

Assignment 1, Cloud Computing

Put all deliverables into github repository in your profile. Share link to google form 24 hours before defense. Defend by explaining deliverables and answering questions.

Deliverables: report in pdf

1. Google form:

https://docs.google.com/forms/d/e/1FAIpQLSe0GyNdOYlvM1tX_I_CtlPod5jBf-ACLGdHZq1gVZbUeBzIg/viewform?usp=sf_link

Exercise 1: Understanding Cloud Computing Models

Objective: Explore different cloud computing models and understand their key differences.

2. Steps:

Research the three primary cloud service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).

1) What is IaaS?

IaaS provides virtualized computing resources over the internet. Instead of buying physical servers, storage, or networking hardware, you rent them from a cloud provider. You have control over the infrastructure but don't have to worry about managing the physical hardware.

2) What is PaaS?

PaaS provides a platform that lets developers build, run, and manage applications without having to worry about underlying infrastructure (like servers or storage). It simplifies the development process by offering pre-configured environments and services.

3) What is SaaS?

SaaS provides fully functional software that you can use directly over the internet. You don't need to install or manage anything—just log in and use the software. The provider manages everything, including infrastructure, platforms, and the software itself.

- Create a table comparing these models in terms of control, flexibility, and use cases.

Aspect	IaaS (Infrastructure as a Service)	PaaS (Platform as a Service)	SaaS (Software as a Service)
Control	High control: Users manage infrastructure (servers, storage, network).	Medium control: Users manage applications; provider manages infrastructure.	Low control: Provider manages everything; users only access the software.

Flexibility	Highly flexible: Users can configure infrastructure to meet specific needs.	Moderate flexibility: Users focus on building apps without worrying about infrastructure.	Low flexibility: Users customize limited features of software.
Use Cases	<ul style="list-style-type: none"> - Hosting websites and apps - Backup and storage - High-performance computing 	<ul style="list-style-type: none"> - Application development - Data analytics - IoT development 	<ul style="list-style-type: none"> - Email services - CRM tools - Collaboration software
Examples of GCP Services	<ul style="list-style-type: none"> - Compute Engine (VM instances) - Cloud Storage - Cloud Load Balancing 	<ul style="list-style-type: none"> - App Engine - Cloud Functions - BigQuery 	<ul style="list-style-type: none"> - Google Workspace (Gmail, Drive, Docs) - Google Maps API

- o Identify examples of services offered by Google Cloud Platform (GCP) under each model.

3. Questions:

What are the main differences between IaaS, PaaS, and SaaS?

IaaS (Infrastructure as a Service):

- 1) Control over virtual machines, storage, and networking.
- 2) Highly customizable.
- 3) Ideal for managing your own infrastructure (e.g., Google Compute Engine).

PaaS (Platform as a Service):

- 1) Manage applications; provider handles infrastructure.
- 2) Focus on app development without server management.
- 3) Best for developers (e.g., Google App Engine).

SaaS (Software as a Service):

- 1) Least control; software fully managed by the provider.
- 2) Ready-to-use with minimal customization.
- 3) For accessing software online (e.g., Google Workspace).

1) Which GCP services fall under each of these models?

1. IaaS (Infrastructure as a Service):

Google Compute Engine: Provides virtual machines (VMs) to run your applications.

Google Cloud Storage: Offers scalable and secure object storage.

Google VPC: Virtual Private Cloud for configuring networks and controlling traffic.

2. PaaS (Platform as a Service):

Google App Engine: A fully managed platform for building and deploying web apps.

Google Cloud Functions: Serverless compute service that executes code in response to events.

Google BigQuery: A fully managed data warehouse for large-scale data analytics.

3. SaaS (Software as a Service):

Google Workspace: A suite of productivity tools (Gmail, Google Docs, Drive, etc.).

Google Maps API: Provides mapping and location services.

Google Cloud Identity: A service for managing users, apps, and devices securely.

These services are tailored for different levels of control and management depending on the model.

2) Provide a real-world example where each cloud service model might be the most appropriate choice.

IaaS (Infrastructure as a Service)

- Example: A video game development company wants to host its game servers to handle fluctuating player demand.

Appropriate Choice: The company uses Google Compute Engine to provision virtual machines that can be quickly scaled up or down based on player activity, allowing them to manage costs effectively while ensuring a smooth gaming experience.

PaaS (Platform as a Service)

- Example: A healthcare startup is developing a patient management application and needs a platform to build, test, and deploy it without managing the underlying infrastructure.

Appropriate Choice: The startup utilizes Google App Engine, which provides an environment for running the application and automatically handles scaling and load balancing, allowing the team to focus on coding and enhancing features without infrastructure concerns.

SaaS (Software as a Service)

- Example: A marketing agency requires a solution for managing client relationships, campaigns, and sales data without the need for extensive software installations.

Appropriate Choice: The agency adopts Salesforce, a SaaS solution that allows them to manage their customer relationship management (CRM) processes through a web interface, with all updates and maintenance handled by Salesforce, freeing up resources for other tasks.

Exercise 2: Exploring Google Cloud Platform's Core Services

1. Objective: Get acquainted with the core services provided by Google Cloud Platform.

2. Steps:

- o Access the Google Cloud Console and navigate to the list of GCP services.
- o Explore and describe the purpose of the following core services:

- Compute Engine

Purpose: Provides virtual machines (VMs) to run applications on Google's infrastructure. It allows users to customize their computing environment, scale resources as needed, and manage workloads with high flexibility.

- Google Kubernetes Engine (GKE)

Purpose: A managed environment for deploying, managing, and scaling containerized applications using Kubernetes. GKE simplifies container orchestration, automates deployments, and enhances scalability and reliability.

- App Engine

Purpose: A fully managed platform for developing and hosting web applications. It abstracts the underlying infrastructure, allowing developers to focus on coding and scaling applications without worrying about server management or maintenance.

- Cloud Storage

Purpose: Provides scalable and secure object storage for storing and retrieving any amount of data. It is designed for high availability and durability, making it suitable for various data storage needs, such as backups, archives, and serving website content.

- BigQuery

Purpose: A fully managed, serverless data warehouse designed for large-scale data analytics. It allows users to run fast SQL queries on massive datasets, making it ideal for business intelligence and data analysis tasks.

3. For each service, identify a potential use case in a business scenario.

IaaS (Infrastructure as a Service)

Example: A video game development company wants to host its game servers to handle

fluctuating player demand.

PaaS (Platform as a Service)

Example: A healthcare startup is developing a patient management application and needs a platform to build, test, and deploy it without managing the underlying infrastructure.

SaaS (Software as a Service)

Example: A marketing agency requires a solution for managing client relationships, campaigns, and sales data without the need for extensive software installations.

