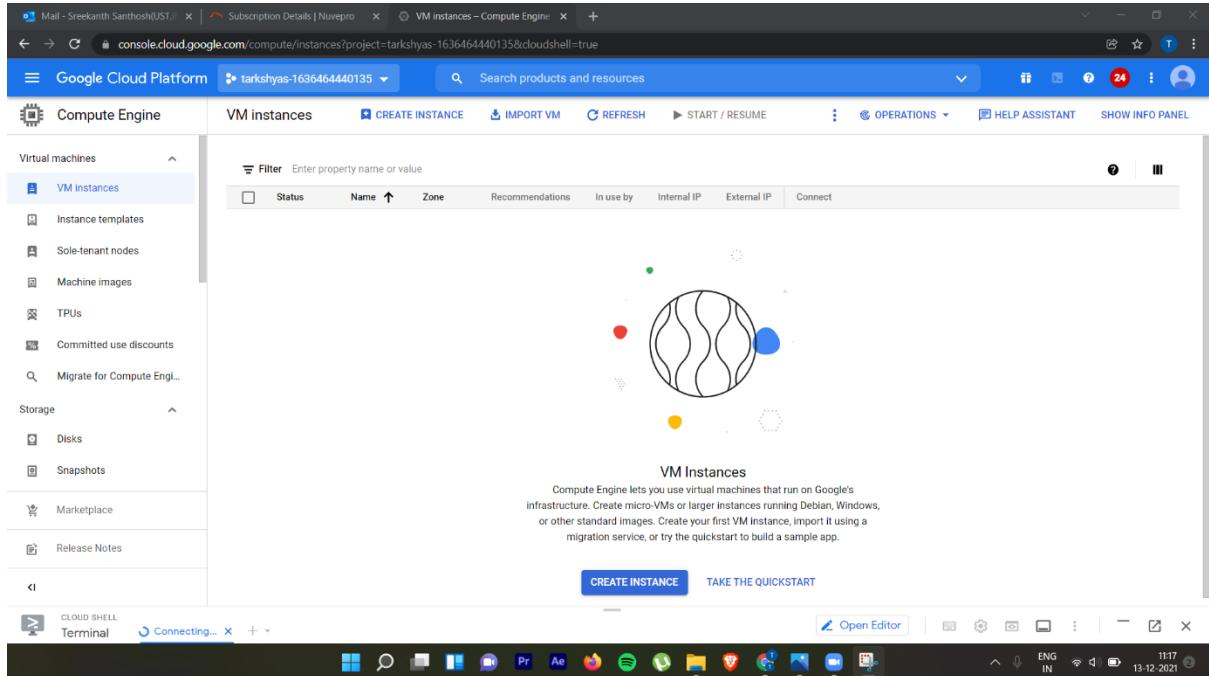


## 11.Terraform and Ansible

### A) Ansible

Ensuring that no VM instances are there



## STEP 1 : Create a Service account

The image shows two screenshots of the Google Cloud Platform (GCP) IAM & Admin Service Accounts interface.

**Top Screenshot:** Shows the 'Service accounts' page for the project "tarkshyas-1636464440135". The sidebar on the left is titled "IAM & Admin" and includes sections for IAM, Identity & Organization, Policy Troubleshooter, Policy Analyzer, Organization Policies, Service Accounts (which is selected), Workload Identity Federat..., Labels, Tags, Settings, Privacy & Security, Identity-Aware Proxy, Manage Resources, and Release Notes. The main area displays a table of service accounts, with one entry visible:

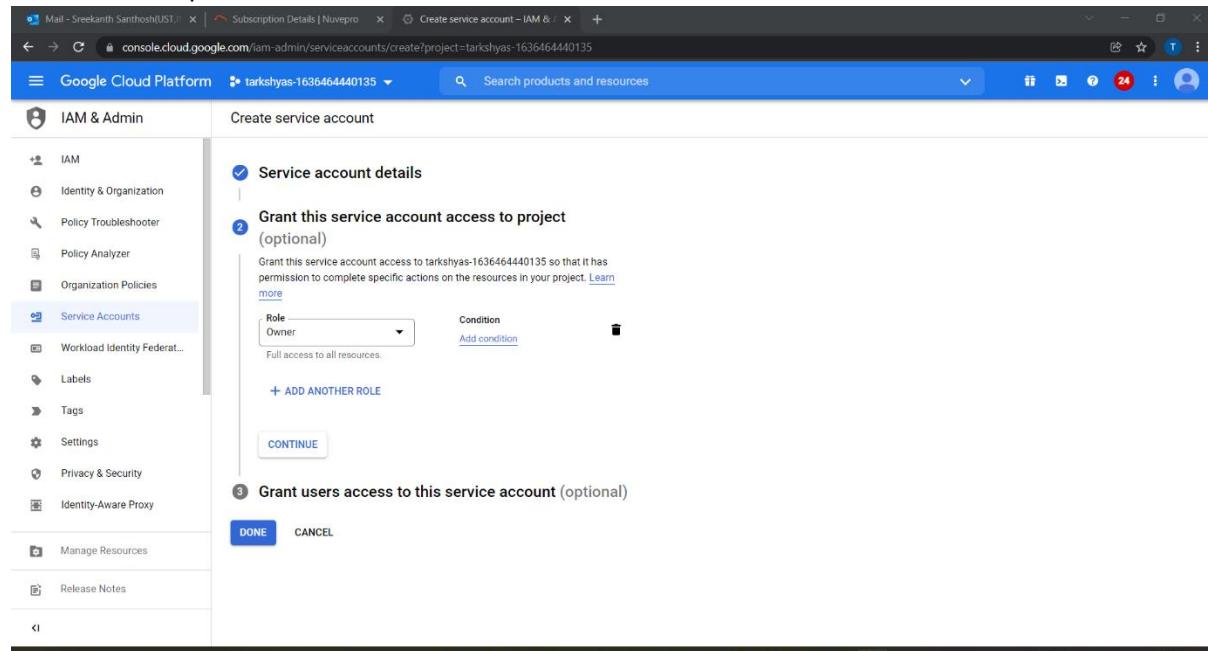
Email	Status	Name	Description	Key ID	Key creation date	OAuth 2 Client ID	Actions
250101677718-compute@developer.gserviceaccount.com	✓	Compute Engine default service account	No keys			115969840959427651660	⋮

**Bottom Screenshot:** Shows the "Create service account" wizard. The sidebar is identical. The main area has three steps:

- 1 Service account details**: Fields include "Service account name" (tsgcp-service-account), "Display name for this service account", "Service account ID" (tsgcp-service-account @tarkshyas-1636464440135.iam.gserviceac), and "Service account description". A "CREATE AND CONTINUE" button is at the bottom.
- 2 Grant this service account access to project (optional)**
- 3 Grant users access to this service account (optional)**

At the bottom of the wizard are "DONE" and "CANCEL" buttons.

### Provide the required role for the service account



**Create service account**

**Service account details**

**Grant this service account access to project (optional)**

Grant this service account access to tarkshyas-1636464440135 so that it has permission to complete specific actions on the resources in your project. [Learn more](#)

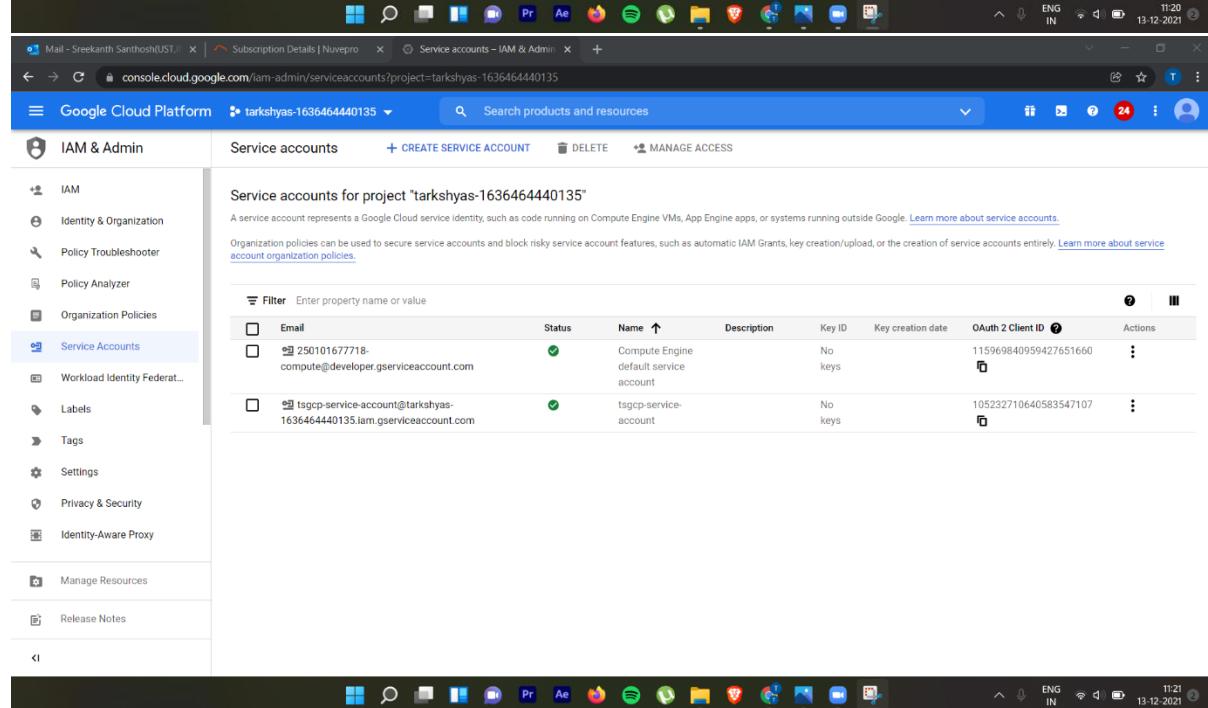
Role	Condition
Owner	Add condition

[+ ADD ANOTHER ROLE](#)

[CONTINUE](#)

**Grant users access to this service account (optional)**

[DONE](#) [CANCEL](#)

**Service accounts**

**Service accounts for project "tarkshyas-1636464440135"**

A service account represents a Google Cloud service identity, such as code running on Compute Engine VMs, App Engine apps, or systems running outside Google. [Learn more about service accounts](#).

Organization policies can be used to secure service accounts and block risky service account features, such as automatic IAM Grants, key creation/upload, or the creation of service accounts entirely. [Learn more about service account organization policies](#).

