UNIT I – INTRODUCTION TO CLOUD COMPUTING QUESTION BANK

I. Remembering

1. What is cloud computing in simple terms?

Cloud computing is the delivery of computing services like servers, storage, and software over the internet, enabling on-demand access to resources without direct active management by the user.

2. List five essential features that define a cloud environment.

1. On-demand self-service
2. Broad network access
3. Resource pooling
4. Rapid elasticity
5. Measured service

3. Name the three main cloud service models.

1. Infrastructure as a Service (IaaS)
2. Platform as a Service (PaaS)
3. Software as a Service (SaaS)

4. Identify the four primary deployment models used in cloud computing.

1. Public Cloud
2. Private Cloud
3. Community Cloud
4. Hybrid Cloud

5. What does on-demand self-service mean in a cloud context?

Users can automatically provision computing resources like server time and network storage as needed without requiring human interaction with the service provider.

6. Give two examples of well-known public cloud providers.

Amazon Web Services (AWS) and Microsoft Azure.

7. What is meant by measured service in cloud systems?

Cloud systems automatically control and optimize resource use by metering it, allowing

transparent monitoring and billing based on consumption.

8. What is broad network access?
Cloud services are available over the network and can be accessed through standard mechanisms by various client platforms like mobile phones, laptops, and tablets.

9. State one example each of front-end and back-end components in cloud architecture.

- **Front-end:** Web browser (e.g., Chrome, Firefox)
- **Back-end:** Data storage servers

II. Understanding

1. Describe how advances in virtualization contributed to the rise of cloud computing.
Virtualization allowed one physical server to be split into multiple virtual systems using a hypervisor. This made resource sharing more efficient, reduced hardware costs, and enabled the pay-as-you-go model that is foundational to cloud computing.

2. Differentiate between cluster, grid, and utility computing with one example each.

- **Cluster Computing:** Several computers linked to work as a single system for high availability or performance. *Example: A web server farm.*
- **Grid Computing:** Applies resources of numerous computers to work on a single large problem. *Example: Scientific research projects.*
- **Utility Computing:** A service provisioning model where providers offer computing resources, and customers pay for what they use. *Example: Cloud storage.*

3. Explain with an example how resource pooling benefits both providers and users.
The provider serves multiple customers from the same physical resources. For example, a cloud provider can run virtual machines for many users on one server farm. This allows the provider to reduce costs through efficiency, and the user benefits from lower prices and virtually unlimited resource availability.

4. Discuss how elasticity helps organizations manage changing workloads.
Elasticity allows organizations to rapidly scale resources out (to handle traffic spikes) or in (when demand is low). This ensures performance during peaks and avoids paying for unused capacity during lulls.

5. What is the purpose of a shared responsibility model in cloud security?
It defines the security obligations of the cloud provider and the customer. The provider

secures the cloud infrastructure, while the customer is responsible for security *in* the cloud, such as protecting their data and access management.

6. Illustrate the difference between IaaS, PaaS, and SaaS in terms of user control.

- **IaaS:** User controls OS, storage, and applications (e.g., AWS EC2).
- **PaaS:** User controls only the deployed applications (e.g., Google App Engine).
- **SaaS:** User only uses the application; no control over underlying infrastructure (e.g., Gmail).

7. Explain how the front-end and back-end interact within cloud architecture.
The front-end (client device) sends requests over the internet to the back-end. The back-end (cloud infrastructure) processes the request, manages resources, and sends the response back to the front-end.

8. Describe any five characteristics that make cloud computing distinct from traditional IT.

1. On-demand self-service
2. Broad network access
3. Resource pooling
4. Rapid elasticity
5. Measured service

9. What is the concept of data consistency in distributed systems?
It ensures that all nodes in a distributed system have the same view of data at any given time, requiring coordination and synchronization between nodes.

10. Explain how service-level agreements (SLAs) maintain quality in cloud services.
SLAs are contracts that define the level of service, availability, and performance the provider guarantees. They maintain quality by setting measurable standards and often include remedies (like service credits) if the provider fails to meet them.

III. Applying

1. A new college wants to host its learning management system online. Suggest a suitable deployment model and justify your answer.
Suggestion: Public Cloud (e.g., AWS or Azure).
Justification: It offers low initial cost, easy scalability for a growing number of students, and the provider manages all maintenance.