4. Questions:

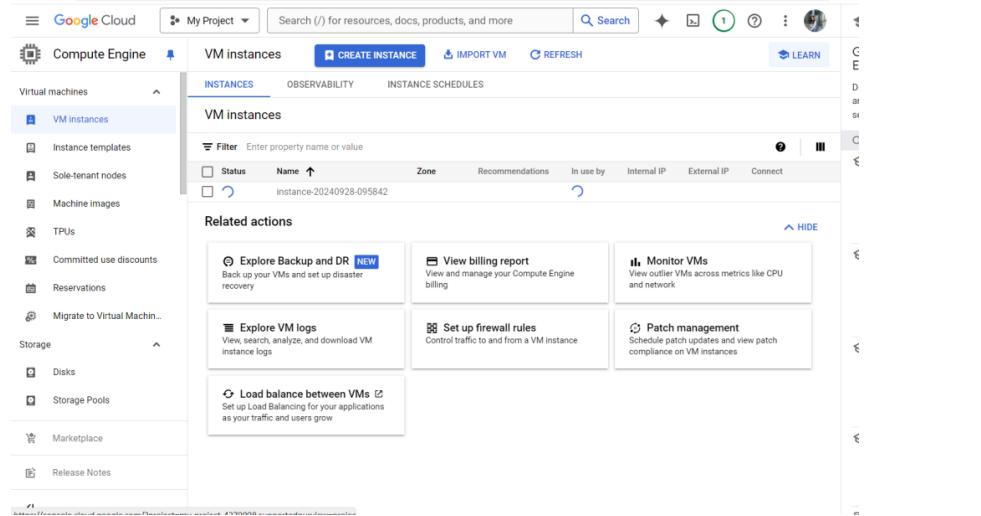
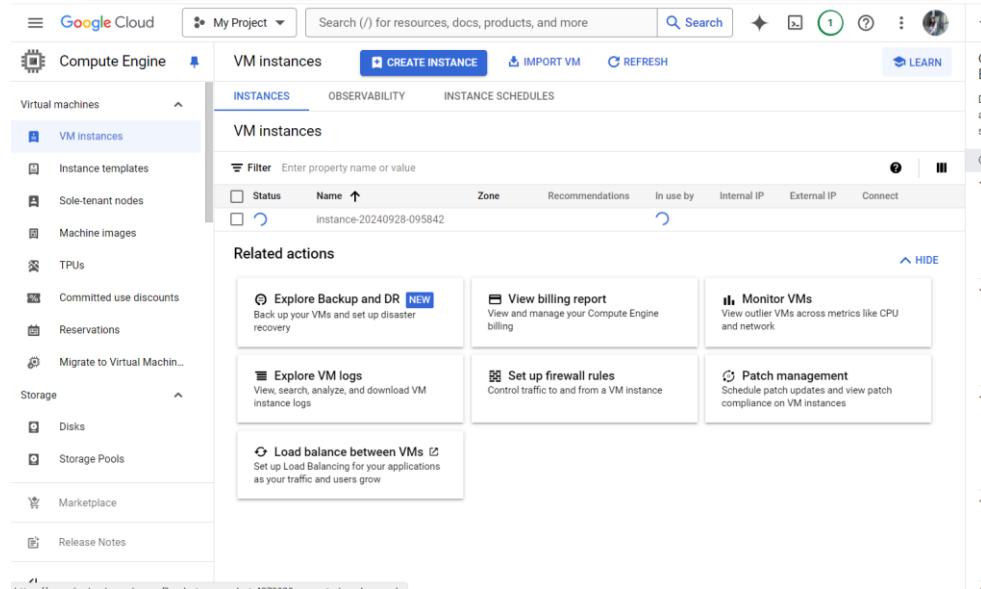
1. What is the primary use case of Compute Engine?
Running VMs to deploy scalable applications with full control over the environment.
2. How does Google Kubernetes Engine (GKE) simplify the management of containerized applications?
GKE automates deployment, scaling, and updates of containerized apps, reducing infrastructure management.
3. What advantages does Cloud Storage offer for data management?
Scalable, durable, and secure object storage with global access, redundancy, and integration with Google Cloud services.
4. Why would a business choose BigQuery for their data analysis needs?
BigQuery offers fast, scalable data analysis, handling large datasets with real-time insights and integrated machine learning.

Exercise 3: Creating and Managing Virtual Machines with Compute Engine

1. Objective: Learn how to create, manage, and interact with virtual machines (VMs) using Compute Engine.

2. Steps:

- In the Google Cloud Console, navigate to Compute Engine and create a new VM instance.
- Configure the VM with specific parameters, such as the machine type, region, and operating system.



- **Connect to the VM using SSH and install a basic web server (e.g., Apache or Nginx)**

```

SSH-in-browser
Get:25 https://deb.debian.org/debian-security/bookworm-security/main amd64 Packages [183 kB]
Get: https://deb.debian.org/debian-security/bookworm-security/main Translation-en [111 kB]
Fetched 5469 kB/s (in 0s)
Building package lists... Done
Building dependency tree... Done
Reading state information... Done
4 packages can be upgraded. Run 'apt list --upgradable' to see them.
ademo:jumaniyazova@instance-20240928-095842:~$ sudo apt install apache2 -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  apache2-bin apache2-data apache2-utils libapr1 libaprutil1 libaprutil1-db5-sqlite3 libaprutil1-ldap
  libaprutil4 liblua5.3-0 ssl-cert
Suggested packages:
  apache2-doc apache2-suexec-pristine | apache2-suexec-custom www-browser
The following NEW packages will be installed:
  apache2 apache2-bin apache2-data apache2-utils libapr1 libaprutil1 libaprutil1-db5-sqlite3
  libaprutil1-ldap libjansson4 liblua5.3-0 ssl-cert
0 upgraded, 11 newly installed, 0 to remove and 4 not upgraded.
Need to get 2378 kB of archives.
After this operation, 8464 kB of additional disk space will be used.
Get: file:///etc/apt/sources.list.d/debian-security.list [30 B]
Get:2 https://deb.debian.org/debian-security/main amd64 libapr1 amd64 1.7.2-3 [102 kB]
Get:3 https://deb.debian.org/debian-security/main amd64 libaprutil1 amd64 1.6.3-1 [87.8 kB]
Get:4 https://deb.debian.org/debian-security/main amd64 libaprutil1-db5-sqlite3 amd64 1.6.3-1 [13.6 kB]
Get:5 https://deb.debian.org/debian-security/main amd64 libaprutil1-ldap amd64 1.6.3-1 [11.8 kB]
Get: https://deb.debian.org/debian-security/main amd64 libjansson4 amd64 2.14-2 [40.8 kB]
Get:7 https://deb.debian.org/debian-security/main amd64 liblua5.3-0 amd64 5.3.6-2 [123 kB]
Get:8 https://deb.debian.org/debian-security/main amd64 apache2-bin amd64 2.4.62-1-deb12u1 [1385 kB]
Get:9 https://deb.debian.org/debian-security/main amd64 apache2-data all 2.4.62-1-deb12u1 [160 kB]
Get:10 https://deb.debian.org/debian-security/main amd64 apache2-utils amd64 2.4.62-1-deb12u1 [210 kB]
Get:11 https://deb.debian.org/debian-security/main amd64 apache2 amd64 2.4.62-1-deb12u1 [223 kB]
Get:12 https://deb.debian.org/debian-security/main amd64 ssl-cert all 1.1.2 [21.1 kB]
Fetched 2378 kB in 0s (13.6 MB/s)
Preconfiguring packages...
Selecting previously unselected package libapr1:amd64.
(Reading database ... 69885 files and directories currently installed.)
Preparing to unpack .../00-libapr1_1.7.2-3_amd64.deb ...
Unpacking libapr1:amd64 (1.7.2-3) ...
Selecting previously unselected package libaprutil1:amd64.
Preparing to unpack .../01-libaprutil1_1.6.3-1_amd64.deb ...
Unpacking libaprutil1:amd64 (1.6.3-1) ...
Selecting previously unselected package libaprutil1-db5-sqlite3:amd64.
Preparing to unpack .../02-libaprutil1-db5-sqlite3_1.6.3-1_amd64.deb ...
Unpacking libaprutil1-db5-sqlite3:amd64 (1.6.3-1) ...
Selecting previously unselected package libaprutil1-ldap:amd64.

