<u>**THEORETICAL ANSWERS**</u>

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

TensorFlow is developed by Google and is known for production deployment and scalability while PyTorch is developed by Facebook, preferred for research and experimentation due to its dynamic computation graph and easier debugging.

PyTorch is preferable for quick prototyping and research while TensorFlow is preferred for large-scale production or when integrating with mobile and web applications.

b) Describe two use cases for Jupyter Notebooks in AI development.

Interactive experimentation: Developers can test code snippets, visualize results, and tweak parameters in real time.

Data analysis and visualization: Jupyter supports libraries like Matplotlib and Pandas for exploring datasets and creating visual insights.

c) How does spaCy enhance NLP tasks compared to basic Python string operations?

spaCy provides advanced, pre-trained models for tokenization, part-of-speech tagging, named entity recognition, and dependency parsing—tasks that basic string methods can't handle. It is also faster, more accurate, and optimized for large-scale text processing than manual text manipulation.

<u>**Comparative Analysis**</u>

a) Compare Scikit-learn and TensorFlow in terms of:
   i.   Target applications

Scikit-learn is designed for classical machine learning algorithms such as regression, classification, clustering, and dimensionality reduction while TensorFlow focuses on deep learning and neural network models, including CNNs, RNNs, and transformers.

   ii. Ease of use for beginners.

Scikit-learn has a simple, consistent API and minimal setup hence easier to learn while TensorFlow is more complex, requires understanding of computational graphs and tensors, though Keras (built-in) simplifies usage

iii.   Community support.

Scikit-learn has strong academic and research community with extensive documentation and tutorials while TensorFlow has a very large global community, supported by Google, with vast resources for deep learning and deployment.