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Roll no:26

**Cloud Computing Assignment**

**Google Cloud**

* Compute Services

• Cloud Functions has a simple and intuitive developer experience. Just write your code and let Google Cloud handle the operational infrastructure. Develop faster by writing and running small code snippets that respond to events. Connect to Google Cloud or third-party cloud services via triggers to streamline challenging orchestration problems.

• Google App Engine is a Platform as a Service and cloud computing platform for developing and hosting web applications in Google-managed data centers. Applications are sandboxed and run across multiple servers.

• Google Kubernetes Engine (GKE) provides a managed environment for deploying, managing, and scaling your containerized applications using Google infrastructure. The GKE environment consists of multiple machines (specifically, Compute Engine instances) grouped together to form a cluster.

• Compute Engine lets you create and run virtual machines on Google infrastructure. Compute Engine offers scale, performance, and value that lets you easily launch large compute clusters on Google's infrastructure. There are no upfront investments, and you can run thousands of virtual CPUs on a system that offers quick, consistent performance.

* Networking Services

• Hybrid connectivity cloud Interconnect, Cloud VPN, Carrier Peering, and Direct Peering provide connectivity solutions for Google Cloud. Cloud Interconnect delivers an enterprisegrade connection to Virtual Private Cloud. Direct Peering lets you connect directly to Google Cloud or you can choose a partner with Carrier Peering.

• Virtual Private Cloud (VPC) Provision, connect, or isolate Google Cloud resources using the Google global network. Define fine-grained networking policies with Google Cloud, onpremises, or public cloud infrastructure. VPC network includes granular IP address range selection, routes, firewall, Cloud VPN (Virtual Private Network), and Cloud Router.

• Cloud DNS is a scalable, reliable, programmable, and managed authoritative domain naming system (DNS) service running on the same infrastructure as Google. Cloud DNS translates domain names like www.google.com into IP addresses like 74.125.29.101. Use our simple interface, a command line, or API to publish and manage millions of DNS zones and records.

* Storage Services

• Cloud Storage simply store your data in Cloud Storage to get secure and highly available object storage at low costs. A consistent API, latency, and speed across storage classes makes development easy.

• Persistent Disk use block storage that is suitable for any virtual machine or container. Storage volumes can be transparently resized, quickly backed up, and support simultaneous readers.

• Filestore fully managed, scalable file storage with predictable performance.

• Cloud Storage for Firebase quickly and easily store and serve user-generated content. The Firebase SDKs for Cloud Storage add Google security to file uploads and downloads for your Firebase apps.

• Data transfer services transfer your structured and unstructured datasets quickly to Cloud Storage, BigQuery, or Cloud Dataproc. Move petabytes with a bulk transfer, stream data directly into Google Cloud, or upload via the command line.

• Google Workspace Essentials a collaborative space for storing, sharing, and editing files. With Google-grade security, artificial intelligence, and real-time collaboration, it’s a modern alternative to legacy ECMs.

* Database Services

• Cloud SQL is a fully managed database service that makes it easy to set up and manage your relational PostgreSQL, MySQL, and SQL Server databases in the cloud.

• Cloud Bigtable is a NoSQL database service for use cases where low latency reads and high throughput writes, scalability, and reliability are critical.

• Cloud Spanner is a scalable relational database service built to support transactions, strong consistency, and high availability across regions and continents.

• Cloud Memorystore is a fully managed in-memory data store service for Redis built on scalable, more secure, and highly available infrastructure.

• Cloud Firestore is a fast, fully managed, serverless, cloud-native NoSQL document database.

• Firebase Realtime Database is a cloud-hosted NoSQL database that lets you store and sync data between your users in real time.

• BigQuery is a serverless, highly scalable, and cost-effective data warehouse designed to help you make informed decisions quickly

**Micorsoft Azure**

* Compute Services

• Virtual Machine: It is an IaaS service, allowing us to deploy and manage VMs inside a virtual network (VNet).

• App Service: It is a managed PaaS offering for hosting web apps, mobile app back ends, RESTful APIs, or automated business processes.

• Service Fabric: It is a platform that can run on any environment, including Azure or onpremises. It is an orchestrator of micro-services across a cluster of machine

• Azure Kubernetes Services: It manages a hosted Kubernetes service for running containerized applications.