2. Choose the correct service model for each of the following:
a) A company hosting its website: **IaaS**

b) A developer testing new software: **PaaS**
c) A startup using online accounting software: **SaaS**

3. A small business faces seasonal traffic spikes. How can elasticity and measured service help it save costs?
Elasticity allows it to automatically add resources during peaks and remove them after, while **Measured Service** ensures it only pays for the resources it uses, avoiding the cost of maintaining idle servers year-round.

4. Propose a cloud-based plan for a school to manage data storage and communication.
Use **SaaS** (like Google Workspace or Microsoft 365) for email, document sharing, and collaboration. Use **IaaS** cloud storage for backing up administrative data.

5. A health-care agency wants full control of patient data. Which deployment model should it adopt?
Private Cloud. This model offers complete control over resources and security, which is crucial for sensitive patient data and regulatory compliance.

6. Recommend a service model for an organization running AI and machine-learning workloads.
IaaS. It provides the most flexibility and control over the underlying hardware (including GPUs), which is necessary for configuring and running complex AI/ML workloads.

7. Suggest how a design studio can use SaaS tools to improve collaboration.
They can use SaaS applications like Figma or Adobe Creative Cloud for real-time collaborative design work, allowing multiple designers to edit and comment on projects simultaneously from any location.

8. Choose appropriate models for the following scenarios:
a) A low-budget startup: **Public Cloud**
b) A large enterprise with strict security needs: **Private Cloud**
c) A firm wanting to combine private and public clouds: **Hybrid Cloud**

9. Identify the best cloud feature to handle sudden demand for streaming video.
Rapid Elasticity. It allows the service to automatically and quickly scale out resources to handle the traffic spike and scale back in when demand decreases.

10. Which cloud service could students use to jointly edit and store documents online?

SaaS, specifically using applications like **Google Docs** or **Microsoft Office 365**, which are designed for real-time collaboration and cloud storage.

IV. Analyzing

1. Contrast IaaS, PaaS, and SaaS in terms of user responsibilities.

- **IaaS:** User manages OS, runtime, data, and applications.
- **PaaS:** User manages only data and applications.
- **SaaS:** User manages nothing; only uses the software.

2. Examine the trade-off between availability and consistency in distributed systems.
The CAP theorem states that during a network partition (P), a system must choose between Consistency (all nodes see the same data) and Availability (every request gets a response). You cannot guarantee both simultaneously under a partition.

3. Analyze how resource pooling enables multi-tenancy.
Resource pooling allows the provider to serve multiple customers (tenants) from the same shared physical resources. The provider dynamically assigns and reassigns resources according to demand, making multi-tenancy cost-effective and efficient.
(Source: Unit I-Intro-to-Cloud-Computing.pdf - Page 45)

4. Compare cluster and grid computing in terms of architecture and scalability.

- **Cluster:** Tightly-coupled computers in one location, working as a single system. Scalable but within a confined architecture.
- **Grid:** Loosely-coupled, geographically dispersed computers working on a common task. Highly scalable by adding more independent nodes from different organizations.

5. Identify the main components of a cloud system and explain their interaction.
Main Components: Client Infrastructure, Application, Service, Runtime Cloud, Storage, Infrastructure, Management, Security, Internet.
Interaction: The client uses the internet to access services hosted on the back-end, which are managed and secured by the provider's infrastructure.

6. Analyze the pros and cons of adopting a hybrid cloud for a global company.
Pros: Flexibility, control over sensitive data (on private cloud), cost-effectiveness for variable workloads (on public cloud).

Cons: Complexity to manage, potential data transfer latency, and higher initial setup cost.

7. Discuss how measured service influences cost optimization.
It provides transparency into resource usage, allowing organizations to identify and eliminate waste, scale inefficient services, and only pay for what they actually use, leading to direct cost savings.

8. Differentiate between horizontal and vertical scaling with suitable examples.

- **Vertical Scaling (Scaling Up):** Adding power (CPU, RAM) to an existing server. *Example: Upgrading an AWS instance from a t3.small to a t3.large.*
- **Horizontal Scaling (Scaling Out):** Adding more servers to a pool. *Example: Adding more web servers behind a load balancer to handle more users.*

9. Examine trade-offs between consistency and availability (CAP) with a short scenario.
Scenario: A social media post is updated.