Email	Status	Name	Description	Key ID	Key creation date	OAuth 2 Client ID	Actions
compute@developer.gserviceaccount.com	✓	Compute Engine default service account	No keys	115969840959427651660			⋮
tsgcp-service-account@tarkshyas-1636464440135.iam.gserviceaccount.com	✓	tsgcp-service-account	No keys	105232710640583547107			⋮

## STEP 2: Create a new key and download it

Email	Status	Name	Description	Key ID	Key creation date	OAuth 2 Client ID	Actions
25010167718-compute@developer.gserviceaccount.com	✓	Compute Engine default service account	No keys			115969840959427651660	<span>⋮</span>
tsycop-service-account@tarkshyas-1636464440135.iam.gserviceaccount.com	✓	tsycop-service-account	No keys			105232710640583547107	<span>⋮</span>

Keys

Service account keys could pose a security risk if compromised. We recommend you avoid downloading service account keys and instead use the [Workload Identity Federation](#). You can learn more about the best way to authenticate service accounts on Google Cloud [here](#).

Add a new key pair or upload a public key certificate from an existing key pair.

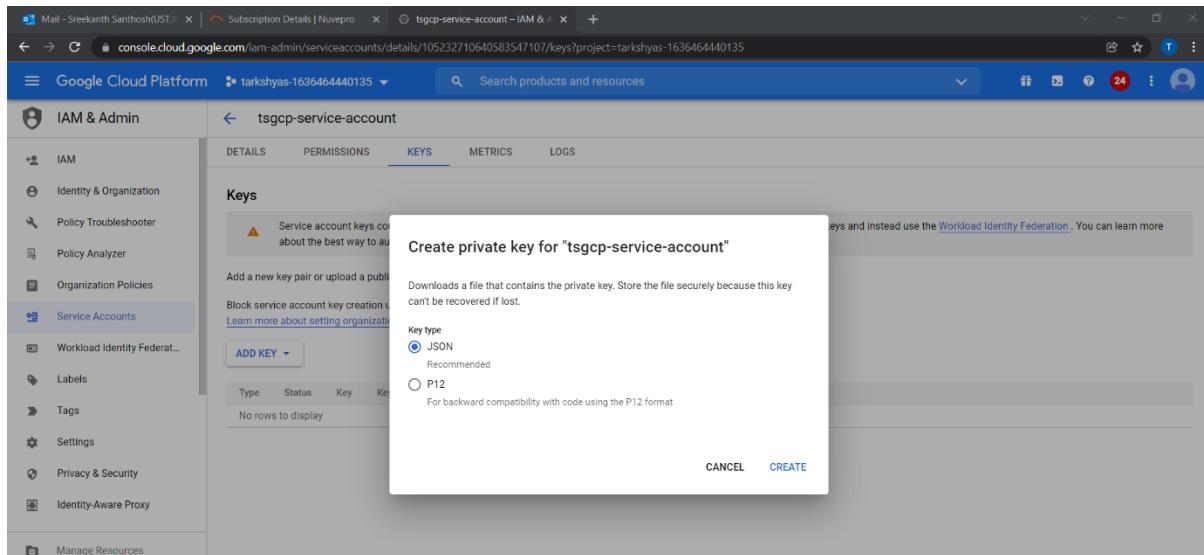
Block service account key creation using [organization policies](#). [Learn more about setting organization policies for service accounts](#)

**ADD KEY**

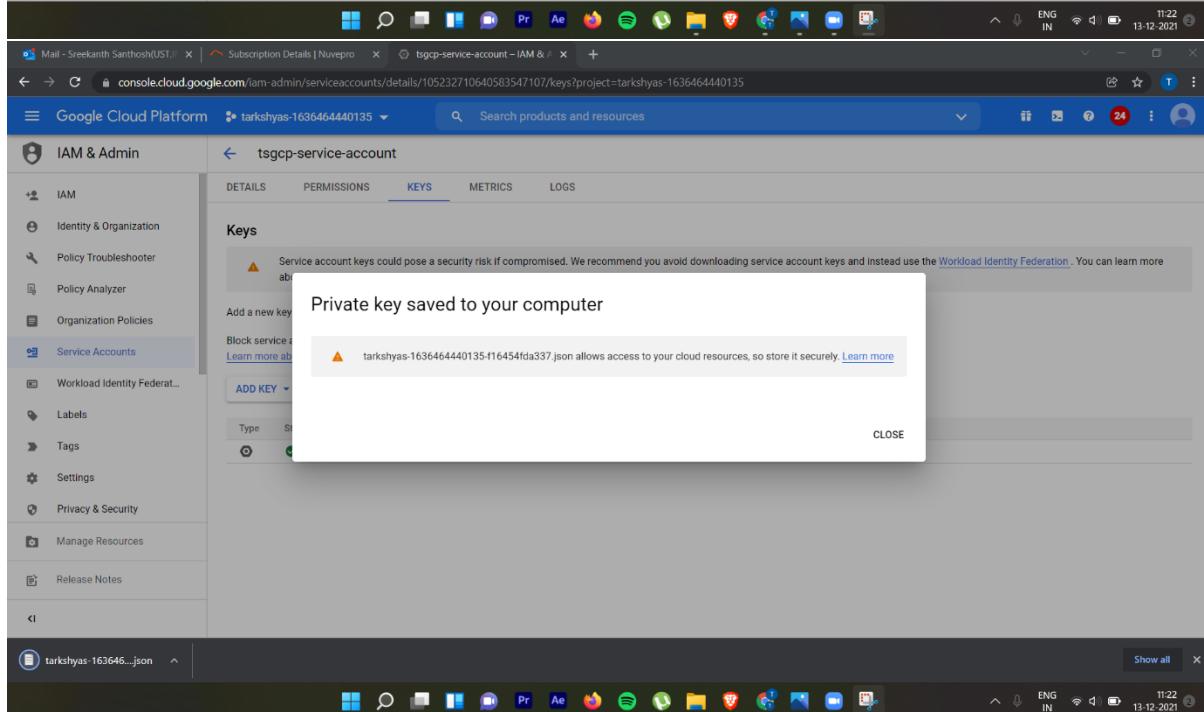
Create new key      Key creation date      Key expiration date

Upload existing key

## Sreekanth Santhosh-198642

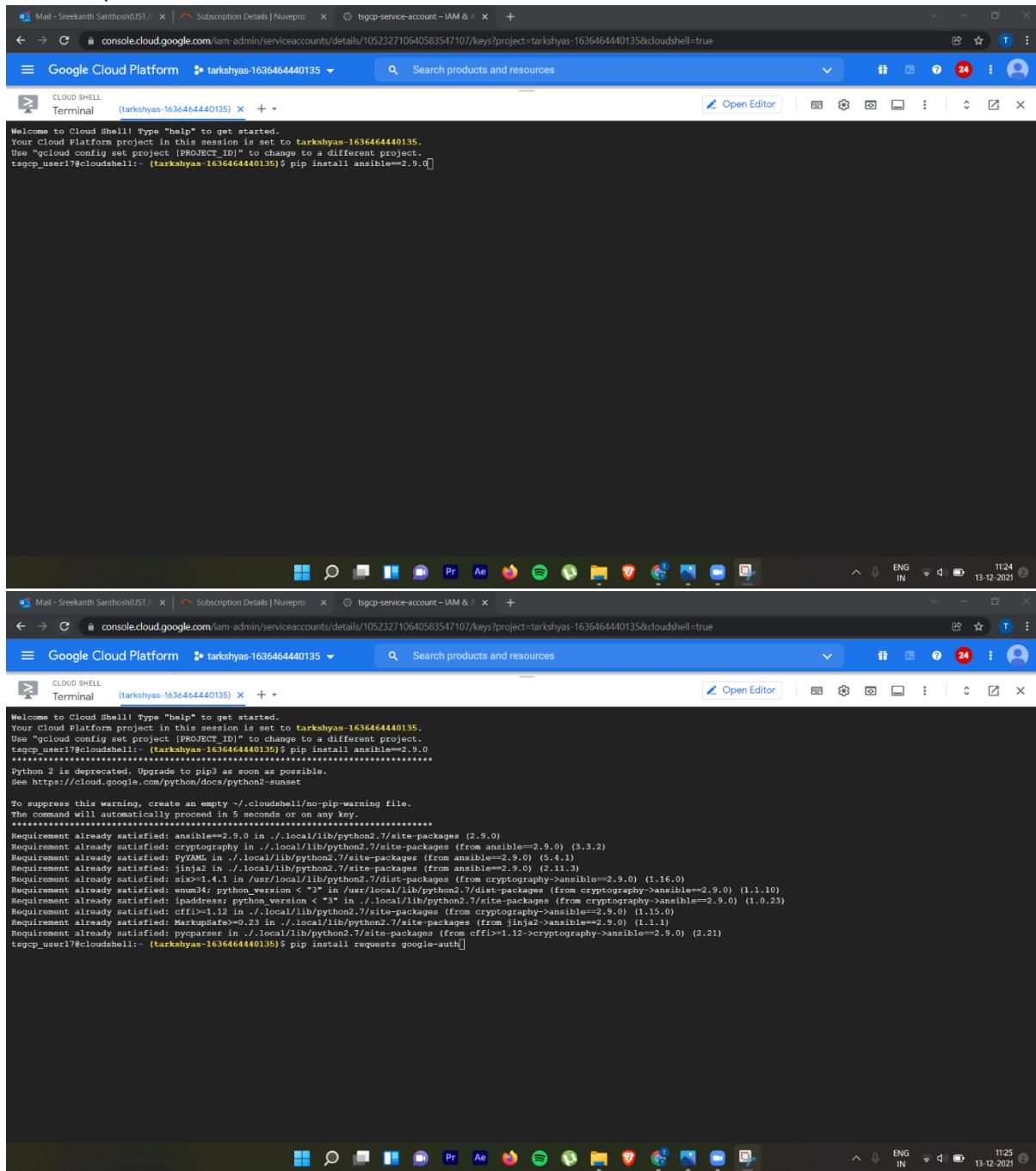


The screenshot shows the Google Cloud Platform (GCP) IAM & Admin interface. A modal dialog box titled "Create private key for 'tsgcp-service-account'" is open. It contains instructions to download a private key file and a warning about its security risk. Two options are available: "JSON" (selected) and "P12". At the bottom right of the dialog are "CANCEL" and "CREATE" buttons.

The screenshot shows the same GCP IAM & Admin interface. A modal dialog box titled "Private key saved to your computer" is open, indicating that the key has been successfully downloaded. It includes a note about the security of the key and a "CLOSE" button at the bottom right.