```

- Stop, start, and delete the VM through the console.

VM instances

INSTANCE SCHEDULES

VM instances

Status	Name	Zone	Recommendations	In use by	Internal IP	External IP	Connect
<input checked="" type="checkbox"/>	instance-20240928-095842	us-central1-f			10.128.0.2 (nic0)	34.70.22.203 (nic0)	SSH

Related actions

- Explore Backup and DR NEW
Back up your VMs and set up disaster recovery
- View billing report
View and manage your Compute Engine billing
- Monitor VMs
View outlier VMs across metrics like CPU and network
- Explore VM logs
View, search, analyze, and download VM instance logs
- Set up firewall rules
Control traffic to and from a VM instance
- Patch management
Schedule patch updates and view patch compliance on VM instances
- Load balance between VMs
Set up Load Balancing for your applications as your traffic and users grow

Stopping instance-20240928-095842... X

INSTANCES OBSERVABILITY INSTANCE SCHEDULES

VM instances

Filter Enter property name or value

Status	Name ↑	Zone	Recommendations	In use by	Internal IP	External IP	Connect
<input type="checkbox"/>	instance-20240928-095842	us-central1-f			10.128.0.2 (nic0)		SSH

Related actions

Explore Backup and DR NEW
Back up your VMs and set up disaster recovery

View billing report
View and manage your Compute Engine billing

Monitor VMs
View outlier VMs across metrics like CPU and network

Explore VM logs
View, search, analyze, and download VM instance logs

Set up firewall rules
Control traffic to and from a VM instance

Patch management
Schedule patch updates and view patch compliance on VM instances

Load balance between VMs
Set up Load Balancing for your applications as your traffic and users grow

VM instance stopped

VM instances CREATE INSTANCE IMPORT VM REFRESH LEARN

INSTANCES OBSERVABILITY INSTANCE SCHEDULES

VM instances

Filter Enter property name or value

Status	Name ↑	Zone	Recommendations	In use by	Internal IP	External IP	Connect
<input type="checkbox"/>	instance-20240928-095842	us-central1-f			10.128.0.2 (nic0)		SSH

Related actions

Explore Backup and DR NEW
Back up your VMs and set up disaster recovery

Start instance-20240928-095842?
You'll be charged for running this VM according to its configuration.

Set up firewall rules
Control traffic to and from a VM instance

Patch management
Schedule patch updates and view patch compliance on VM instances

Monitor VMs
View outlier VMs across metrics like CPU and network

Explore VM logs
View, search, analyze, and download VM instance logs

Load balance between VMs
Set up Load Balancing for your applications as your traffic and users grow

VM instances CREATE INSTANCE IMPORT VM REFRESH LEARN

INSTANCES OBSERVABILITY INSTANCE SCHEDULES

VM instances

Filter Enter property name or value

Status	Name	Zone	Recommendations	In use by	Internal IP	External IP	Connect
<input checked="" type="checkbox"/>	instance-20240928-095842	us-central1-f			10.128.0.2 (nic0)	34.29.23.217 (nic0)	SSH ⋮

Related actions HIDE

Explore Backup and DR NEW
Backup up your VMs and set up disaster recovery

View billing report
View and manage your Compute Engine billing

Monitor VMs
View outlier VMs across metrics like CPU and network

Explore VM logs
View, search, analyze, and download VM instance logs

Set up firewall rules
Control traffic to and from a VM instance

Patch management
Schedule patch updates and view patch compliance on VM instances

Load balance between VMs
Set up Load Balancing for your applications as your traffic and users grow

VM instance started X

```

Linux instance-20240928-095842 6.1.0-25-cloud-amd64 #1 SMP PREEMPT_DYNAMIC Debian 6.1.106-3 (2024-08-26) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Sat Sep 28 10:07:04 2024 from 35.235.244.32
adema_jumaniyazova@instance-20240928-095842:~$ sudo systemctl status apache2
● apache2.service - The Apache HTTP Server
    Loaded: loaded (/lib/systemd/system/apache2.service; enabled; preset: enabled)
    Active: active (running) since Sat 2024-09-28 10:25:37 UTC; 3min 3s ago
      Docs: https://httpd.apache.org/docs/2.4/
   Process: 384 ExecStart=/usr/sbin/apachectl start (code=exited, status=0/SUCCESS)
 Main PID: 416 (apache2)
    Tasks: 55 (limit: 4682)
   Memory: 11.7M
      CPU: 84ms
     CGroup: /system.slice/apache2.service
             └─416 /usr/sbin/apache2 -k start
                 ├─418 /usr/sbin/apache2 -k start
                 └─419 /usr/sbin/apache2 -k start

Sep 28 10:25:37 instance-20240928-095842 systemd[1]: Starting apache2.service - The Apache HTTP Server...
Sep 28 10:25:37 instance-20240928-095842 systemd[1]: Started apache2.service - The Apache HTTP Server.
adema_jumaniyazova@instance-20240928-095842:~$ 

```

VM instances CREATE INSTANCE IMPORT VM REFRESH LEARN

INSTANCES OBSERVABILITY INSTANCE SCHEDULES

VM instances

Filter Enter property name or value

Status	Name	Zone	Recommendations	In use by	Internal IP	External IP	Connect
<input type="checkbox"/>	instance-20240928-095842	us-central1-f			10.128.0.2 (nic0)	34.29.23.217 (nic0)	SSH

Delete instance-20240928-095842?

Are you sure you want to delete instance instance-20240928-095842?

