Adaptive Learning Assignment — Math Adventures (AI-Powered Adaptive Learning Prototype)

Objective

To build a minimal adaptive math learning prototype that dynamically adjusts the puzzle difficulty based on the learner's performance using either rule-based logic or a lightweight machine learning approach.

Problem Overview

The system helps children (ages 5–10) practice basic arithmetic (addition, subtraction, multiplication, division). It generates math puzzles at three difficulty levels (Easy, Medium, Hard), tracks user performance (correctness, time taken), adjusts difficulty automatically, and displays an end-of-session summary (accuracy, average time, next recommended level).

Architecture / Flow

Modules:
1. puzzle_generator.py – creates math problems by difficulty.
2. tracker.py – records correctness and response time.
3. adaptive_engine.py – decides next difficulty based on performance.
4. main.py – runs the main loop and integrates all components.

Flow Diagram (text format):
Start → User enters name & selects difficulty → Puzzle generated → User answers → Performance logged (correct/time) → Adaptive Engine adjusts next difficulty → Repeat → Display summary (accuracy, avg time, next level).

Adaptive Logic Used (Rule-Based Example)

• If user answers ≥ 3 consecutive correct & avg time < 10 sec → Increase difficulty.
• If user answers 2 consecutive wrong or avg time > 20 sec → Decrease difficulty.
• Else → Keep current level.

This keeps learners in their optimal challenge zone.

Metrics Tracked

• Number of questions attempted
• Correct answers
• Average response time
• Difficulty transitions
• Final accuracy percentage

Justification of Approach

A rule-based adaptive engine is used for simplicity and transparency. It can easily be extended later using ML models once more real user data is collected.

Sample Output (Console Example)

Welcome, Riya! Current level: Medium
Question: 7 × 3 = ?
■ Correct! Time: 8.5s → Increasing difficulty to Hard
Question: 24 ÷ 8 = ?
■ Wrong! Time: 15.3s → Decreasing difficulty to Medium

Session Summary:
Accuracy: 70%
Avg Time: 11.2s
Next Recommended Level: Medium

Repository Structure

math-adaptive-prototype/
■■ README.md
■■ requirements.txt
■■ src/
  ■■ main.py
  ■■ puzzle_generator.py
  ■■ tracker.py
  ■■ adaptive_engine.py

References

• Adaptive learning principles in EdTech
• Basic Python programming for logic control