## STEP 4: Open Cloud Shell and Install Ansible

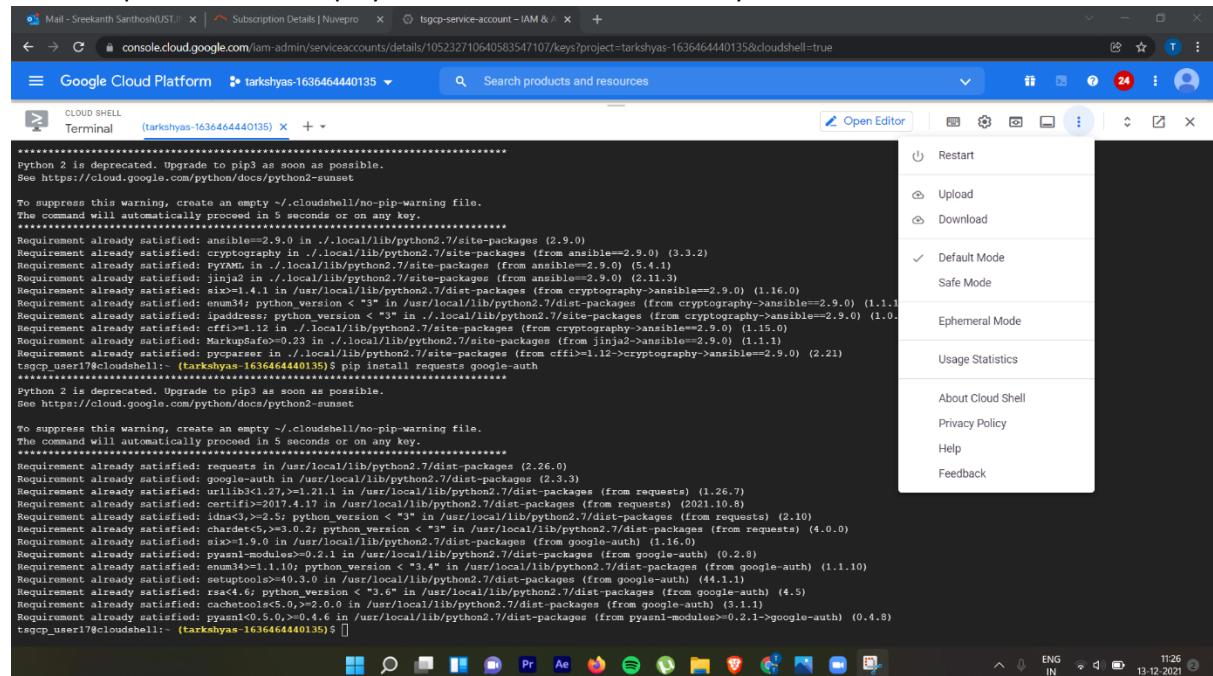


Welcome to Cloud Shell! Type "help" to get started.  
Your Cloud Platform project in this session is set to **tarkshyas-1636464440135**.  
Use "cloud config set project [PROJECT ID]" to change to a different project.  
tsgcp\_user17@cloudshell:~ (tarkshyas-1636464440135)\$ pip install ansible==2.9.0

```
*****
Python 2 is deprecated. Upgrade to pip3 as soon as possible.
See https://cloud.google.com/python/docs/python3-sunset

To suppress this warning, create an empty ~/.cloudshell/no-pip-warning file.
The command will automatically proceed in 5 seconds or on any key.
*****
Requirement already satisfied: ansible<2.9.0 in ./local/lib/python2.7/site-packages (from ansible==2.9.0) (2.9.0)
Requirement already satisfied: cffi>=1.0.0 in ./local/lib/python2.7/site-packages (from ansible==2.9.0) (3.3.2)
Requirement already satisfied: PyYAML in ./local/lib/python2.7/site-packages (from ansible==2.9.0) (5.4.1)
Requirement already satisfied: Jinja2 in ./local/lib/python2.7/site-packages (from ansible==2.9.0) (2.11.3)
Requirement already satisfied: six>=1.4.1 in /usr/local/lib/python2.7/dist-packages (from cryptography->ansible==2.9.0) (1.16.0)
Requirement already satisfied: enum34; python_version < "3" in /usr/local/lib/python2.7/dist-packages (from cryptography->ansible==2.9.0) (1.1.10)
Requirement already satisfied: ipaddress; python_version < "3" in ./local/lib/python2.7/site-packages (from cryptography->ansible==2.9.0) (1.0.23)
Requirement already satisfied: cffi>=1.12 in ./local/lib/python2.7/site-packages (from cryptography->ansible==2.9.0) (1.15.0)
Requirement already satisfied: MarkupSafe>0.23 in ./local/lib/python2.7/site-packages (from Jinja2->ansible==2.9.0) (1.1.1)
Requirement already satisfied: pycparser in ./local/lib/python2.7/site-packages (from cffi>=1.12->cryptography->ansible==2.9.0) (2.21)
tsgcp_user17@cloudshell:~ (tarkshyas-1636464440135)$ pip install requests[google-auth]
```

## STEP 5: Upload the ansible playbook and the downloaded Key from service account

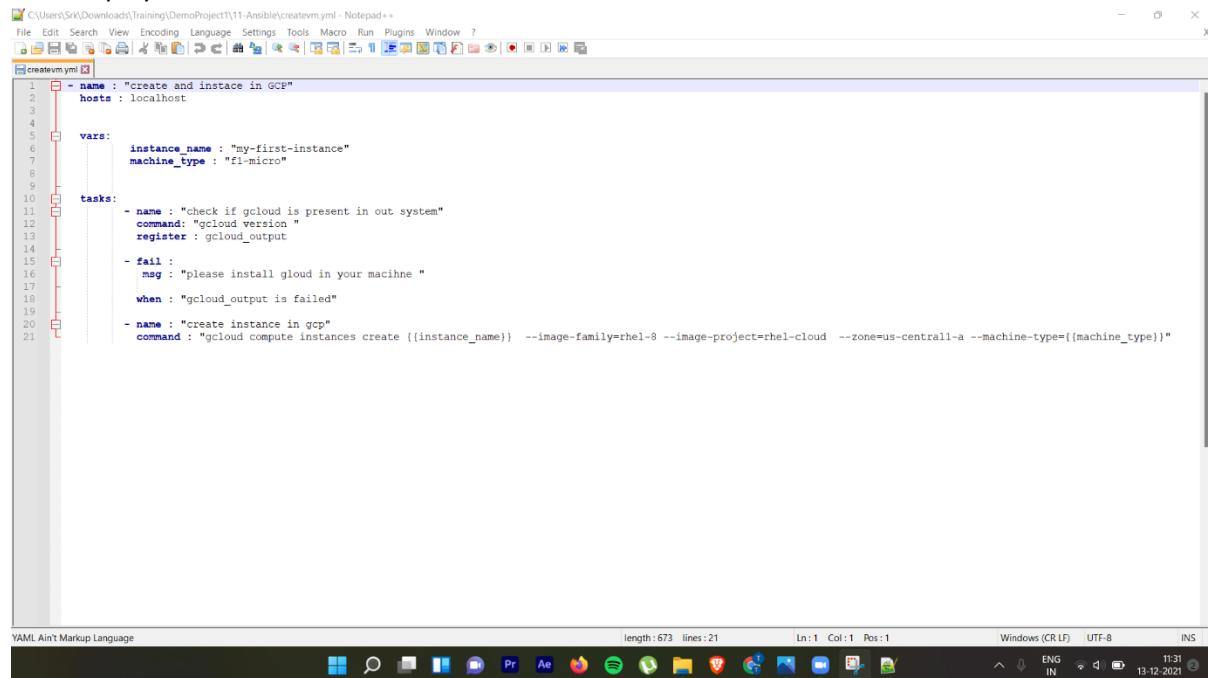


The screenshot shows a Google Cloud Shell terminal window. The terminal output displays two separate pip upgrade logs. The first log is for Python 2, showing numerous requirements being satisfied, including cryptography, pyyaml, jinja2, enum34, ipaddress, and cffi. The second log is for Python 3, also showing similar dependency satisfaction. To the right of the terminal, a context menu is open with options like 'Restart', 'Upload', 'Download', 'Default Mode', 'Safe Mode', 'Ephemeral Mode', 'Usage Statistics', 'About Cloud Shell', 'Privacy Policy', 'Help', and 'Feedback'. The status bar at the bottom right indicates 'ENG IN' and the date '13-12-2021'.

```
*****  
Python 2 is deprecated. Upgrade to pip3 as soon as possible.  
See https://cloud.google.com/python/docs/python2-sunset  
  
To suppress this warning, create an empty ~/.cloudshell/no-pip-warning file.  
The command will automatically proceed in 5 seconds or on any key.....  
*****  
Requirement already satisfied: ansible==2.9.0 in ./local/lib/python2.7/site-packages (2.9.0)  
Requirement already satisfied: cryptography in ./local/lib/python2.7/site-packages (from ansible==2.9.0) (3.3.2)  
Requirement already satisfied: pyyaml in ./local/lib/python2.7/site-packages (from ansible==2.9.0) (5.4.1)  
Requirement already satisfied: jinja2 in ./local/lib/python2.7/site-packages (from ansible==2.9.0) (2.11.3)  
Requirement already satisfied: six>=1.4.1 in ./local/lib/python2.7/dist-packages (from cryptography->ansible==2.9.0) (1.16.0)  
Requirement already satisfied: enum34; python_version < "3" in ./local/lib/python2.7/dist-packages (from cryptography->ansible==2.9.0) (1.1.1)  
Requirement already satisfied: ipaddress; python_version < "3" in ./local/lib/python2.7/dist-packages (from cryptography->ansible==2.9.0) (1.0.0)  
Requirement already satisfied: cffi>=1.12 in ./local/lib/python2.7/site-packages (from cryptography->ansible==2.9.0) (1.15.0)  
Requirement already satisfied: MarkupSafe<0.33,>=0.23 in ./local/lib/python2.7/site-packages (from Jinja2->ansible==2.9.0) (1.1.1)  
Requirement already satisfied: requests in ./local/lib/python2.7/site-packages (from cffi>=1.12->cryptography->ansible==2.9.0) (2.21)  
Requirement already satisfied: tsgcp_user17@cloudshell: [tarkshyas-1636464440135]$ pip install requests google-auth  
*****  
  
Python 2 is deprecated. Upgrade to pip3 as soon as possible.  
See https://cloud.google.com/python/docs/python2-sunset  
  
To suppress this warning, create an empty ~/.cloudshell/no-pip-warning file.  
The command will automatically proceed in 5 seconds or on any key.....  
*****  
Requirement already satisfied: ansible==3.0.0 in ./local/lib/python2.7/dist-packages (3.0.0)  
Requirement already satisfied: google-auth in ./local/lib/python2.7/dist-packages (2.3.3)  
Requirement already satisfied: urllib3<1.27,>=1.21.1 in ./local/lib/python2.7/dist-packages (from requests) (1.26.7)  
Requirement already satisfied: certifi>=2017.4.17 in ./local/lib/python2.7/dist-packages (from requests) (2021.10.8)  
Requirement already satisfied: idna3,>=2.5; python_version < "3" in ./local/lib/python2.7/dist-packages (from requests) (2.10)  
Requirement already satisfied: charset5,>=3.0.2; python_version < "3" in ./local/lib/python2.7/dist-packages (from requests) (4.0.0)  
Requirement already satisfied: six>=1.9.0 in ./local/lib/python2.7/dist-packages (from google-auth) (1.16.0)  
Requirement already satisfied: pyasn1-modules>=0.2.1 in ./local/lib/python2.7/dist-packages (from google-auth) (0.2.8)  
Requirement already satisfied: enum34>=1.1.10; python_version < "3.4" in ./local/lib/python2.7/dist-packages (from google-auth) (1.1.10)  
Requirement already satisfied: setuptools>=40.3.0 in ./local/lib/python2.7/dist-packages (from google-auth) (44.1.1)  
Requirement already satisfied: rsa<4.0,>=3.4.2 in ./local/lib/python2.7/dist-packages (from google-auth) (4.5)  
Requirement already satisfied: cachetools<0.5.0,>=2.0.0 in ./local/lib/python2.7/dist-packages (from google-auth) (3.1.1)  
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in ./local/lib/python2.7/dist-packages (from pyasn1-modules>=0.2.1->google-auth) (0.4.8)  
tsgcp_user17@cloudshell: [tarkshyas-1636464440135]$
```