This will delete boot disk instance-20240928-095842

CANCEL DELETE

Explore Backup and DR NEW
Back up your VMs and set up disaster recovery

Set up firewall rules
Control traffic to and from a VM instance

View VMs
Monitor VMs across metrics like CPU and network

Explore VM logs
View, search, analyze, and download VM instance logs

VM instance started

VM instances CREATE INSTANCE IMPORT VM REFRESH LEARN

INSTANCES OBSERVABILITY INSTANCE SCHEDULES

VM instances

Filter Enter property name or value

Status	Name	Zone	Recommendations	In use by	Internal IP	External IP	Connect
<input type="checkbox"/>	instance-20240928-095842	us-central1-f			10.128.0.2 (nic0)	34.29.23.217 (nic0)	SSH

Related actions

Explore Backup and DR NEW
Back up your VMs and set up disaster recovery

View billing report
View and manage your Compute Engine billing

Monitor VMs
View outlier VMs across metrics like CPU and network

Explore VM logs
View, search, analyze, and download VM instance logs

Set up firewall rules
Control traffic to and from a VM instance

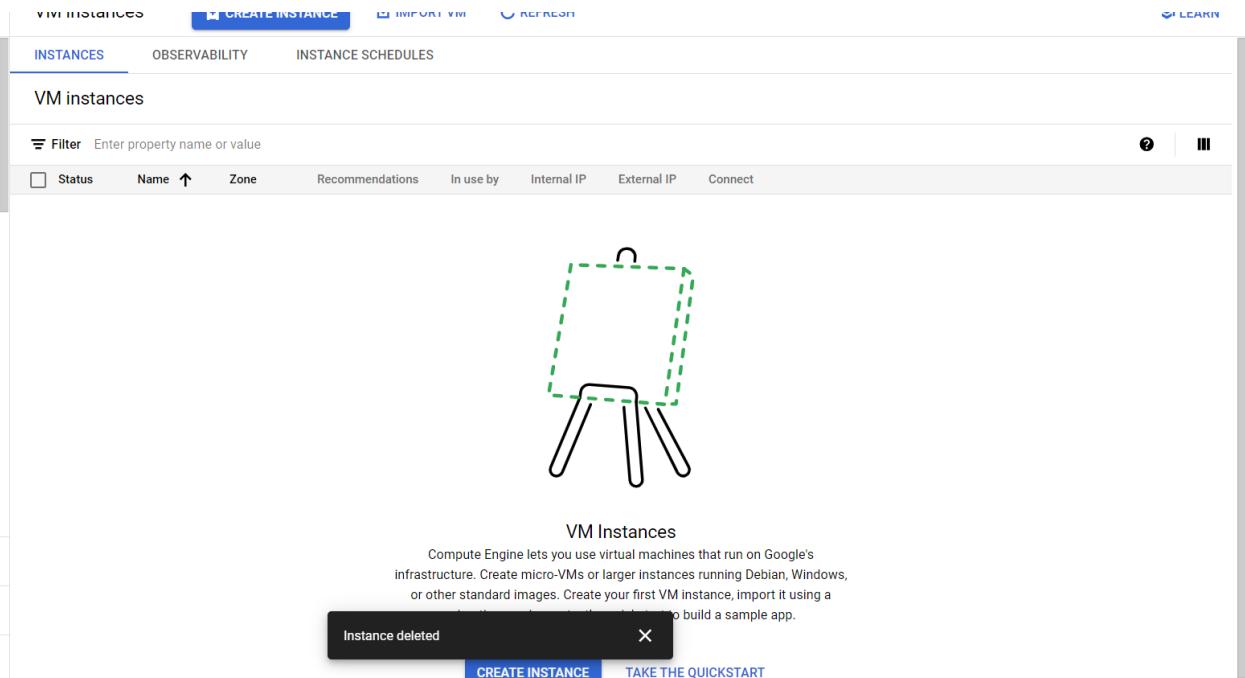
Patch management
Schedule patch updates and view patch compliance on VM instances

Load balancer
Set up Load Balancer as your traffic and users grow

Deleting instance-20240928-095842...

Spice it up, up, up, hold up
Burn it up, see me down, controller
Up, up, up, roll up

5%



3. Questions:

- o **What steps did you follow to create the VM?**

Navigate to Compute Engine:

In the Navigation Menu on the left, select Compute Engine > VM Instances.

Create a new VM:

- o Click the Create Instance button at the top.

Configure the VM:

- o Set the Name for the VM.
- o Choose a Region and Zone (closer regions usually have lower latency).
- o Select the Machine Type based on your requirements (e.g., e2-micro for small workloads).
- o Under the Boot disk section, choose an operating system (e.g., Debian, Ubuntu, or others). I used Debian as an example.
- o Leave other settings as default or customize as needed.

Create the VM:

- o After configuring the parameters, click Create. The VM will be provisioned and start automatically.

- **How did you connect to the VM, and what commands did you use to install the web server?**
1) After the VM was running, I went back to the Compute Engine > VM Instances page. I clicked on the SSH button next to the VM I created to open an SSH terminal in the browser.

2) sudo apt update

```
sudo apt install apache2 -y
```

- What happens to the VM and its data when it is stopped versus when it is deleted?

When Stopped: The VM shuts down, and you stop paying for compute resources, but data on disks remains intact. The VM resumes from the same state when restarted.

When Deleted: The VM is permanently removed, and the boot disk (with its data) is deleted unless backed up or retained.

Exercise 4: Deploying a Containerized Application on Google Kubernetes Engine (GKE)