- **Choosing Consistency:** The system may become temporarily unavailable to ensure all users see the updated post simultaneously, preventing some from seeing old data.
- **Choosing Availability:** The system remains responsive, but some users might briefly see the old post until the update propagates to all servers (eventual consistency).

V. Evaluating

1. "Cloud computing is economical and flexible for modern enterprises." Discuss.
Agree. It converts capital expenditure (buying hardware) to operational expenditure (paying for services). Its on-demand nature provides flexibility to scale instantly, supporting business agility and growth without upfront investment.

2. Evaluate key security and privacy concerns in cloud computing and propose safeguards.
Concerns: Data theft, multi-tenancy risks, and compliance.
Safeguards: Use encryption for data, implement strong access controls (IAM), and choose providers with compliance certifications (e.g., ISO 27001).

3. Evaluate whether the public cloud is suitable for government projects with sensitive data.
Not ideally suitable. While cost-effective, the public cloud's shared infrastructure can pose security and privacy risks for highly sensitive government data. A private or community

cloud would offer more control and security.

4. "Measured service lies at the heart of cloud efficiency." Do you agree? Give reasons.
Yes. Measured service enables the pay-per-use model, which directly links cost to consumption. This eliminates waste, provides cost transparency, and is the foundation for the economic efficiency of cloud computing.

5. Critically compare utility computing and cloud computing.

- **Utility Computing:** A business model focused on providing computational resources and charging based on usage, similar to electricity.
- **Cloud Computing:** A broader technology that includes utility pricing but also encompasses on-demand self-service, rapid elasticity, and various service models (IaaS, PaaS, SaaS). Cloud computing is the realization of the utility computing concept.

6. Judge whether hybrid cloud is always the ideal enterprise solution. Support your view.
No, not always. It is ideal for businesses needing a balance of security and scalability. However, its complexity and management overhead can be overkill for small businesses or those with workloads that fit entirely and securely in a public cloud.

7. Evaluate the effectiveness of SLAs in managing provider-client relationships.
SLAs are effective as they set clear, measurable expectations for service quality and uptime. They provide a framework for accountability and often include penalties for non-compliance, which helps maintain trust and service standards.

8. Discuss whether open-source cloud platforms can match proprietary systems in reliability.
They can. Open-source platforms like OpenStack have matured and are used by large enterprises, offering high reliability. However, they may require more in-house expertise to set up and manage compared to proprietary systems like VMware, which offer integrated support.
(Requires synthesis of concepts from Virtualization & Cloud Challenges)

VI. Creating

1. Design a labeled diagram showing cloud architecture with front-end, back-end, and resource layers.
(Conceptual Diagram Description)

- **Front End:** User devices (Laptop, Mobile) connected via the Internet.
- **Back End:** Central Server.
- **Resource Layers within Back End:**
    - Application
    - Service
    - Runtime Cloud
    - Storage
    - Infrastructure (Hardware)
- **Management & Security** surrounding the back-end components.

2. Propose a cloud-based system for streaming a live cultural event to a large online audience.

Use a **Public Cloud (IaaS/PaaS)**. Leverage its **rapid elasticity** to scale server and bandwidth capacity for the live stream. Use a **CDN (Content Delivery Network)** to deliver the stream globally with low latency. Process and store the recorded video using cloud storage and analytics services.

(Synthesis of concepts from Unit I - Characteristics & Service Models)

3. Outline a migration plan for moving a small business from on-premise servers to the cloud.

1. **Assessment:** Audit existing applications and data.
2. **Planning:** Choose a cloud provider and service model (e.g., IaaS for servers, SaaS for email).
3. **Pilot Migration:** Move a non-critical application first.
4. **Data Migration:** Transfer data securely to cloud storage.
5. **Full Migration:** Move remaining applications and decommission old servers.
6. **Optimization:** Train staff and monitor usage to control costs.

(Synthesis of concepts from Key Drivers and Service Models)

4. Develop an awareness campaign for teaching students about safe cloud usage.
Campaign: "Cloud Smart, Cloud Safe"

- **Topics:** Strong passwords & 2FA, recognizing phishing scams, understanding data privacy settings on cloud apps, responsible use of shared documents.
- **Methods:** Interactive workshops, infographics, and real-world scenario quizzes.

(Synthesis of concepts from Security and Privacy challenges)