Sreekanth Santhosh-198642

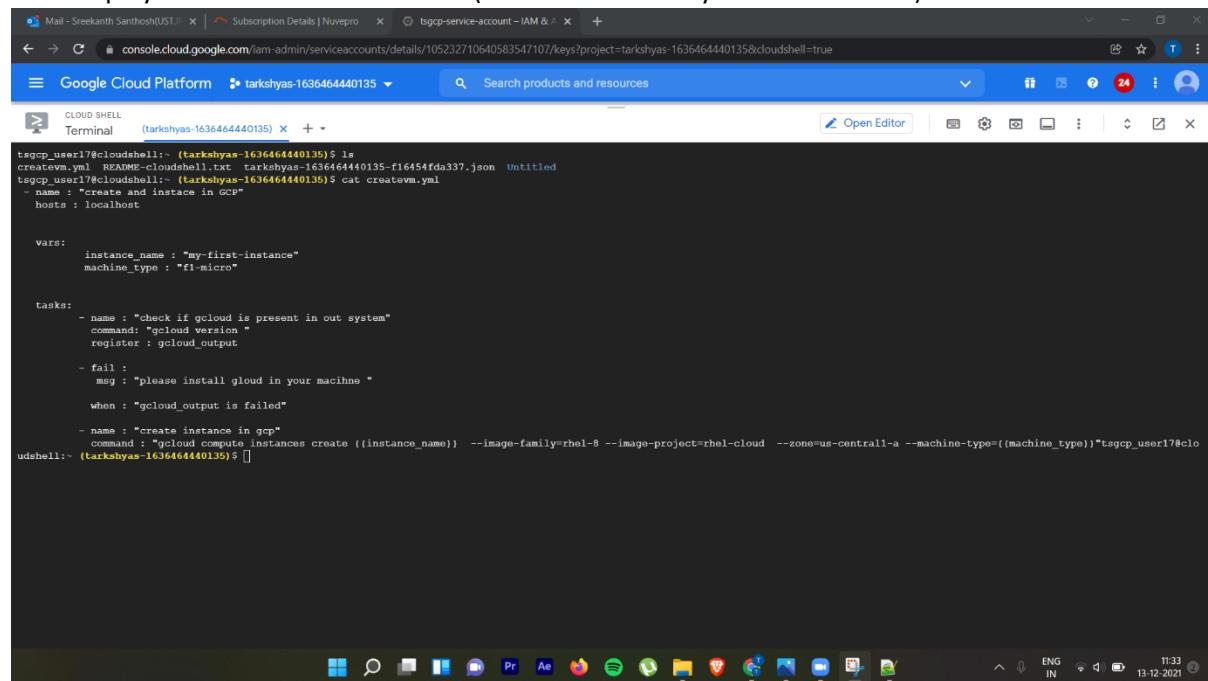
### Ansible playbook viewed in NOTEPAD++



```
createvm.yml
1 - name : "create and instance in GCP"
2   hosts : localhost
3
4
5   vars:
6     instance_name : "my-first-instance"
7     machine_type : "f1-micro"
8
9
10  tasks:
11    - name : "check if gcloud is present in out system"
12      command: "gcloud version"
13      register : gcloud_output
14
15    - fail :
16      msg : "please install gloud in your macihne "
17      when : "gcloud_output is failed"
18
19    - name : "create instance in gcp"
20      command : "gcloud compute instances create {{instance_name}} --image-family=rhel-8 --image-project=rhel-cloud --zone=us-central1-a --machine-type={{machine_type}}"
21
```

YAML Ain't Markup Language length: 673 lines:21 Ln:1 Col:1 Pos:1 Windows (CR LF) UTF-8 INS

### Ansible playbook viewed in Cloud shell(Use “cat filename.yml” as command)



```
tsgcp_user17@cloudshell: ~ (tarkshyas-1636464440135)$ ls
createvm.yml README-cloudshell.txt tarkshya-1636464440135-f16454fd337.json Untitled
tsgcp_user17@cloudshell: ~ (tarkshyas-1636464440135)$ cat createvm.yml
- name : "create and instace in GCP"
  hosts : localhost

  vars:
    instance_name : "my-first-instance"
    machine_type : "f1-micro"

  tasks:
    - name : "check if gcloud is present in out system"
      command: "gcloud version"
      register : gcloud_output
    - fail :
      msg : "please install gloud in your macihne "
      when : "gcloud_output is failed"
    - name : "create instance in gcp"
      command : "gcloud compute instances create {{instance_name}} --image-family=rhel-8 --image-project=rhel-cloud --zone=us-central1-a --machine-type={{machine_type}}"
tsgcp_user17@cloudshell: ~ (tarkshyas-1636464440135)$ [
```

Sreekanth Santhosh-198642

Mail - Srekanth Santhosh(UST) | Subscription Details | Nuvelpro | lsgrp-service-account - IAM & ... | console.cloud.google.com/fam-admin/serviceaccounts/details/105232710640583547107/keys?project=tarkshyas-1636464440135&cloudshell=true

Google Cloud Platform tarkshyas-1636464440135 Search products and resources

CLOUD SHELL Terminal (tarkshyas-1636464440135) + Open Editor

```
[--sftp-extra-args SFTP_EXTRA_ARGS]
[--scp-extra-args SCP_EXTRA_ARGS]
[--ssh-extra-args SSH_EXTRA_ARGS] [-C [--syntax-check] [-D]
[-e EXTRA_VARS] [-vault-id VAULT_IDS]
[-ask-vault-pass] [-p password-file VAULT_PASSWORD_FILES]
[-f FORKS] [-M MODULE_PATH] [-playbook-dir BASEDIR]
[-V VARS] [-m MODULE_NAME]
pattern

ansible: error: unrecognized arguments: createmw.yml
tsgcp user1@cloudshell:~ (tarkshyas-1636464440135)$ ls
createmw.yml README-cloudshell.txt tarkshyas-1636464440135-f16454fd337.json Untitled
tsgcp user1@cloudshell:~ (tarkshyas-1636464440135)$ "
tsgcp user1@cloudshell:~ (tarkshyas-1636464440135)$ ansible-playbook createmw.yml
/home/tsgcp_user1/.local/lib/python2.7/site-packages/ansible/parsing/vault/_init_.py:41: CryptographyDeprecationWarning: Python 2 is no longer supported by the Python core team. Support for it is now deprecated in cryptography, and will be removed in the next release.
  from Cryptography.exceptions import InvalidSignature
[WARNING]: No inventory was parsed, only implicit localhost is available

[WARNING]: provided hosts list is empty, only localhost is available. Note that the implicit localhost does not match 'all'

PLAY [create and instance in GCP] **

TASK [Gathering Facts] ****
ok: [localhost]

TASK [Check if gcloud is present in out system] ****
changed: [localhost]

TASK [Fail] ****
skipping: [localhost]

TASK [Create instance in gcp] ****
changed: [localhost]

PLAY RECAP ****
localhost : ok=3    changed=2    unreachable=0    failed=0    skipped=1    rescued=0    ignored=0

tsgcp_user1@cloudshell:~ (tarkshyas-1636464440135)$ 
```

Successfully created a VM instance

The screenshot shows the Google Cloud Platform Compute Engine VM Instances page. The left sidebar has 'VM instances' selected. The main area shows a table with one row for 'my-first-instance'. The table columns are Status, Name, Zone, Recommendations, In use by, Internal IP, External IP, and Connect. The 'my-first-instance' row shows 'Status' as green (running), 'Name' as 'my-first-instance', 'Zone' as 'us-central1-a', 'Internal IP' as '10.128.0.2 (nic0)', 'External IP' as '35.223.95.39', and 'Connect' with an SSH button. Below the table is a terminal window showing Ansible playbooks for creating the instance.

Status	Name	Zone	Recommendations	In use by	Internal IP	External IP	Connect
Green (Running)	my-first-instance	us-central1-a			10.128.0.2 (nic0)	35.223.95.39	SSH

```
PLAY [fail] ****
  skipping: [localhost]

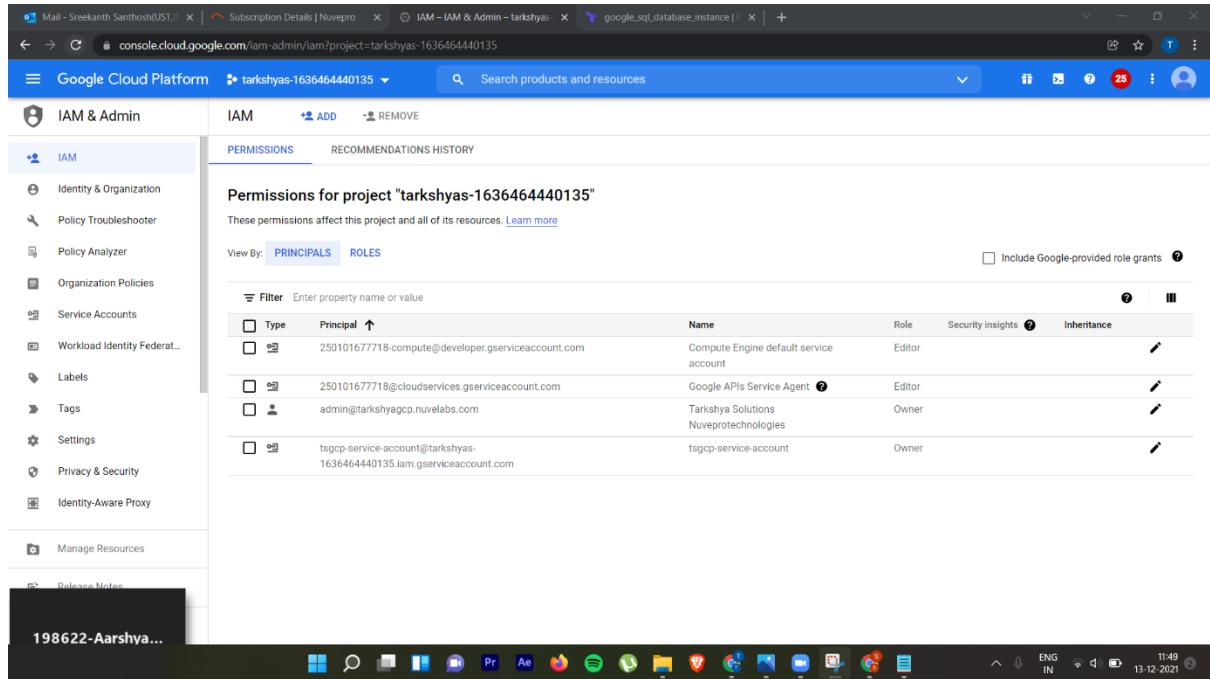
TASK [create instance in gcp]
  changed: [localhost]

PLAY RECAP ****
localhost                  : ok=3    changed=2    unreachable=0    failed=0    skipped=1    rescued=0    ignored=0

tsgcp_user17@cloudshell:~ (tarkshyas-1636464440135) $ 
```