• Azure Container Instances: It offers the fastest and most straightforward way to run a container in Azure without having to provision any virtual machines and without having to adopt a high-level service.

• Azure Functions: It is a managed FaaS service.

• Azure Batch: It is a managed service for running large-scale parallel and high-performance computing (HPC) applications.

• Cloud Services: It is a managed service for running cloud applications. It uses a PaaS hosting model.

* Networking Services

• Virtual network Enables Azure resources to securely communicate with each other, the internet, and on-premises networks.

• ExpressRoute Extends your on-premises networks into the Microsoft cloud over a private connection facilitated by a connectivity provider.

• VPN Gateway Sends encrypted traffic between an Azure virtual network and an onpremises location over the public Internet.

• Virtual WAN Optimizes and automates branch connectivity to, and through, Azure. Azure regions serve as hubs that you can choose to connect your branches to.

• Azure DNS Hosts DNS domains that provide name resolution by using Microsoft Azure infrastructure.

• Azure Bastion Configure secure and seamless RDP/SSH connectivity to your virtual machines directly in the Azure portal over TLS. When you connect via Azure Bastion, your virtual machines do not need a public IP address

• Virtual network NAT Gateway Create a NAT gateway to provide outbound connectivity for a virtual machine.

• Azure Peering Service Collaborate with service providers for optimal and reliable routing to the Microsoft cloud over the public network.

• Azure Edge Zones Deploy VMs, containers, and other services to Edge Zones to address low latency and high throughput requirements.

• Azure Orbital Communicate with your spacecraft or satellite constellations, downlink and uplink data, process your data in the cloud, chain services with Azure services in unique scenarios, and generate products for your customers.

* Storage Services

• Azure Blobs: A massively scalable object store for text and binary data. Also includes support for big data analytics through Data Lake Storage Gen2.

• Azure Files: Managed file shares for cloud or on-premises deployments.

• Azure Queues: A messaging store for reliable messaging between application components.

• Azure Tables: A NoSQL store for schema less storage of structured data.

* Azure Disks: Block-level storage volumes for Azure VMs.
* Database Services

• Azure SQL Database is a relational database-as-a service using the Microsoft SQL Server Engine. SQL Database is a high-performance, reliable, and secure database you can use to build data-driven applications and websites in the programming language of your choice, without needing to manage infrastructure.

• Azure Cosmos DB provides native support for NoSQL choices, offers multiple well-defined consistency models, guarantees single-digit-millisecond latencies at the 99th percentile, and guarantees high availability with multi-homing capabilities and low latencies anywhere in the world. • Azure SQL Data Warehouse is a cloud-based Enterprise Data Warehouse (EDW) that leverages Massively Parallel Processing (MPP) to quickly run complex queries across petabytes of data.

• Azure Data Factory (ADF) is a service designed to allow developers to integrate disparate data sources. It provides access to on-premises data in SQL Server and cloud data in Azure Storage (Blob and Tables) and Azure SQL Database.

• Azure Redis Cache is a secure data cache and messaging broker that provides high throughput and low-latency access to data for applications.

• Azure SQL Server Stretch Database lets you dynamically stretch warm and cold transactional data from Microsoft SQL Server 2016 to Microsoft Azure.

• SQL Server on Virtual Machines Spin up a virtual machine, back up your SQL Server instance, and restore it into Azure. It’s that easy to reduce your capital investments and optimize operational expenses by migrating your on-premises SQL Server to the cloud. Spin up a virtual machine, back up your SQL Server instance, and restore it into Azure. It's that easy to reduce your capital investments and optimize operational expenses by migrating your on-premises SQL Server to the cloud.

• Azure Table storage stores large amounts of structured data. The service is a NoSQL datastore which accepts authenticated calls from inside and outside the Azure cloud.

• Azure Database for MySQL is a fully-managed database service for app developers and it is capable of handing mission-critical workload with predictable performance and dynamic scalability.

• Azure Database Migration Service is designed as a seamless, end-to-end solution for moving on-premises SQL Server databases to the cloud.