1. **Objective:** Understand how to deploy and manage containerized applications using Google Kubernetes Engine.
 2. **Steps:**
 - Create a simple Docker container for a web application.
 - Push the container image to Google Container Registry (GCR)

```
Welcome to My Project - Google Cloud Console
Search (/) for resources, docs, products, and more
Open Editor
Cloud Shell Terminal (my-project-437009) x +
```

```
"docker.us-east1.rep.pkg.dev": "gcloud",
"us-east4-docker.pkg.dev": "gcloud",
"docker.us-east4.rep.pkg.dev": "gcloud",
"us-east5-docker.pkg.dev": "gcloud",
"docker.us-east5.rep.pkg.dev": "gcloud",
"us-north1-docker.pkg.dev": "gcloud",
"docker.us-south1.rep.pkg.dev": "gcloud",
"us-west1-docker.pkg.dev": "gcloud",
"us-west1.rep.pkg.dev": "gcloud",
"docker.us-west1.rkg.pkg.dev": "gcloud",
"us-west2-docker.pkg.dev": "gcloud",
"docker.us-west2.rsp.pkg.dev": "gcloud",
"us-west3-docker.pkg.dev": "gcloud",
"docker.us-west3.rep.pkg.dev": "gcloud",
"us-west4-docker.pkg.dev": "gcloud",
"docker.us-west4.rep.pkg.dev": "gcloud",
"us-west5-docker.pkg.dev": "gcloud",
"us-east7-docker.pkg.dev": "gcloud",
"docker.us-east7.rsp.pkg.dev": "gcloud"
}

Adding credentials for all GCR repositories.
WARNING: A long list of credential helpers may cause delays running 'docker build'. We recommend passing the registry name to configure only the registry you are using.
gcloud credential helpers already registered correctly.
adema_jumanizava@cloudshell:~/my-app/my-app [my-project-437009]$ docker push gcr.io/your-project-id/my-web-app:v1
The push refers to repository [gcr.io/your-project-id/my-web-app]
f1503d494c2: Retrying in 1 second
b0f60355fd52: Retrying in 1 second
027907faf592: Retrying in 1 second
11134cc97d7f: Retrying in 1 second
f7a5847cdedc: Retrying in 1 second
adema_jumanizava@cloudshell:~/my-app/my-app [my-project-437009]$ docker push gcr.io/your-project-id/my-web-app:v1
71fb3077bd07: Waiting
3ff96b2e5450: Waiting
63cafb843ae: Waiting
unknown: Service 'containerregistry.googleapis.com' is not enabled for consumer 'project:your-project-id'.
adema_jumanizava@cloudshell:~/my-app/my-app [my-project-437009]$ docker push gcr.io/my-project-437009/my-app:v1
The push refers to repository [gcr.io/my-project-437009/my-app]
An image does not exist locally with the tag: gcr.io/my-project-437009/my-app
adema_jumanizava@cloudshell:~/my-app/my-app [my-project-437009]$ c
adema_jumanizava@cloudshell:~/my-app/my-app [my-project-437009]$ docker tag my-web-app gcr.io/my-project-437009/my-web-app:v1
adema_jumanizava@cloudshell:~/my-app/my-app [my-project-437009]$
```

Create a GKE cluster in Google Cloud Console.

The screenshot shows the Google Cloud Platform web interface. At the top, there's a banner for a free trial with \$300.00 credit and 91 days remaining. Below the banner, the navigation bar includes 'Google Cloud' and 'My Project'. The search bar contains the text 'container'. On the right of the search bar are icons for 'DISMISS', 'ACTIVATE', and help/tutorials.

The main content area is titled 'Create an Autopilot cluster'. On the left, a sidebar lists steps: 'Cluster basics', 'Fleet registration', 'Networking', 'Advanced settings', and 'Review and create'. The 'Cluster basics' step is currently active, showing a sub-section titled 'Cluster basics' with the following text: 'Create an Autopilot cluster by specifying a name and region. After the cluster is created, you can deploy your workload through Kubernetes and we'll take care of the rest.' Below this is a 'Navigate at a glance' section with a progress bar showing '1/4' completed. The 'NEXT' button is visible. The main form area has a 'Region' dropdown set to 'us-central1'. Below it is a note about regional location. At the bottom of the form are 'NEXT: FLEET REGISTRATION' and 'RESET SETTINGS' buttons.

On the right side of the interface, there's a sidebar titled 'Get started with GKE' containing links like 'GKE overview', 'Help document', and 'Create and explore a cluster'. Below that is another sidebar titled 'Example workflows' with links for 'Configure a cluster and workload for staging' and 'Update and deploy from an IDE'.

Free trial status: \$300.00 credit and 91 days remaining. Activate your full account to get unlimited access to all of Google Cloud—use any remaining credits, then pay only for what you use.

Google Cloud My Project container **DISMISS** **ACTIVATE**

Kubernetes Engine

- All Fleets
- Resource Management
 - Overview
 - Clusters**
 - Workloads
 - Teams
 - Applications
 - Secrets & ConfigMaps
 - Storage
 - Object Browser
 - Marketplace
 - Release Notes

Clusters **DELETE** **DEPLOY** **CONNECT** **DUPLICATE**

autopilot-cluster-1

Cluster creation can take five minutes or more. **DISMISS**

59% - Cluster is being deployed...

- Configuring
- Deploying
- Health checks

HIDE PROGRESS STEPS

DETAILS	STORAGE	OBSERVABILITY	LOGS	APP ERRORS (0)
Cluster basics				
Name	autopilot-cluster-1			
Location type	Regional			
Region	us-central1			
Default node zones	us-central1-b us-central1-c us-central1-f us-central1-a			
Release channel	Regular channel			

Recommended for you

- Overview of node pools** Help document Understand how node pools work in GKE.
- Quickstart** Tutorial Deploy a containerized web application on a GKE cluster, using Cloud console.
- Add and manage node pools** Help document Add and manage the node pools that are running in your GKE clusters.
- Cluster architecture** Help document Understand the architecture of GKE clusters, including cluster masters, nodes, and node-allocatable resources.
- Create a private cluster** Help document Create a private GKE cluster with internal IP addresses only to ensure that network traffic remains private.

My Project container **DISMISS** **ACTIVATE**

Clusters

autopilot-cluster-1

DETAILS	STORAGE	OBSERVABILITY	LOGS	APP ERRORS (0)
Cluster basics				
Name	autopilot-cluster-1			
Location type	Regional			
Region	us-central1			
Default node zones	us-central1-b us-central1-c us-central1-f us-central1-a			
Release channel	Regular channel			
Version	1.30.3-gke.1969001			
External endpoint	34.16.34.207 Show cluster certificate			
Internal endpoint	10.128.0.3 Show cluster certificate			
Rollout sequence	To use rollout sequencing, register your cluster to a fleet			

The cluster was created successfully. **X**

Automation

Recommended for you

- Overview of node pools** Help document Understand how node pools work in GKE.
- Quickstart** Tutorial Deploy a containerized web application on a GKE cluster, using Cloud console.
- Add and manage node pools** Help document Add and manage the node pools that are running in your GKE clusters.
- Cluster architecture** Help document Understand the architecture of GKE clusters, including cluster masters, nodes, and node-allocatable resources.
- Create a private cluster** Help document Create a private GKE cluster with internal IP addresses only to ensure that network traffic remains private.

```
adema_jumaniyazova@cloudshell:~/my-app/my-app (my-project-437009)$ kubectl apply -f deployment.yaml
The connection to the server localhost:8080 was refused - did you specify the right host or port?
adema_jumaniyazova@cloudshell:~/my-app/my-app (my-project-437009)$ ^C
adema_jumaniyazova@cloudshell:~/my-app/my-app (my-project-437009)$ gcloud container clusters get-credentials your-cluster-name --zone your-zone --project your-project-id
Fetching cluster endpoint and auth data.
ERROR: (gcloud.container.clusters.get-credentials) ResponseError: code=403, message=Permission denied on 'locations/your-zone' (or it may not exist). This command is authenticated as adema_jumaniyazova@gmail.com which is the active account specified by the [core/account] property.
adema_jumaniyazova@cloudshell:~/my-app/my-app (my-project-437009)$
adema_jumaniyazova@cloudshell:~/my-app/my-app (my-project-437009)$
```

Deploy the containerized application to the GKE cluster.