## B) Terraform

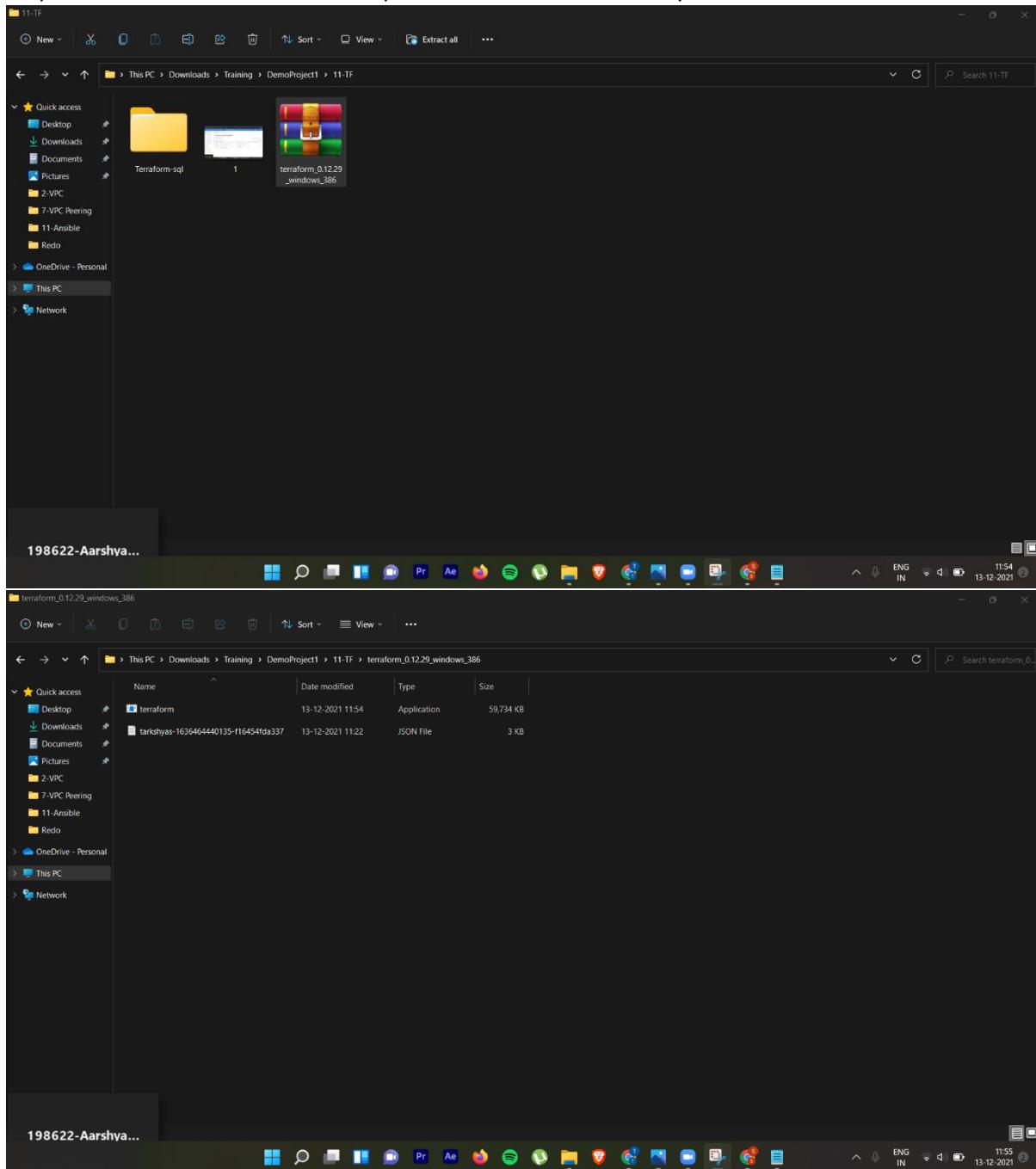
### STEP 1: Create a Service Account and Download key



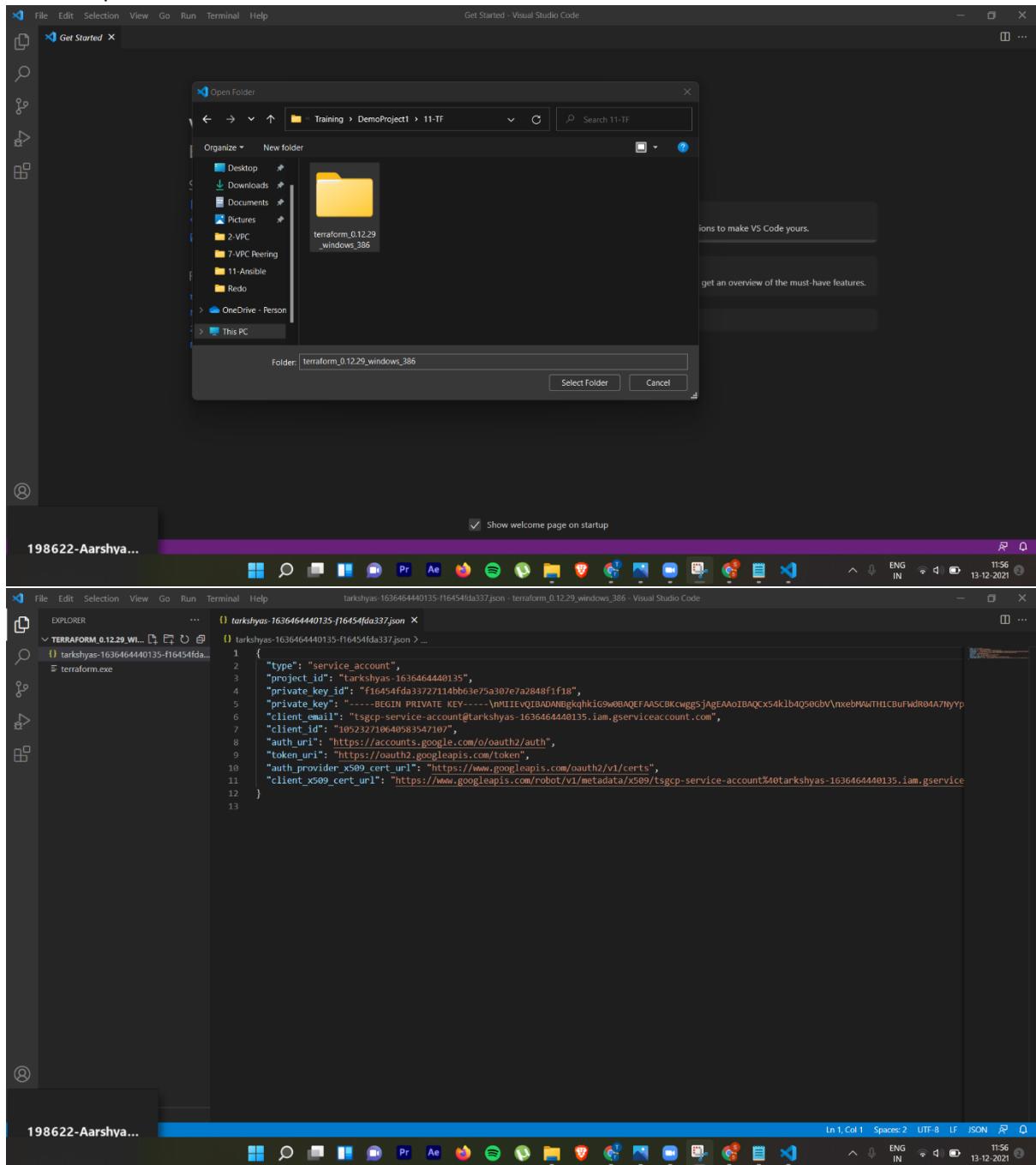
The screenshot shows the Google Cloud Platform IAM & Admin interface. The left sidebar is titled 'IAM & Admin' and includes sections for Identity & Organization, Policy Troubleshooter, Policy Analyzer, Organization Policies, Service Accounts, Workload Identity Federations, Labels, Tags, Settings, Privacy & Security, Identity-Aware Proxy, Manage Resources, and Release Notes. The main content area is titled 'PERMISSIONS' and shows 'Permissions for project "tarkshyas-1636464440135"'. It lists four principals: 'Compute Engine default service account', 'Google APIs Service Agent', 'Tarkshya Solutions Nuveprotechnologies', and 'tsgcp-service-account'. The 'tsgcp-service-account' has the role 'Owner'. There are tabs for 'PRINCIPALS' and 'ROLES', and a filter bar at the top.

Type	Principal	Name	Role	Security Insights	Inheritance
✉️	250101677718-compute@developer.gserviceaccount.com	Compute Engine default service account	Editor		
✉️	250101677718@cloudservices.gserviceaccount.com	Google APIs Service Agent	Editor		
👤	admin@tarkshyagcp.nuelabs.com	Tarkshya Solutions Nuveprotechnologies	Owner		
✉️	tsgcp-service-account@tarkshyas-1636464440135.iam.gserviceaccount.com	tsgcp-service-account	Owner		

Step2: Extract the terraform file and paste the Service account key in same folder



### STEP 3: Open the file in Visual Studio Code



STEP 4: Create files vm.tf and provider.tf as shown below in the same folder

The screenshot shows two instances of Visual Studio Code side-by-side, both displaying Terraform configuration files.

