

Prompt Engineering – 100+ Lab Exercises Roadmap (Basic, Intermediate, Advanced)

□ Basic Level (30+ Exercises)

Objective: Understand foundational concepts, experiment with basic prompt formats, and explore prompt behaviors.

□ Foundations of Prompt Engineering

- Introduction to Large Language Models (LLMs).
- What is Prompt Engineering? Key terminology.
- Understand zero-shot, one-shot, and few-shot prompting.
- Introduction to prompt templates and input-output structure.
- Explore model temperature and top-p settings.

□ Basic Prompt Experiments

- Write simple factual prompts (e.g., "What is a computer?").
- Generate lists (e.g., "List 5 countries in Asia").
- Reformat text (e.g., "Convert this to title case").
- Translate between languages using prompts.
- Ask the model to summarize a paragraph.

□ Output Formatting

- Ask LLM to return answers in Markdown format.
- Prompt the model to output JSON data.
- Request numbered lists or bullet points.
- Extract structured data from unstructured input.
- Wrap responses in HTML for integration with UI.

□ Basic Roles & Context Setting

- Set persona: "You are a teacher explaining..."
- Impose tone: formal vs. casual vs. humorous.
- Specify output audience (e.g., for 6th graders).
- Ask for step-by-step reasoning.



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- Request analogy-based answers.

□ Intermediate Level (40+ Exercises)

Objective: Craft intelligent, reusable prompt systems and understand fine control over output using context, constraints, and chaining.

□ Prompt Patterns & Strategies

- Chain-of-Thought prompting.
- ReAct (Reasoning + Acting) prompting.
- Tree-of-Thought prompting.
- Role-play based prompt flows.
- Reflection-based self-improvement prompts.

□ Prompt Engineering for Tools & APIs

- Design prompts for code generation (e.g., Python, JS).
- Create structured SQL queries from natural language.
- Generate REST API documentation from prompt.
- Debug code using error-prompt explanation.
- Prompt for test case generation.

□ Contextual Prompting

- Supply background context in prompts.
- Use delimiter markers ("'", <<< >>>) for large inputs.
- Reference prior responses in chained prompts.
- Control memory with system-level instructions.
- Inject temporal or location-based constraints.

□ Industry-Specific Prompting

- Finance: Extract financial data from news articles.
- Healthcare: Summarize patient notes.
- Law: Rephrase legal documents.
- Education: Generate custom quizzes.
- HR: Draft emails and performance reviews.



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□ Advanced Level (40+ Exercises)

Objective: Create production-grade prompt systems, integrate with APIs and agents, and apply prompt engineering for autonomous systems.

□ Advanced Prompt Design & Optimization

- Token management and compression strategies.
- Use of embeddings in retrieval-augmented generation (RAG).
- Convert long documents into vectorized chunks for input.
- Dynamic prompt injection with APIs (LangChain, LlamaIndex).
- Prompt optimization using `eval()`-based testing.

□ Agents & Autonomous Prompt Systems

- Prompt chaining using LangChain agents.
- Build multi-step tool-using agents (e.g., web + code).
- Construct tools with function calling.
- Use prompt routers for context switching.
- Multi-agent communication (e.g., teacher ↔ student).

□ Prompt Evaluation & Debugging

- Evaluate prompt accuracy, safety, and hallucination.
- Identify prompt-induced biases and reduce them.
- Use OpenAI's `evals` framework or custom test sets.
- Implement A/B testing for prompts.
- Log and version-control prompts with metadata.

□ Ethical & Secure Prompting

- Prevent jailbreaks in prompts.
- Sanitize user input in public prompt forms.
- Control offensive output with constraints.
- Add moderation layers using prompt validation.
- Use guardrails to block harmful queries.

□ Capstone Projects



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- Design a chatbot that provides legal advice using prompt chaining.
- Build a content generation pipeline (SEO blogs, emails).
- Create a self-improving agent with feedback loops.
- Implement an AI tutor with memory-based prompts.
- Develop a code review assistant with prompt-based correction.

□ Tools & Libraries

- LangChain, LlamaIndex, PromptLayer
- OpenAI Playground, Claude Console, Gemini Studio
- Gradio, Streamlit, Chainlit
- Replit, Jupyter Notebooks
- LangSmith (for logging, tracing)

□ Resources

- OpenAI Cookbook, Anthropic Prompt Guides
- Papers like “Prompt Programming for Large Language Models”
- OpenPrompt, DeepEval, PromptSource
- Blogs: Latent Space, Weights & Biases, OpenAI Engineering