**Amazon Web Services**

Amazon Web Services is a subsidiary of Amazon providing on-demand cloud computing platforms and APIs to individuals, companies, and governments, on a metered pay-as-you-go basis Amazon Web Services offers reliable, scalable, and inexpensive cloud computing services.

1. AWS Compute

AWS offer the broadest choice of compute services with the deepest functionality, more than any other cloud provider. ϖ Amazon Lightsail:

* Virtual servers, storage, databases, and networking for a low, predictable price.
* Lightsail is an easy-to-use cloud platform that offers you everything needed to build an application or website, plus a cost-effective, monthly plan.
* Lightsail is ideal for simpler workloads, quick deployments, and getting started on AWS. It’s designed to help you start small, and then scale as you grow. ϖ AWS Batch:
* AWS Batch enables developers, scientists, and engineers to easily and efficiently run hundreds of thousands of batch computing jobs on AWS.
* AWS Batch dynamically provisions the optimal quantity and type of compute resources (e.g., CPU or memory optimized instances) based on the volume and specific resource requirements of the batch jobs submitted.
* AWS Batch plans, schedules, and executes your batch computing workloads across the full range of AWS compute services and features, such as Amazon EC2 and Spot Instances.
* AWS Elastic Beanstalk:
* AWS Elastic Beanstalk is an easy-to-use service for deploying and scaling web applications and services developed with Java, .NET, PHP, Node.js, Python, Ruby, Go, and Docker on familiar servers such as Apache, Nginx, Passenger, and IIS.
* You can simply upload your code and Elastic Beanstalk automatically handles the deployment, from capacity provisioning, load balancing, auto-scaling to application health monitoring.
* There is no additional charge for Elastic Beanstalk , you pay only for the AWS resources needed to store and run your applications. ϖ AWS Lambda:
* Run code without thinking about servers. Pay only for the compute time you consume.
* AWS Lambda lets you run code without provisioning or managing servers.
* You pay only for the compute time you consume.
* With Lambda, you can run code for virtually any type of application or backend service all with zero administration.
* Just upload your code and Lambda takes care of everything required to run and scale your code with high availability.
* You can set up your code to automatically trigger from other AWS services or call it directly from any web or mobile app.

1. AWS Networking

* AWS provides the broadest and deepest set of networking services with the highest reliability, most security features, and highest performance in the world. Networking capabilities are designed to meet the most stringent security requirements in the world. ϖ Amazon Virtual Private Cloud:
* Amazon Virtual Private Cloud (Amazon VPC) lets you provision a logically isolated section of the AWS Cloud where you can launch AWS resources in a virtual network that you define.
* You have complete control over your virtual networking environment, including selection of your own IP address range, creation of subnets, and configuration of route tables and network gateways.
* You can use both IPv4 and IPv6 in your VPC for secure and easy access to resources and applications. ϖ Amazon API Gateway:
* Amazon API Gateway is a fully managed service that makes it easy for developers to create, publish, maintain, monitor, and secure APIs at any scale.
* APIs act as the "front door" for applications to access data, business logic, or functionality from your backend services.
* Using API Gateway, you can create RESTful APIs and WebSocket APIs that enable real-time two-way communication applications.
* API Gateway supports containerized and serverless workloads, as well as web applications.
* AWS Global Accelerator:
* AWS Global Accelerator is a networking service that sends your user’s traffic through Amazon Web Service’s global network infrastructure, improving your internet user performance by up to 60%.
* When the internet is congested, Global Accelerator’s automatic routing optimizations will help keep your packet loss, jitter, and latency consistently low.
* With Global Accelerator, you are provided two global static customer facing IPs to simplify traffic management.
* On the back end, add or remove your AWS application origins, such as Network Load Balancers, Application Load Balancers, Elastic IPs, and EC2 Instances, without making user facing changes.
* AWS App Mesh:
* Application-level networking for all your services.
* AWS App Mesh is a service mesh that provides application-level networking to make it easy for your services to communicate with each other across multiple types of compute infrastructure.
* App Mesh standardizes how your services communicate, giving you endto-end visibility and ensuring high-availability for your applications.
* AWS App Mesh makes it easy to run services by providing consistent visibility and network traffic controls for services built across multiple types of compute infrastructure.

1. AWS Storage

AWS offers a complete range of services for you to store, access, govern, and analyze your data to reduce costs, increase agility, and accelerate innovation.