**Top Window (provider.tf):**

```
provider "google" {
  credentials = "tarkshyas-1636464440135-f16454fd4337.json"
  project     = "tarkshyas-1636464440135"
  region      = "us-central1"
  zone        = "us-central1-c"
}
```

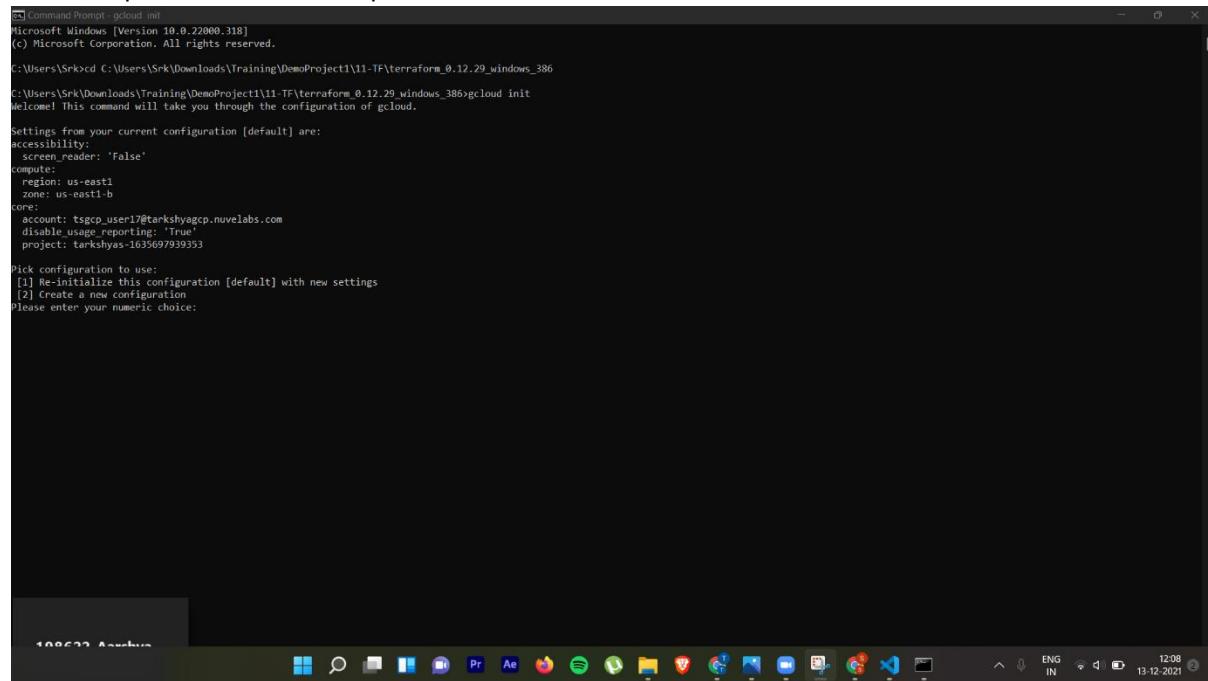
**Bottom Window (vm.tf):**

```
resource "google_compute_instance" "vm_instance" {
  name            = "terraform-instance"
  machine_type   = "f1-micro"

  boot_disk {
    initialize_params {
      image = "debian-cloud/debian-9"
    }
  }

  network_interface {
    network = "default"
    access_config{
    }
  }
}
```

### STEP 5: Open Command Prompt and initialize GCLOUD and TERRAFORM



```
Command Prompt gcloud init
Microsoft Windows [Version 10.0.22000.318]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\terrafrom_0.12.29_windows_386>gcloud init
Welcome! This command will take you through the configuration of gcloud.

Settings from your current configuration [default] are:
accessibility:
  screen_reader: 'False'
compute:
  region: us-east1
  zone: us-east1-b
core:
  account: tsgcp_user17@tarkshyagcp.nuvelabs.com
  disable_usage_reporting: 'True'
  project: tarkshyas-1636697939353

Pick configuration to use:
[1] Re-initialize this configuration [default] with new settings
[2] Create a new configuration
Please enter your numeric choice:
```

## Sreekanth Santhosh-198642

```
ps Command Prompt : terraform init
able to do this for you the next time you run it, make sure the
Compute Engine API is enabled for your project on the
https://console.developers.google.com/apis page.

Your Google Cloud SDK is configured and ready to use!

* Commands that require authentication will use tsgcp_user17@tarkshyagcp.nuvelabs.com by default
* Commands will reference project 'tarkshyas-163646440135' by default
Run 'gcloud help config' to learn how to change individual settings

This gcloud configuration is called [default]. You can create additional configurations if you work with multiple accounts and/or projects.
Run 'gcloud topic configurations' to learn more.

Some things to try next:
* Run 'gcloud --help' to see the Cloud Platform services you can interact with. And run 'gcloud help COMMAND' to get help on any gcloud command.
* Run 'gcloud topic --help' to learn about advanced features of the SDK like arg files and output formatting

Updates are available for some Cloud SDK components. To install them,
please run:
$ gcloud components update

To take a quick anonymous survey, run:
$ gcloud survey

C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\terraform_0.12.29_windows_386>tf init
'tf' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\terraform_0.12.29_windows_386>terraform init
Initializing the backend...
Initializing provider plugins...
- Checking for available provider plugins...
- Downloading plugin for provider "google" (hashicorp/google) 3.65.0...

10:22:22 Azimuth
12:10 13-12-2021

ps Command Prompt
To take a quick anonymous survey, run:
$ gcloud survey

C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\terraform_0.12.29_windows_386>tf init
'tf' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\terraform_0.12.29_windows_386>terraform init
Initializing the backend...
Initializing provider plugins...
- Checking for available provider plugins...
- Downloading plugin for provider "google" (hashicorp/google) 3.65.0...

The following providers do not have any version constraints in configuration,
so the latest version was installed.

To prevent automatic upgrades to new major versions that may contain breaking
changes, it is recommended to add version = "...." constraints to the
corresponding provider blocks in configuration, with the constraint strings
suggested below.

* provider.google: version = "~> 3.65"

Warning: registry.terraform.io: This version of Terraform has an outdated GPG key and is unable to verify new provider releases. Please upgrade Terraform to at least 0.12.31 to receive new provider updates. For
details see: https://discuss.hashicorp.com/t/hcsec-2021-12-codecov-security-event-and-hashicorp-gpg-key-exposure/23512

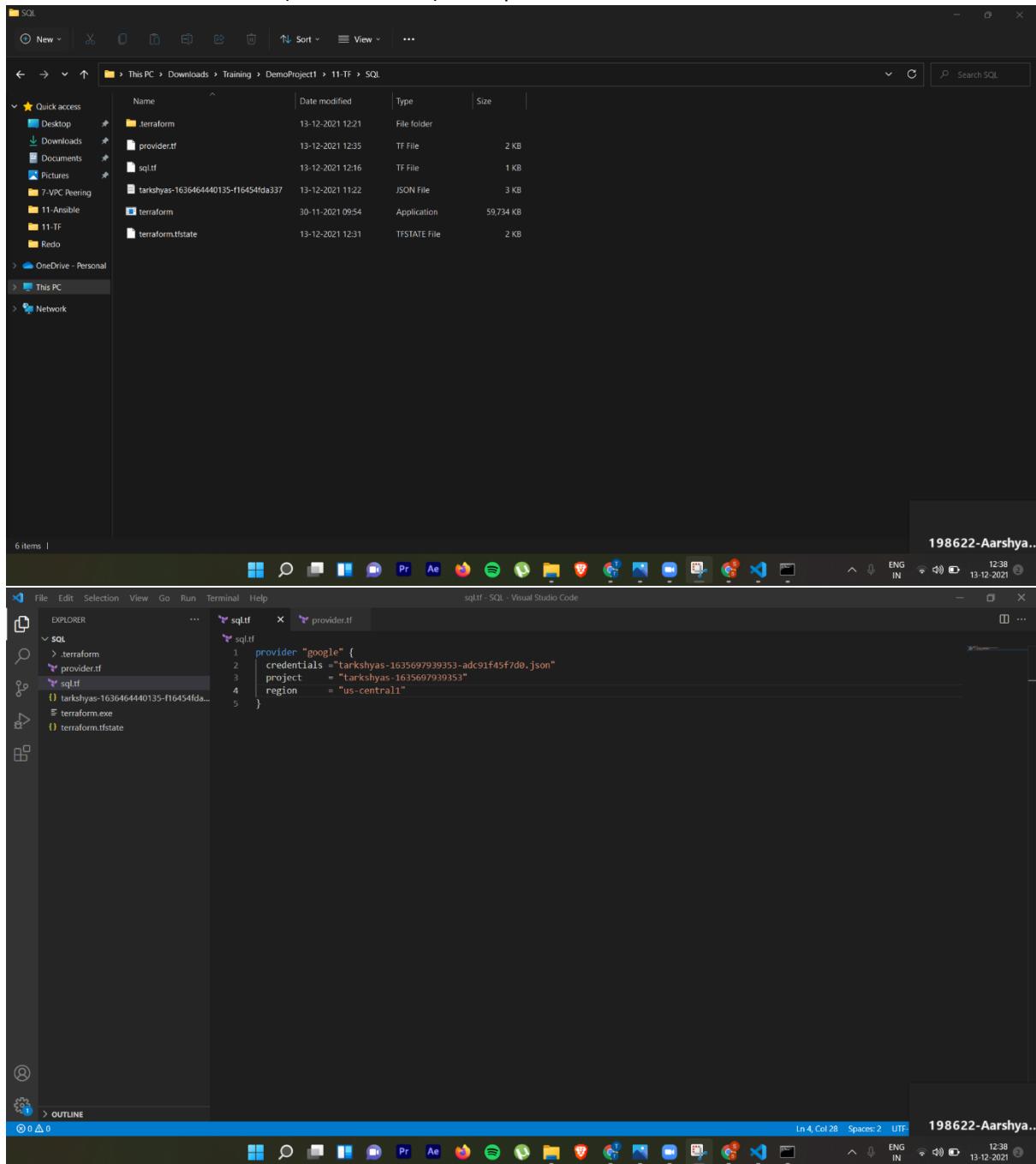
Terraform has been successfully initialized

You may now begin working with Terraform. Try running "terraform plan" to see
any changes that are required for your infrastructure. All Terraform commands
should now work.

If you ever set or change modules or backend configuration for Terraform,
rerun this command to reinitialize your working directory. If you forget, other
commands will detect it and remind you to do so if necessary.

C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\terraform_0.12.29_windows_386>
```

STEP 6: Create a similar file( to create SQL) and open it in Visual studio Code



The image shows two side-by-side instances of Visual Studio Code, both displaying the same Terraform configuration file named `provider.tf`. The configuration is written in Terraform syntax and defines resources for a Google Compute Network and a Google SQL Database Instance.

```

provider "google-beta" {
  credentials = "tarkshyas-1636464440135-f16454fd337.json"
  project    = "tarkshyas-1636464440135"
  region    = "us-central1"
  zone      = "us-central1-c"
}

resource "google_compute_network" "private_network" {
  provider = google-beta
  name = "private-network"
}

resource "google_compute_global_address" "private_ip_address" {
  provider = google-beta
  name     = "private-ip-address"
  purpose  = "VPC_PEERING"
  address_type = "INTERNAL"
  prefix_length = 16
  network   = google_compute_network.private_network.id
}

resource "google_service_networking_connection" "private_vpc_connection" {
  provider = google-beta
  network      = google_compute_network.private_network.id
  service      = "servicenetworking.googleapis.com"
  reserved_peering_ranges = [google_compute_global_address.private_ip_address.name]
}

resource "random_id" "db_name_suffix" {
  byte_length = 4
}

resource "google_sql_database_instance" "instance" {
  provider = google-beta
  name      = "private-instance-${random_id.db_name_suffix.hex}"
  region   = "us-central1"
  database_version = "MySQL_5_7"
}

depends_on = [google_service_networking_connection.private_vpc_connection]

settings {
  tier = "db-f1-micro"
  ip_configuration {
    ipv4_enabled = false
    private_network = google_compute_network.private_network.id
  }
}

```

The configuration includes a provider block for Google Cloud Platform (beta), resource blocks for creating a private network, a global IP address, and a VPC connection, and a resource block for creating a MySQL 5.7 database instance. The database instance depends on the VPC connection. The code uses random IDs for the database suffix and the IP address.

