Part 1: Theoretical Understanding

Q1: Explain the primary differences between TensorFlow and PyTorch. When would you choose one over the other?

TensorFlow uses static computation graphs (define-and-run) while **PyTorch** uses dynamic computation graphs (define-by-run).

- **PyTorch** is more intuitive and preferred in **research and experimentation** due to its Pythonic design and easier debugging.

- **TensorFlow** is more optimized for **production and deployment**, especially with tools like TensorFlow Lite and TensorFlow Serving.

Choose PyTorch when prototyping new models quickly.
Choose TensorFlow when scalability, deployment, or integration with cloud platforms is a priority.

Q2: Describe two use cases for Jupyter Notebooks in AI development.

1. **Model Prototyping and Experimentation**:
   Researchers and data scientists use Jupyter Notebooks to write and test model architectures, visualize data, and track performance interactively.

2. **Reproducible Reports and Presentations**:
   Jupyter allows mixing **code, output, and explanations** (Markdown/visuals) in one place — ideal for sharing findings, tutorials, or experiments.

Q3: How does spaCy enhance NLP tasks compared to basic Python string operations?

spaCy provides **pre-trained, linguistically-aware pipelines** that go far beyond string splitting or regex. It can:

- Perform **tokenization, POS tagging, dependency parsing**, and **named entity recognition (NER)**.

- Understand context and grammar, unlike basic `.split()` or regex which rely solely on character patterns.

This makes spaCy much more reliable for **real-world language tasks** where structure matters.

2. Comparative Analysis: Scikit-learn vs TensorFlow

Aspect	**Scikit-learn**	**TensorFlow**
Target Applications	Classical ML (SVMs, Random Forests, etc.)	Deep Learning (Neural Nets, CNNs, RNNs, etc.)
Ease of Use	Very beginner-friendly with simple syntax	More complex (especially graph concepts), but Keras makes it easier
Community Support	Strong, mature, and stable	Huge global support, especially for DL and deployment