   * Compare AI-generated contributions to human problem-solving approaches.
2. **Analyzing AI Bias in Code Generation:**
   * Students evaluate AI-generated solutions for potential biases or limitations.
   * Discussion on AI’s ethical considerations in software development.

**Advanced Problem-Solving Challenges**

1. **Multi-Step AI Code Generation Pipelines:**
   * Students develop complex scripts using multiple AI-generated components.
   * Refinement and debugging over multiple iterations.
2. **Comparing AI vs. Traditional Development Workflows:**
   * Students build a solution using both AI assistance and traditional coding methods.
   * Analyze efficiency, accuracy, and maintainability differences.

**Outcome:**

By the end of this session, students will:

* Successfully complete a structured final project using AI-assisted programming.
* Demonstrate their ability to iterate, refine, and optimize AI-generated solutions.
* Understand the **strengths, weaknesses, and ethical considerations** of AI-assisted development.
* Be equipped to integrate AI-assisted problem-solving into future coding and data science projects.