**Question 1: Cloud Computing for Deep Learning (20 points)**

Cloud computing offers significant advantages for deep learning applications.

(a) Define **elasticity** and **scalability** in the context of cloud computing for deep learning. (10 points)  
(b) Compare **AWS SageMaker**, **Google Vertex AI**, and **Microsoft Azure Machine Learning Studio** in terms of their deep learning capabilities. (10 points)

**Expected Output**

Write the definition and comparison for (a) and (b). No code needed.

**Answer:**

**a)**

**Elasticity:**

Elasticity in cloud computing refers to the ability of a system to automatically scale resources up or down based on demand. This ensures efficient use of resources while minimizing costs. In deep learning, elasticity allows cloud platforms to allocate more computational power when training large models and reduce resources when the workload decreases.

**Scalability:**

Scalability is the capability of a system to handle increased workload by adding more resources, either vertically (upgrading existing hardware) or horizontally (adding more machines). In deep learning, scalability ensures that as datasets and model complexity grow, the cloud infrastructure can accommodate the increasing demands without performance degradation.

b)

Comparison of AWS SageMaker, Google Vertex AI, and Microsoft Azure Machine Learning Studio

|  |  |  |  |
| --- | --- | --- | --- |
| Feature | **AWS SageMaker** | **Google Vertex AI** | **Microsoft Azure ML Studio** |
| **Ease of Use** | Moderate | High | High |
| **AutoML Capabilities** | Yes | Yes | Yes |
| **Scalability** | High | High | High |
| **Integration with Cloud Services** | Deep integration with AWS services | Deep integration with Google Cloud | Deep integration with Google Cloud |
| **GPU/TPU Support** | Yes (Nvidia GPUs) | Yes (TPUs & GPUs) | Yes (GPUs) |
| **Pricing Model** | Pay-per-use | Pay-per-use | Pay-per-use |
| **Best For** | Enterprises needing AWS integration | AI-driven applications leveraging Google Cloud | Businesses using Microsoft’s ecosystem |

Each of these cloud platforms offers powerful tools for deep learning, and the choice depends on specific project needs, preferred cloud ecosystem, and cost considerations.