The screenshot shows the Google Cloud Platform interface for creating a deployment. The top navigation bar includes 'Google Cloud', 'My Project' (set to 'container'), a search bar ('Search' button), and a sidebar with 'LEARN TUTORIAL' and 'Recommended for you' sections. The main form has fields for 'Namespace' (set to 'default'), 'Labels' (with a key-value pair 'app: deployment-1'), and 'Cluster' (selected 'Kubernetes Cluster: autopilot-cluster-1 (us-central1)'). A success message 'The cluster was created successfully.' is displayed at the bottom. The right sidebar lists recommended topics like 'Overview of deploying workloads', 'Stateless applications', 'Deploying a stateful application', 'Scaling applications', and 'Performing rolling updates'.

The screenshot shows the Google Cloud Platform interface for managing a deployment. The left sidebar is for 'Kubernetes Engine' with 'Workloads' selected. The main view shows a deployment named 'deployment-1' with three error status cards: 'Pod errors: Unschedulable', 'Does not have minimum availability', and 'To let others access your deployment, expose it to create a service'. Below these are tabs for 'OVERVIEW', 'DETAILS', 'OBSERVABILITY', 'REVISION HISTORY', 'EVENTS', 'LOGS', and 'APP ERRORS'. The right sidebar lists recommended topics like 'Deploying workloads', 'Deploy a stateful application', 'Deploy a stateless Windows application', and 'Expose applications using'.

Exercise 5: Storing and Accessing Data in Google Cloud Storage

1. **Objective:** Learn how to store, manage, and access data using Google Cloud Storage.
2. **Steps:**
 - o Create a new Cloud Storage bucket in the Google Cloud Consol

Get Started
Name: lab1111

Choose where to store your data
This choice defines the geographic placement of your data and affects cost, performance, and availability. Cannot be changed later. [Learn more](#)

Location type

- Multi-region Highest availability across largest area
- Dual-region High availability and low latency across 2 regions
- Region Lowest latency within a single region

[CONTINUE](#)

Good to know

Location pricing
Storage rates vary depending on the storage class of your data and location of your bucket. [Pricing details](#)

Current configuration: Multi-region / Standard

Item	Cost
us (multiple regions in United States)	\$0.026 per GB-month
With default replication	\$0.020 per GB written

ESTIMATE YOUR MONTHLY COST

- o Upload various types of files (e.g., text, images, videos) to the bucket.

Free trial status: \$300.00 credit and 91 days remaining. Activate your full account to get unlimited access to all of Google Cloud—use any remaining credits, then pay only for what you use. [DISMISS](#) [ACTIVATE](#)

Bucket details

Location	Storage class	Public access	Protection
us (multiple regions in United States)	Standard	Not public	Soft Delete

Folder browser

Buckets > lab1111

[CREATE FOLDER](#) [UPLOAD](#) [TRANSFER DATA](#)

Filter by name prefix only

Name	Size	Storage class	Last modified
Assignment 1, Cloud Computing.de	65.7 KB	application/pdf	2023-10-10
line_plot.png	33.7 KB	image/png	2023-10-10

LEARN Tutorial

- Get started with Cloud Storage
- Getting bucket information
- Uploading objects
- Downloading objects
- Use cases for Cloud Storage
- Terraform samples

Bucket details

LOCATION	NAME	SIZE	TYPE
us (multiple regions in United States)	Assignment 1, Cloud Computing.de	65.7 KB	application/pdf
us (multiple regions in United States)	line_plot.png	33.7 KB	image/png

Folder browser

Buckets > lab1111

[CREATE FOLDER](#) [UPLOAD](#) [TRANSFER DATA](#)

Filter by name prefix only

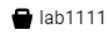
Name	Size	Type
Assignment 1, Cloud Computing.de	65.7 KB	application/pdf
line_plot.png	33.7 KB	image/png

- Set access permissions for the bucket and test public and private access to the files.

Grant access to "lab1111"

Grant principals access to this resource and add roles to specify what actions the principals can take. Optionally, add conditions to grant access to principals only when a specific criteria is met. [Learn more about IAM conditions](#)

Resource



Add principals

Principals are users, groups, domains, or service accounts. [Learn more about principals in IAM](#)

New principals *

?

Assign roles

Roles are composed of sets of permissions and determine what the principal can do with this resource. [Learn more](#)

Role * ?

IAM condition (optional) ?

[+ ADD IAM CONDITION](#)



Grants permission to view objects and their metadata, excluding ACLs.

[+ ADD ANOTHER ROLE](#)

[SAVE](#)

[CANCEL](#)

Bucket details

Location: us (multiple regions in United States) Storage class: Standard Public access: **⚠️ Public to internet** Protection: Soft Delete

OBJECTS CONFIGURATION PERMISSIONS PROTECTION LIFECYCLE OBSERVABILITY INVENTORY

Public access

⚠️ Public to internet

One or more bucket-level permissions grant access to everyone on the internet (`allUsers`) or anyone signed into a Google account (`allAuthenticatedUsers`). If this bucket should not be publicly accessible, remove these public permissions or prevent public access to this bucket. [Learn more](#)

[PREVENT PUBLIC ACCESS](#)

Access control

Uniform: No object-level ACLs enabled

90 days left to change this setting

All object access is controlled by bucket permissions and objects cannot have their own access control lists (ACLs). To allow per-object access, you can switch to fine-grained access within 90 days. [Learn more](#)

[SWITCH TO FINE-GRAINED](#)

Permissions

[VIEW BY PRINCIPALS](#) [VIEW BY ROLES](#)

[+GRANT ACCESS](#)

Policy updated

Bucket details

Location: us (multiple regions in United States)

⚠️ Public to internet

Uniform: No object-level ACLs enabled

90 days left to change this setting

All object access is controlled by bucket permissions and objects cannot have their own access control lists (ACLs). To allow per-object access, you can switch to fine-grained access within 90 days. [Learn more](#)

[PREVENT PUBLIC ACCESS](#)

Prevent public access to this bucket?

You are about to revoke all public access to the bucket lab1111 and its objects. This action:

- Overrides access granted to `allUsers` (including `allAuthenticatedUsers`) at both the bucket and object levels
- Restricts public sharing of existing and future resources
- Does not impact individual user permissions

⚠️ This setting overrides public access on existing objects. Make sure none of your workloads will be interrupted by enforcement of this policy. [Learn more about this setting](#)

[CANCEL](#) [CONFIRM](#)

<https://storage.googleapis.com/lab1111/Assignment%201%2C%20Cloud%20Computing.pdf>

My Project ▾ Search (/) for resources, docs, products, and more Search 9 ⓘ ⚡

Object details

Buckets > lab1111 > Assignment 1, Cloud Computing.pdf

[DOWNLOAD](#) [EDIT METADATA](#) [EDIT ACCESS](#) [DELETE](#)

Overview

Type	application/pdf
Size	65.7 KB
Created	Sep 28, 2024, 6:26:48 PM
Last modified	Sep 28, 2024, 6:26:48 PM
Storage class	Standard
Custom time	—
Public URL ⓘ	https://storage.googleapis.com/lab1111/Assignment%201%20Cloud%20Computing.pdf
Authenticated URL ⓘ	https://storage.cloud.google.com/lab1111/Assignment%201%20Cloud%20Computing.pdf
gsutil URI ⓘ	gs://lab1111/Assignment 1, Cloud Computing.pdf

Permissions

storage.googleapis.com

Assignment 1, Cloud Computing

Assignment 1, Cloud Computing

1 / 3 - 100% + ⌂ ⌂

Assignment 1, Cloud Computing

Put all deliverables into github repository in your profile. Share link to google form 24 hours before defense. Defend by explaining deliverables and answering questions.