STEP 7: Open command prompt and initialize GCLOUD and TERRAFORM once again

The screenshot shows a Windows Command Prompt window titled "Command Prompt". The command \$ gcloud components update is run, followed by \$ terraform init. The output indicates that Terraform is initializing its provider plugins, specifically the "google" provider. It also mentions a warning about an outdated GPG key for the registry. The command \$ gcloud init is also shown at the bottom.

```
please run:
$ gcloud components update

To take a quick anonymous survey, run:
$ gcloud survey

C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\terraform_0.12.29_windows_386>tf init
'tf' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\terraform_0.12.29_windows_386>terraform init
Initializing the backend...
Initializing provider plugins...
- Checking for available provider plugins...
- Downloading plugin for provider "google" (hashicorp/google) 3.65.0...
The following providers do not have any version constraints in configuration,
so the latest version was installed.

To prevent automatic upgrades to new major versions that may contain breaking
changes, it is recommended to add version = "...." constraints to the
corresponding provider blocks in configuration, with the constraint strings
suggested below.

* provider.google: version = "~> 3.65"

Warning: registry.terraform.io: This version of Terraform has an outdated GPG key and is unable to verify new provider releases. Please upgrade Terraform to at least 0.12.31 to receive new provider updates. For details see: https://discuss.hashicorp.com/t/hcsec-2021-12-codecov-security-event-and-hashicorp-gpg-key-exposure/23512

Terraform has been successfully initialized!

You may now begin working with Terraform. Try running "terraform plan" to see
any changes that are required for your infrastructure. All Terraform commands
should now work.

If you ever set or change modules or backend configuration for Terraform,
rerun this command to reinitialize your working directory. If you forget, other
commands will detect it and remind you to do so if necessary.

C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\terraform_0.12.29_windows_386>cd C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\SQL
C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\SQL>gcloud init
```

## Sreekanth Santhosh-198642

```
PS C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\SQL>terraform init
You are logged in as: [tsgcp_user17@tarkshyagcp.nuvelabs.com].
WARNING: Listing available projects failed: There was a problem refreshing your current auth tokens: ('invalid_grant: Account has been deleted', {'error': 'invalid_grant', 'error_description': 'Account has been deleted'})
Please run:
$ gcloud auth login
to obtain new credentials.

If you have already logged in with a different account:
$ gcloud config set account ACCOUNT
to select an already authenticated account to use.
Enter project id you would like to use: tarkshyas-1636464440135
Your current project has been set to: [tarkshyas-1636464440135].
Not setting default zone/region (this feature makes it easier to use [gcloud compute] by setting an appropriate default value for the --zone and --region flag).
see https://cloud.google.com/compute/docs/gcloud-compute section on how to set default zone/region/description.
If you would like [gcloud init] to be able to do this for you the next time you run it, make sure the Compute Engine API is enabled for your project on the https://console.developers.google.com/apis page.

Your Google Cloud SDK is configured and ready to use!
* Commands that require authentication will use tsgcp_user17@tarkshyagcp.nuvelabs.com by default
* Commands will reference project 'tarkshyas-1636464440135' by default
Run 'gcloud help config' to learn how to change individual settings

This gcloud configuration is called [default]. You can create additional configurations if you work with multiple accounts and/or projects.
Run 'gcloud topic configurations' to learn more.

Some things to try next:
* Run 'gcloud --help' to see the Cloud Platform services you can interact with. And run 'gcloud help COMMAND' to get help on any gcloud command.
* Run 'gcloud topic --help' to learn about advanced features of the SDK like arg files and output formatting

C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\SQL>terraform init
Initializing the backend...
Initializing provider plugins...
- Checking for available provider plugins...
- Downloading plugin for provider "google" (hashicorp/google) 3.65.0...
The following providers do not have any version constraints in configuration,
so the latest version was installed.

To prevent automatic upgrades to new major versions that may contain breaking
changes, it is recommended to add version = "..." constraints to the
corresponding provider blocks in configuration, with the constraint strings
suggested below.

* provider.google: version = "> 3.65"
* provider.google-beta: version = "> 3.65"
* provider.random: version = "> 3.1"

Warning: registry.terraform.io: This version of Terraform has an outdated GPG key and is unable to verify new provider releases. Please upgrade Terraform to at least 0.12.31 to receive new provider updates. For details see: https://discuss.hashicorp.com/t/hcsec-2021-12-codecov-security-event-and-hashicorp-gpg-key-exposure/23512

Warning: registry.terraform.io: This version of Terraform has an outdated GPG key and is unable to verify new provider releases. Please upgrade Terraform to at least 0.12.31 to receive new provider updates. For details see: https://discuss.hashicorp.com/t/hcsec-2021-12-codecov-security-event-and-hashicorp-gpg-key-exposure/23512

Warning: registry.terraform.io: This version of Terraform has an outdated GPG key and is unable to verify new provider releases. Please upgrade Terraform to at least 0.12.31 to receive new provider updates. For details see: https://discuss.hashicorp.com/t/hcsec-2021-12-codecov-security-event-and-hashicorp-gpg-key-exposure/23512

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If you ever set or change modules or backend configuration for Terraform,
rerun this command to reinitialize your working directory. If you forget, other
commands will detect it and remind you to do so if necessary.

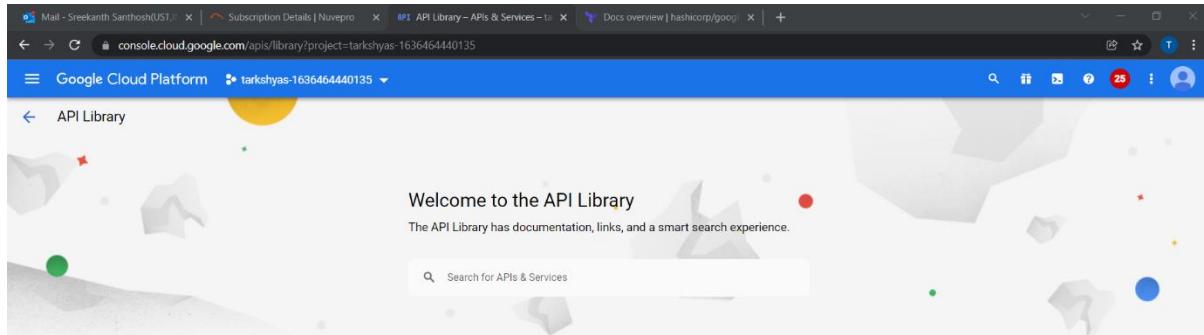
C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\SQL>
```

STEP 8: Go to API Library and Enable the following services

a) Service Networking API

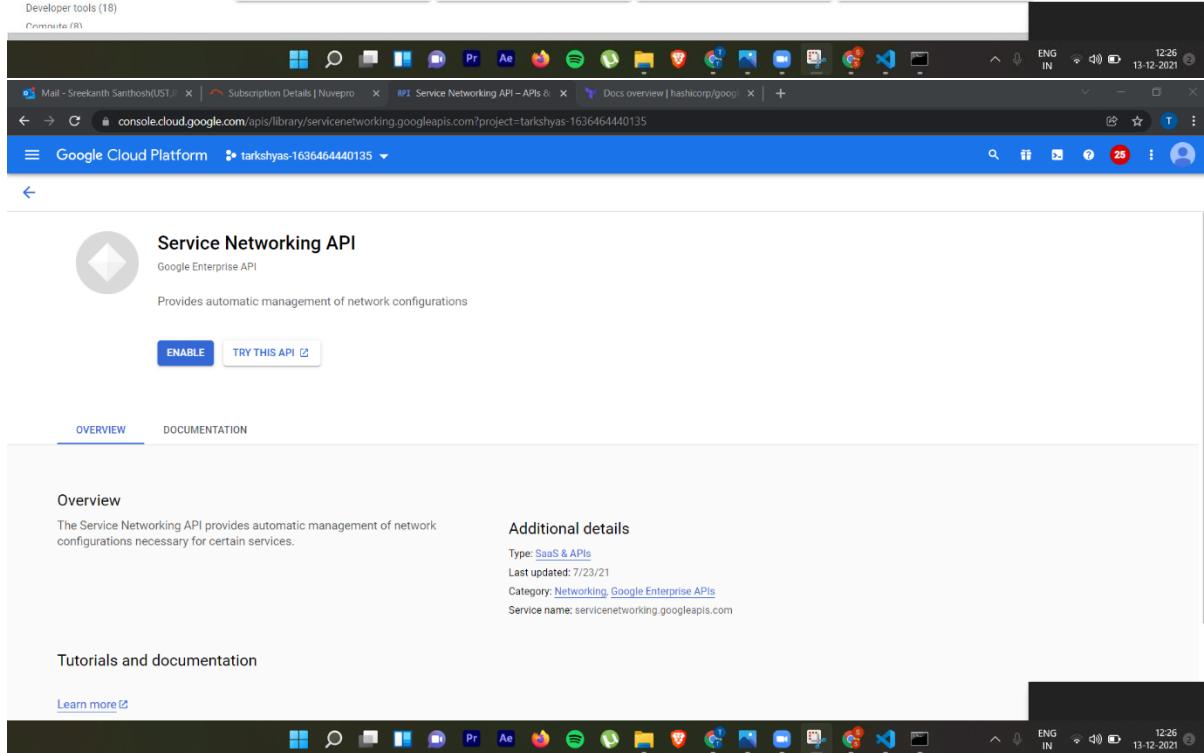
b) Cloud SQL Admin API

c) Cloud Resource Manager API



The screenshot shows the Google Cloud Platform API Library interface. At the top, there's a search bar labeled "Search for APIs & Services". Below it, a section titled "Welcome to the API Library" with the subtext "The API Library has documentation, links, and a smart search experience." On the left, there's a sidebar with "Filter by" sections for "VISIBILITY" (Public: 356, Private: 2) and "CATEGORY" (Maps: 15, Big data: 16, Analytics: 5, Databases: 6, Machine learning: 9, Developer tools: 18). A "VIEW ALL (15)" link is also present. The main content area displays four API cards under the "Maps" category:

- Maps SDK for Android (Google): Maps for your native Android app.
- Maps SDK for iOS (Google): Maps for your native iOS app.
- Maps JavaScript API (Google): Maps for your website.
- Places API (Google Enterprise API): Get detailed information about 100 million places.

