Theoretical Understanding (40%)

1. Short Answer Questions

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

TensorFlow is a deep learning framework developed by Google that uses static computation graphs (though TensorFlow 2 supports eager execution). PyTorch, developed by Meta (Facebook), uses dynamic computation graphs, which allow on-the-fly graph construction—making it more intuitive for debugging and experimentation.

When to choose:

• TensorFlow is preferred for large-scale production environments, mobile deployment (TensorFlow Lite), and compatibility with Google Cloud.
• PyTorch is ideal for research, rapid prototyping, and academic projects due to its simplicity and Pythonic design.

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

1. **Interactive Experimentation:** Jupyter allows data scientists to write, test, and modify code in small sections, visualize results instantly, and perform exploratory data analysis efficiently.

2. **Documentation and Presentation:** Jupyter Notebooks combine executable code, text, and visualizations, making them excellent tools for creating AI tutorials, sharing research results, and preparing reproducible reports.

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

spaCy provides pre-trained models and linguistic features such as tokenization, lemmatization, part-of-speech tagging, named entity recognition, and dependency parsing. In contrast, basic Python string operations can only handle simple text manipulations without understanding grammar or semantics. Therefore, spaCy enables developers to perform context-aware and linguistically informed text analysis efficiently.

2. Comparative Analysis

Feature	**Scikit-learn**	**TensorFlow**
Target Applications	Focuses on classical machine learning algorithms such as regression, classification, clustering, and	Designed for deep learning and neural networks, supp
Ease of Use for Beginners	Easier for beginners due to its simple, consistent API and well-documented functions.	Steeper learning curve; requires understanding of neur
Community Support	Strong community for traditional ML tasks; extensive documentation and tutorials.	Very large and active community; widely supported by