Deliverables: report in pdf

Google form: https://docs.google.com/forms/d/e/1FAIpQLSe0GyNdOYivM1IX_I_CtIPod5jBF-ACLGdHYZq1gVZbUeBzlg/viewform?usp=sf_link

Exercise 1: Understanding Cloud Computing Models

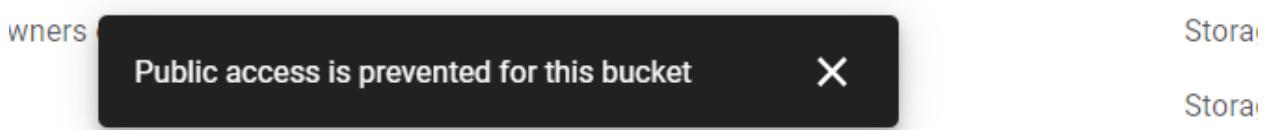
1. **Objective:** Explore different cloud computing models and understand their key differences.
2. **Steps:**
 - o Research the three primary cloud service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).
 - o Create a table comparing these models in terms of control, flexibility, and use cases.
 - o Identify examples of services offered by Google Cloud Platform (GCP) under each model.
3. **Questions:**
 - o What are the main differences between IaaS, PaaS, and SaaS?
 - o Which GCP services fall under each of these models?
 - o Provide a real-world example where each cloud service model might be the most appropriate choice.

Exercise 2: Exploring Google Cloud Platform's Core Services

The screenshot shows the Google Cloud Storage interface. A modal dialog box is centered over the main content. The title of the dialog is "Prevent public access to this bucket?". The message inside the dialog states: "You are about to revoke all public access to the bucket lab1111 and its objects. This action:" followed by three bullet points:

- Overrides access granted to `allUsers` (including `allAuthenticatedUsers`) at both the bucket and object levels
- Restricts public sharing of existing and future resources
- Does not impact individual user permissions

 Below the message is a warning icon with the text: "This setting overrides public access on existing objects. Make sure none of your workloads will be interrupted by enforcement of this policy. [Learn more about this setting](#)". At the bottom of the dialog are two buttons: "CANCEL" and "CONFIRM".



- Use the Cloud Console to download, move, and delete files in the bucket.

The screenshot shows the Google Cloud Storage interface with a list of files in a bucket. The header includes "CREATE FOLDER", "UPLOAD", "LEARN", and a "Help document" link. The file list table has columns for "Name", "Size", and "Type". Two files are listed:

Name	Size	Type
Assignment 1, Cloud Computing.pdf	65.7 KB	application/pdf
line_plot.png	33.7 KB	image/png

 On the right side of the file list, there are download icons for each file: a blue arrow pointing down for the PDF and a green arrow pointing down for the PNG. A tooltip for the PDF download says "Download Assignment 1, Cloud Computing.pdf".

Download

Cloud Storage My Project Google Cloud Console

DISMISS ACTIVE

sources, docs, products, and more 9

[GO TO PATH](#) [REFRESH](#)

ACTION	PERMISSIONS	PROTECTION	LIFECYCLE	OBSERVABILITY	INVENTORY
Buckets > lab1111 <input type="button"/>					
CREATE FOLDER UPLOAD <input type="button"/> LEARN					
Filter by name prefix only <input type="button"/> Filter Show Live objects only <input type="button"/>					
<input type="checkbox"/>	Name	ct d f ol an	Size	Type	<input type="button"/> <input type="button"/>
<input type="checkbox"/>	Assignment 1, Cloud Computing.pdf	65.7 KB	application/pdf	<input type="button"/>	<input type="button"/>
<input type="checkbox"/>	line_plot.png	33.7 KB	image/png	<input type="button"/>	<input type="button"/>

[Edit metadata](#) [Edit access](#) [Edit retention](#) [Copy](#) [Move](#) [Rename](#) [Export to Cloud Pub/Sub](#) [Scan with Sensitive Data Protection](#) [Use cases for Cloud Storage](#) [Help document](#)

Authentications

URL Copy gsutil URI

ted with Cloud S

g bucket information

document

formation on the size ar

ita of your Cloud Stora

s.

Copy objects

Move document

Rename the objects containing

Cloud Storage buckets

Export to Cloud Pub/Sub

Scan with Sensitive Data Protection

oaded the objects from yo

e buckets.

Move object

Source object path
lab1111/Assignment 1, Cloud Computing.pdf

Destination * BROWSE

- Keep source permissions ?
- Use default permissions at destination ?

▼ GSUTIL EQUIVALENT

MOVE

CANCEL

LEARN
Tutorial

Get started with Cloud Storage

Getting started with Cloud Storage

Help document

Get information about the metadata of your buckets.

Uploading objects to Cloud Storage

Help document

Upload the object to your Cloud Storage bucket.

Downloading objects from Cloud Storage

Help document

Download the object from your Cloud Storage bucket.

Use cases for Cloud Storage

Help document

Explore use cases for industry solutions.

Terraform samples for Cloud Storage

Help document

See examples for creating Cloud Storage buckets.

Architecture of Cloud Storage

Bucket details

lab11112222

Location	Storage class	Public access	Protection
us (multiple regions in United States)	Standard	Not public	Soft Delete

OBJECTS CONFIGURATION PERMISSIONS PROTECTION LIFECYCLE OBSERVABILITY INVENTORY

Folder browser

CREATE FOLDER UPLOAD TRANSFER DATA

Name	Size	Type
Assignment 1, Cloud Computing.pdf	65.7 KB	application/pdf

Moved object to lab11112222/Assignment 1

Get started

Getting started

Help

Get in metadata buckets

Upload

Upload to your

Help

Download

Download Storage

Help

User guide

Explore industries

Terra

Help

See examples

Move

Cloud Storage My Project Search (/) for resources, docs, products, and more Search DISMISS ACTIVATE

Buckets + CREATE ⌂ REFRESH GO TO PATH LEARN

Review the soft delete settings on your buckets. Billing for soft deleted objects will begin on September 1st.

LEARN MORE ⌂ MANAGE SOFT DELETE POLICIES

A new Cloud Storage overview page has been released. It will become the Cloud Storage landing page in October 2024.

