

# Generative AI Engineer Interview Homework Assignment

## Introduction

As part of the appliedAI interview process for the Generative AI Engineer position, you are required to complete a take-home homework assignment. This assignment evaluates your ability to design and implement a multi-agent AI system using modern LLM orchestration frameworks to address a practical multi-modal information retrieval challenge.

## Task Description

Your task is to design and implement a multi-agent movie intelligence system using **LangChain** and **LangGraph**. The system must seamlessly combine three distinct capabilities, structured SQL queries, retrieval-augmented generation (RAG) over rich movie descriptions, and external web-based research, into a unified conversational interface. All functionality must be exposed through LLM-driven agents that can work independently or collaborate to answer complex, multi-step questions.

You will receive two files with this assignment:

1. **SQL movie database file (.db)** containing structured tables such as movies, financials, actors, movie\_actor, and languages
2. **RAG\_movies.pdf** containing 100 detailed movie descriptions, each with Movie ID, Movie Name, Description, and Genre

Your goal is to design and implement a multi-agent system (or a single sophisticated agent with multiple tools) that can answer simple single-capability questions or complex questions requiring multiple agents to collaborate effectively and reliably.

## Requirements

### Core Functionality

Your system must implement three specialized agents or tools:

- **SQL Agent:** Provides analytics and structured queries over the movie database (e.g., release years, financial data, actors, languages)
- **RAG Agent:** Enables text-based search and semantic recommendations using movie descriptions and genres
- **Research Agent:** Provides contextual intelligence using live web search tools (e.g., finding producers, directors, awards, or background information)

## System Design

- Build your multi-agent framework using **LangChain** and **LangGraph** and complete the assignment within **3-to-4-hour time limit**
- Design agents that can operate independently for single-capability queries or collaborate effectively for multi-step questions
- Optional: you are welcome to implement a UI based chatbot interface to interact with the agentic system.

## Expected Capabilities

Your system should be able to handle questions ranging from simple single-agent queries to complex multi-agent workflows, such as:

- "How many movies were released in 1999?"
- "What is the movie Titanic about and what genre is it?"
- "Which film talks about Project Mayhem, when was it released, and who produced it?"

## Live Demonstration During the Interview

- Be prepared to demonstrate and discuss your solution live during the interview by running your system on sample questions provided during the session and explaining your design choices.

## Note

This assignment must be completed independently. You may use online resources, documentation, libraries, or AI coding tools (e.g., GitHub Copilot, ChatGPT, Claude) to assist with coding and debugging. However, you must adhere to the following regulations:

- Clearly disclose which AI tools were used and how they contributed to your solution.
- The core design and implementation of the multi-agent framework must reflect your own understanding and problem-solving skills.

