AI-Driven Testing and Reviewing Assistant
GDG AI EduTech Track: Technical Write-Up

Problem Statement & Use Case

Students in STEM and engineering fields often struggle with motivation and effective recall when studying technical material. Traditional flashcards cover only definitions or theorems, leaving a gap in problem-solving practice and hindering long-term retention.
Our solution addresses two core needs:

- **Solve lack of Motivation** by offering varied, interactive testing modalities.
- **Optimize Recall and Active Learning** through a personalized knowledge-dependency tree that guides learners step-by-step from fundamentals to target topics.

Solution Approach

Interactive Testing Mode

1. **"Make Questions" & "Make Answers" Agents:**
    - *Question Generator* produces mixed-type cards:
        - Flashcards (definitions, theorem statements)
        - Exercises (e.g., "Compute eigenvalues of matrix A")
        - True/False prompts
        - Multiple-Choice items
2. **Card-Based Testing Interface:**
    - Presents sets of cards (e.g., 10 cards) in "Apply & Test" mode.
    - Students can respond by selecting, typing or uploading handwritten solutions via OCR.

Review & Feedback Phase:

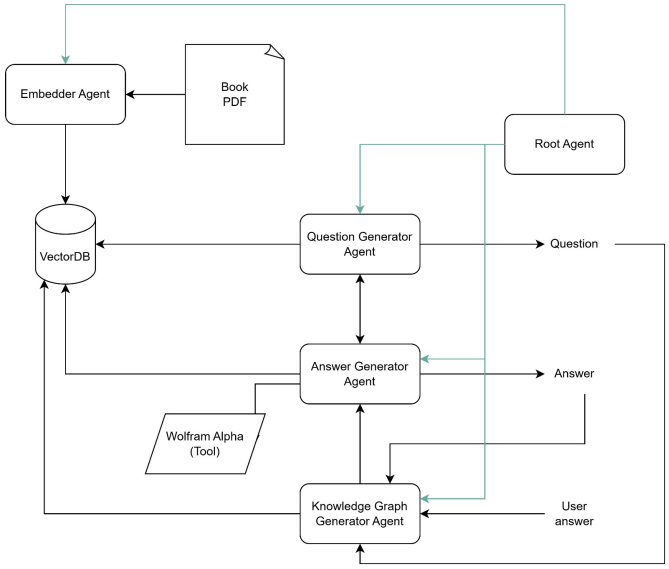
1. **Exact Answer Display:** after each card set, the system shows the correct solution for every question.
2. **Review Link:** for any incorrect response, a direct link takes the student to the exact section or paragraph in the textbook (or external source) where the concept is explained.
3. **Knowledge Tree Generation:**
    - Builds a directed graph of all prerequisite concepts.
    - Contextualizes the correct answer by referencing the specific exercise associated with each node, offering a tailored explanation within that exercise's context.
    - Each node links both to its explanatory text (chapter/paragraph or external source) and to the exact step in the exercise where the concept is applied (e.g., the determinant calculation needed for computing eigenvalues).

Phase-Separated Interface

Three distinct modes, selectable via top-bar buttons:

- **Read & Process** (passive study)
- **Apply & Test** (enriched testing mode)
- **Recall** (flashcards + spaced repetition)

Solution Approach: AI Architecture Overview



Name	Model	Functionality
Root Agent	*Gemini-2.0-flash-001*	Orchestrates request flow: routes "generate exercise" to *Question Generator*, "lookup concept" to *Embedder*, and forwards user answers to *Answer Generator* & *Knowledge Graph Generator*.
Embedder Agent	*Gemini-2.0-flash*	Leverages *LongChain* to ingest `Book PDF` via `PyPDFLoader`, splits into chunks, computes embeddings with *GoogleGenerativeAIEmbeddings*, and populates *FAISS* (VectorDB).
VectorDB	*FAISS*	Stores and indexes chunk embeddings; enables fast top-k similarity search for all agents.
Question Generator Agent	*Gemini-2.0-flash-001*	Retrieves context from VectorDB for a chosen topic; generates mixed-type cards (*flashcards*, *exercises*, *T/F*, *MCQ*); delegates solution generation to *Answer Generator*.
Answer Generator Agent	*Gemini-2.0-flash-001*	Retrieves theorems/examples from VectorDB; performs calculations via *WolframAlpha API*; produces step-by-step, contextualized solutions.
Knowledge Graph Generator Agent	*Gemini-2.0-flash-001*	Analyzes incorrect responses to identify missed concepts; constructs a directed dependency graph; links each node to the exact textbook paragraph and exercise step for interactive review.