🧠 ReAct Research Agent – Report

i. Reasoning with LLM (Gemini) – How It Works

🔍 Step-by-Step Reasoning Involved

This application uses Gemini LLM (via Google Generative AI) for reasoning at two key steps:

1. Generating Research Questions from a Topic

- Prompt Structure: A natural-language prompt is created that asks Gemini to act like a research assistant and generate 5–6 structured, diverse questions based on a given research topic.

- LLM Reasoning Role:

  • Understands the topic
  • Decomposes it into meaningful subtopics
  • Formulates relevant, web-researchable questions

- Output: A numbered list of well-formed, domain-aware questions.

2. Synthesizing a Final Research Report

- Prompt Structure: A structured prompt combines the topic, questions, and web content snippets (from Tavily).

- LLM Reasoning Role:

  • Reads multiple content snippets per question
  • Extracts the core idea (summarization)
  • Synthesizes a well-organized, multi-part research report

- Output: A markdown report with title, introduction, question-wise findings, and conclusion.

ii. Code and Program Flow Explained

🧱 Libraries Used

- streamlit: UI framework
- google.generativeai: Gemini API
- tavily: AI-powered web search
- time: Delays for user feedback

Main Components and Their Flow

1. API Configuration
Initializes the LLM and search services.

2. Session State Initialization
Used to store and persist research data across Streamlit re-runs.

3. Research Question Generator
Uses Gemini to generate diverse questions based on the input topic with a clean output prompt.

4. Web Search Executor
For each question, Tavily searches the web and returns title, snippet, and URL.

5. Report Generator
Constructs a markdown-based prompt combining all research data and calls Gemini to compile it into a structured report.

UI Flow via Streamlit
1. User Inputs Topic
2. User Clicks Button to Start Research
3. LLM + Web Integration Steps
   - Generates questions
   - Searches for answers
   - Compiles full report
4. Displays Output

Summary of Flow
User Enters Topic → Gemini: Generate Questions → Tavily: Search Each Question → Gemini: Compile Structured Report → Streamlit Displays Report

Conclusion
This project demonstrates a ReAct-style AI agent, where the system:
- Plans via Gemini (question generation)
- Acts via Tavily (web search)
- Reflects and compiles via Gemini (report writing)

It showcases how LLMs can reason across multiple steps, coordinate with external tools (like search APIs), and produce complete, structured, human-like research outputs.