TAKE A LOOK

Filter buckets

Name	Created	Location type	Location	Default storage class	Last modified
lab1111	Sep 28, 2024, 6:26:01 PM	Multi-region	us	Standard	Sep 28, 2024, 6:37:14
lab11112222	Sep 28, 2024, 6:40:00 PM	Multi-region	us	Standard	Sep 28, 2024, 6:40:00

Storage class

Delete bucket

Transfer data in

Transfer data out

Create restore job

Export to Cloud

Pub/Sub

Process with Cloud Run functions

Scan with Sensitive Data Protection

Use cases for Cloud Storage

Help document

Explore use cases, best practices

The screenshot shows the Google Cloud Storage Browser. At the top, there are two informational cards: one about soft delete settings and another about a new overview page. Below these is a filter bar labeled 'Filter Filter buckets'. A table lists a single bucket entry:

Name	Created	Location type	Location	Default storage class	Last modified
lab11112222	Sep 28, 2024, 6:40:00 PM	Multi-region	us	Standard	Sep 28, 2024, 6:40:00

A black overlay box at the bottom center contains the text 'Deleting 1 bucket' with a close button 'X'.

Delete

3. Questions:

- How do you create a Cloud Storage bucket, and what options are available during setup?

Go to Storage > Browser in the Google Cloud Console, click "Create bucket," and choose a unique name, location type, and storage class.

- What are the differences between setting a bucket to public versus private?

Public buckets allow anyone to access the contents; private buckets restrict access to specified users only.

- How can you manage access permissions for individual files in a bucket?

Manage permissions by selecting the file, going to the Permissions tab, and adding members with specific roles.

Exercise 6: Analyzing Data with BigQuery

1. Objective: Perform data analysis tasks using BigQuery.

2. Steps:

- o Access BigQuery in the Google Cloud Console.
- o Create a dataset and table by importing a sample dataset provided by Google.

The screenshot shows the 'Create dataset' dialog box in the Google Cloud BigQuery interface. The dialog is titled 'Create dataset' and contains the following fields:

- Project ID ***: my-project-437009 (with a 'CHANGE' link)
- Dataset ID ***: lab11112222 (highlighted with a blue border)
- Location type**: Multi-region (selected radio button)
- Multi-region**: US (multiple regions in United States)
- External Dataset**: A note stating "The selected region supports the following external dataset types: Cloud Spanner".
- Default table expiration**: Options to "Link to an external dataset" and "Enable table expiration".
- Default maximum table age**: A field set to "Days".
- Tags**: A dropdown menu.

At the bottom of the dialog are two buttons: "CREATE DATASET" (in blue) and "CANCEL".

Below the dialog, a success message is displayed in a black bar: "**"lab1111" created.** [GO TO TABLE](#) X".

The background shows the "Query Studio!" interface with sections for "PYTHON NOTEBOOK" and "Try the Google Tree" and "Try the Colab Dem".

The screenshot shows the Google BigQuery UI. On the left, the 'Explorer' sidebar displays resources under 'my-project-437009.lab111222'. A table named 'Adema' is selected. The 'SUMMARY' tab is active, showing details like 'Last modified' (Sep 28, 2024, 7:06:41 PM UTC+6), 'Data location' (US), and 'Table type' (table). On the right, the 'SCHEMA' tab is selected, showing the table's columns:

Field name	Type	Mode	Key	Collation	Default Value	Policy Tags	Description
Hours_Studied	INTEGER	NULLABLE	-	-	-	-	-
Attendance	INTEGER	NULLABLE	-	-	-	-	-
Parental_Involvement	STRING	NULLABLE	-	-	-	-	-
Access_to_Resources	STRING	NULLABLE	-	-	-	-	-
Extracurricular_Activities	BOOLEAN	NULLABLE	-	-	-	-	-
Sleep_Hours	INTEGER	NULLABLE	-	-	-	-	-
Previous_Scores	INTEGER	NULLABLE	-	-	-	-	-
Motivation_Level	STRING	NULLABLE	-	-	-	-	-
Internet_Access	BOOLEAN	NULLABLE	-	-	-	-	-
Tutoring_Sessions	INTEGER	NULLABLE	-	-	-	-	-
Family_Income	STRING	NULIABI	-	-	-	-	-

Buttons at the bottom include 'EDIT SCHEMA' and 'VIEW ROW ACCESS POLICIES'.

- Write and execute SQL queries to perform basic data analysis, such as filtering, aggregation, and sorting

The screenshot shows the results of a query in the 'Untitled query' tab. The query is:

```
1 SELECT * FROM `my-project-437009.lab1112222.Adema` LIMIT 1000
```

The results are displayed in a table titled 'Query results'.

Row	Hours_Studied	Attendance	Parental_Involvement	Access_to_Resources	Extracurricu	Sleep_Hours
1	3	62	Medium	Low	false	6
2	5	65	Low	High	false	7
3	3	60	Medium	Low	true	6
4	9	64	Medium	Low	true	10
5	7	66	High	Low	true	8
6	14	67	Low	Low	true	7
7	17	60	Medium	Low	false	6
8	3	60	Medium	Medium	true	5
9	15	60	High	Medium	false	7
10	13	60	Low	Medium	false	5
11	4	60	Medium	Medium	true	7
12	13	61	High	Low	false	7

At the bottom, there are navigation buttons for 'Results per page' (50), '1 – 50 of 1000', and other page navigation controls.

Untitled query

RUN **SAVE** **DOWNLOAD** **SHARE** **SCHEDULE** **OPEN IN** **MORE**

```
1 SELECT * FROM `my-project-437009.lab11112222.Adema` where Hours_Studied>8
2 ^
```

Press Alt+F1 for Accessibility Options.

Query results

RESULTS

Row	Hours_Studied	Attendance	Parental_Involvement	Access_to_Resources	Extracurricul	Sleep_Hours
1	5	65	Low	High	false	7
2	9	64	Medium	Low	true	10
3	7	66	High	Low	true	8
4	14	67	Low	Low	true	7
5	17	60	Medium	Low	false	6
6	15	60	High	Medium	false	7
7	13	60	Low	Medium	false	5
8	4	60	Medium	Medium	true	7
9	13	61	High	Low	false	7
10	4	61	Low	High	true	7
11	14	61	Medium	Medium	false	5
12	12	61	Medium	Low	true	7

- Visualize the results using Google Data Studio or another visualization tool.



3. Questions:

- What steps did you take to create a dataset and table in BigQuery?

Access BigQuery, click on "Create Dataset," enter a name, and then click "Create." To create a table, select the dataset, click "Create Table," upload a sample dataset, and configure the schema.

- How did you write and execute SQL queries in BigQuery?

Open the BigQuery console, select your dataset, click "Query Table," write your SQL query in the editor, and click "Run" to execute it.

- **What insights were you able to derive from the data analysis?**
Derived trends, averages, and outliers, which helped identify key patterns and informed decision-making based on the data.