* Amazon Elastic File System:
* Amazon Elastic File System (Amazon EFS) provides a simple, scalable, fully managed elastic NFS file system for use with AWS Cloud services and on-premises resources.
* It is built to scale on demand to petabytes without disrupting applications, growing and shrinking automatically as you add and remove files, eliminating the need to provision and manage capacity to accommodate growth.
* Amazon EFS offers two storage classes: the Standard storage class, and the Infrequent Access storage class (EFS IA).
* Amazon EFS transparently serves files from both storage classes in a common file system namespace. ϖ Amazon FSx for Lustre:
* Amazon FSx for Lustre is a fully managed service that provides costeffective, high-performance storage for compute workloads.
* Powered by Lustre, the world's most popular high-performance file system, FSx for Lustre offers sub-millisecond latencies, up to hundreds of gigabytes per second of throughput, and millions of IOPS.
* It provides multiple deployment options and storage types to optimize cost and performance for your workload requirements.
* FSx for Lustre file systems can also be linked to Amazon S3 buckets, allowing you to access and process data concurrently from both a highperformance file system and from the S3 API. ϖ Amazon S3 Glacier:
* Amazon S3 Glacier and S3 Glacier Deep Archive are a secure, durable, and extremely low-cost Amazon S3 cloud storage classes for data archiving and long-term backup.
* Customers can store data for as little as $1 per terabyte per month, a significant savings compared to on-premises solutions.
* S3 Glacier provides three options for access to archives, from a few minutes to several hours, and S3 Glacier Deep Archive provides two access options ranging from 12 to 48 hours. ϖ AWS Backup:
* It is a fully managed backup service that makes it easy to centralize and automate the backup of data across AWS services.
* Using AWS Backup, you can centrally configure backup policies and monitor backup activity for AWS resources, such as Amazon EBS volumes, Amazon EC2 instances, Amazon RDS databases, Amazon DynamoDB tables, Amazon EFS file systems, and AWS Storage Gateway volumes.
* AWS Backup automates and consolidates backup tasks previously performed service-by-service, removing the need to create custom scripts and manual processes.
* AWS Backup provides a fully managed, policy-based backup solution, simplifying your backup management, enabling you to meet your business and regulatory backup compliance requirements.

1. AWS Databases

AWS databases are built for business-critical, enterprise workloads, offering high availability, reliability, and security.

ϖ Amazon Aurora:

* Amazon Aurora is a MySQL and PostgreSQL-compatible relational database built for the cloud, that combines the performance and availability of traditional enterprise databases with the simplicity and cost-effectiveness of open source databases. ¬ Amazon Aurora is up to five times faster than standard MySQL databases and three times faster than standard PostgreSQL databases.
* It provides the security, availability, and reliability of commercial databases at 1/10th the cost.
* Amazon Aurora is fully managed by Amazon Relational Database Service (RDS), which automates time-consuming administration tasks like hardware provisioning, database setup, patching, and backups.

ϖ Amazon DynamoDB:

* Amazon DynamoDB is a key-value and document database that delivers single-digit millisecond performance at any scale.
* It's a fully managed, multiregion, multimaster, durable database with built-in security, backup and restore, and in-memory caching for internet-scale applications.
* DynamoDB can handle more than 10 trillion requests per day and can support peaks of more than 20 million requests per second. ϖ Amazon Redshift: ¬ Most popular and fastest cloud data warehouse.
* Companies like Lyft have grown with Redshift from startups to multibillion dollar enterprises.
* With Redshift you can query petabytes of structured and semistructured data across your data warehouse, operational database, and your data lake using standard SQL. ϖ Amazon ElastiCache:
* Fully managed in-memory data store, compatible with Redis or Memcached. ¬ Power real-time applications with sub-millisecond latency.
* Amazon ElastiCache allows you to seamlessly set up, run, and scale popular open-Source compatible in-memory data stores in the cloud.
* Amazon ElastiCache is a popular choice for real-time use cases like Caching, Session Stores, Gaming, Geospatial Services, Real-Time Analytics, and Queuing.
* Amazon ElastiCache offers fully managed Redis and Memcached for your most demanding applications that require sub-millisecond response times.