The screenshot shows the "Service Networking API" overview page. At the top, there's a large circular icon with a diamond symbol. Below it, the title "Service Networking API" and subtitle "Google Enterprise API" are displayed. A subtext states "Provides automatic management of network configurations". Two buttons are visible: "ENABLE" and "TRY THIS API". Below these, there are two tabs: "OVERVIEW" (which is selected) and "DOCUMENTATION".  
**Overview**  
The Service Networking API provides automatic management of network configurations necessary for certain services.  
**Additional details**  
Type: SaaS & APIs  
Last updated: 7/23/21  
Category: Networking, Google Enterprise APIs  
Service name: servicenetworking.googleapis.com  
  
**Tutorials and documentation**  
[Learn more](#)

The image shows two screenshots of the Google Cloud Platform API library interface.

**Cloud SQL Admin API Overview:**

- Overview:** API for Cloud SQL database instance management.
- Additional details:**
  - Type: SaaS & APIs
  - Last updated: 7/23/21
  - Category: Google Enterprise APIs
  - Service name: sqldadmin.googleapis.com
- Tutorials and documentation:** Learn more

**Cloud Resource Manager API Overview:**

- Overview:** Creates, reads, and updates metadata for Google Cloud Platform resource containers.
- Additional details:**
  - Type: SaaS & APIs
  - Last updated: 7/23/21
  - Category: Google Enterprise APIs
  - Service name: cloudresourcemanager.googleapis.com
- Tutorials and documentation:** Learn more

## STEP 9: Open Command Prompt

```

Command Prompt - terraform plan
Initializing provider plugins...
- Checking for available provider plugins...
- Downloading plugin for provider "google" (hashicorp/google) 3.65.0...
- Downloading plugin for provider "random" (hashicorp/random) 3.1.0...
- Downloading plugin for provider "google-beta" (hashicorp/google-beta) 3.65.0...

The following providers do not have any version constraints in configuration,
so the latest version was installed.

To prevent automatic upgrades to new major versions that may contain breaking
changes, it is recommended to add version = "..." constraints to the
corresponding provider blocks in configuration, with the constraint strings
suggested below.

* provider.google: version = "> 3.65"
* provider.google-beta: version = "> 3.65"
* provider.random: version = "> 3.1"

Warning: registry.terraform.io: This version of Terraform has an outdated GPG key and is unable to verify new provider releases. Please upgrade Terraform to at least 0.12.31 to receive new provider updates. For details see: https://discuss.hashicorp.com/t/hcsec-2021-12-codecov-security-event-and-hashicorp-gpg-key-exposure/23512

Warning: registry.terraform.io: This version of Terraform has an outdated GPG key and is unable to verify new provider releases. Please upgrade Terraform to at least 0.12.31 to receive new provider updates. For details see: https://discuss.hashicorp.com/t/hcsec-2021-12-codecov-security-event-and-hashicorp-gpg-key-exposure/23512

Warning: registry.terraform.io: This version of Terraform has an outdated GPG key and is unable to verify new provider releases. Please upgrade Terraform to at least 0.12.31 to receive new provider updates. For details see: https://discuss.hashicorp.com/t/hcsec-2021-12-codecov-security-event-and-hashicorp-gpg-key-exposure/23512

Terraform has been successfully initialized!

You may now begin working with Terraform. Try running "terraform plan" to see
any changes that are required for your infrastructure. All Terraform commands
should now work.

If you ever set or change modules or backend configuration for Terraform,
rerun this command to reinitialize your working directory. If you forget, other
commands will detect it and remind you to do so if necessary.

C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\SQL>tf
'tf' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\SQL>terraform plan

Plan: 6 to add, 0 to change, 0 to destroy.

-----
Note: You didn't specify an "-out" parameter to save this plan, so Terraform
can't guarantee that exactly these actions will be performed if
"terraform apply" is subsequently run.

C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\SQL>terraform apply

```

```

C:\> Command Prompt - terraform apply
+ pricing_plan          = "PER_USE"
+ replication_type      = (known after apply)
+ tier                  = "db-f1-micro"
+ user_labels           = (known after apply)
+ version               = (known after apply)

+ backup_configuration {
    + binary_log_enabled   = (known after apply)
    + enabled              = (known after apply)
    + location             = (known after apply)
    + point_in_time_recovery_enabled = (known after apply)
    + start_time           = (known after apply)
    + transaction_log_retention_days = (known after apply)
  }

+ backup_retention_settings [
    + retained_backups     = (known after apply)
    + retention_unit       = (known after apply)
  ]
}

+ ip_configuration {
    + ipv4_enabled         = false
    + private_network      = (known after apply)
  }

+ location_preference {
    + follow_gae_application = (known after apply)
    + zone                  = (known after apply)
  }
}

# random_id.db.name_suffix will be created
resource "random_id" "db_name_suffix" {
    + b64_std            = (known after apply)
    + b64_url            = (known after apply)
    + byte_length         = 4
    + dec                = (known after apply)
    + hex                = (known after apply)
    + id                 = (known after apply)
}
}

Plan: 6 to add, 0 to change, 0 to destroy.

Do you want to perform these actions?
Terraform will perform the actions described above.
Only 'yes' will be accepted to approve.

Enter a value: yes
  
```

198622-Aarshya...

```

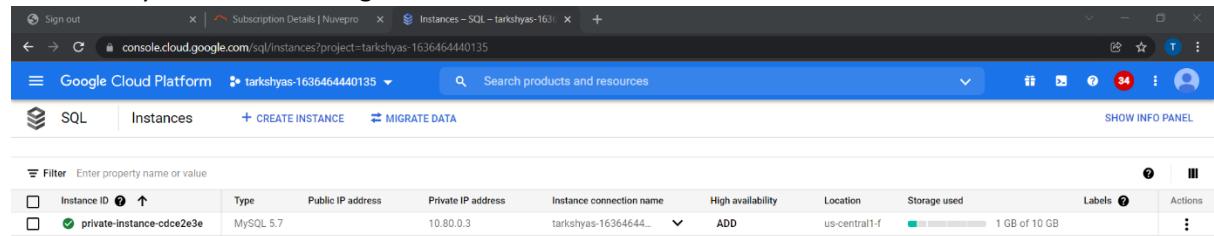
C:\> Command Prompt
google_sql_database_instance: Still creating... [4m51s elapsed]
google_sql_database_instance: Still creating... [5m1s elapsed]
google_sql_database_instance: Still creating... [5m11s elapsed]
google_sql_database_instance: Still creating... [5m21s elapsed]
google_sql_database_instance: Still creating... [5m31s elapsed]
google_sql_database_instance: Still creating... [5m41s elapsed]
google_sql_database_instance: Still creating... [5m51s elapsed]
google_sql_database_instance: Still creating... [6m1s elapsed]
google_sql_database_instance: Still creating... [6m21s elapsed]
google_sql_database_instance: Still creating... [6m31s elapsed]
google_sql_database_instance: Still creating... [6m41s elapsed]
google_sql_database_instance: Still creating... [6m51s elapsed]
google_sql_database_instance: Still creating... [7m1s elapsed]
google_sql_database_instance: Still creating... [7m21s elapsed]
google_sql_database_instance: Still creating... [7m31s elapsed]
google_sql_database_instance: Still creating... [7m41s elapsed]
google_sql_database_instance: Still creating... [7m51s elapsed]
google_sql_database_instance: Still creating... [8m1s elapsed]
google_sql_database_instance: Still creating... [8m21s elapsed]
google_sql_database_instance: Still creating... [8m31s elapsed]
google_sql_database_instance: Still creating... [8m41s elapsed]
google_sql_database_instance: Still creating... [8m51s elapsed]
google_sql_database_instance: Still creating... [9m1s elapsed]
google_sql_database_instance: Still creating... [9m21s elapsed]
google_sql_database_instance: Still creating... [9m31s elapsed]
google_sql_database_instance: Still creating... [9m41s elapsed]
google_sql_database_instance: Still creating... [9m51s elapsed]
google_sql_database_instance: Still creating... [10m1s elapsed]
google_sql_database_instance: Still creating... [10m21s elapsed]
google_sql_database_instance: Still creating... [10m31s elapsed]
google_sql_database_instance: Still creating... [10m41s elapsed]
google_sql_database_instance: Still creating... [10m51s elapsed]
google_sql_database_instance: Still creating... [11m1s elapsed]
google_sql_database_instance: Still creating... [11m21s elapsed]
google_sql_database_instance: Still creating... [11m31s elapsed]
google_sql_database_instance: Still creating... [11m41s elapsed]
google_sql_database_instance: Creation complete after 13m2s [id:private-instance-cde2e3e]
google_sql_database.database: Creation complete after 8s [id:projects/tarkshyas-1636464440135/instances/private-instance-cde2e3e/databases/my-database]

Apply complete! Resources: 6 added, 0 changed, 0 destroyed.

C:\Users\Srk\Downloads\Training\DemoProject1\11-TF\sql>
  
```

198622-Aarshya...

Successfully created SQL using Terraform



The screenshot shows the Google Cloud Platform Instances page for the project 'tarkshyas-1636464440135'. The table lists one instance:

Instance ID	Type	Public IP address	Private IP address	Instance connection name	High availability	Location	Storage used	Labels	Actions
<input type="checkbox"/> private-instance-cdce2e3e	MySQL 5.7	10.80.0.3	tarkshyas-16364644...	ADD	us-central1-f	1 GB of 10 GB			<input type="button" value="⋮"/>

Below the table, there is a Windows taskbar with various icons and a system tray showing the date and time.

## 12.a) Understanding the concept of BigQuery: Import you Data into BigQuery and Cloud storage;

### SQL basics (WHERE, GROUP BY, JOIN TABLES).

The screenshot shows the Google Cloud Platform BigQuery interface. In the top navigation bar, the project ID is tarkshyas-1636464440135 and the search term is 'bigquery'. The main area is titled 'Editor' with a single row labeled '1'. Below the editor, there is a search bar and a message: 'Viewing pinned projects.' A context menu is open over a project entry 'tarkshyas-1636464440135', with options 'Open' and 'Create dataset' visible. The bottom part of the screen shows a 'Create dataset' dialog box. The 'Project ID' field is set to 'tarkshyas-1636464440135'. The 'Dataset ID' field is set to 'dataset1' with a note: 'Letters, numbers, and underscores allowed'. The 'Data location' dropdown is set to 'us (multiple regions in United States)'. Under 'Default table expiration', there is a checkbox for 'Enable table expiration' which is unchecked. The 'Encryption' section shows two options: 'Google-managed encryption key' (selected) and 'Customer-managed encryption key (CMK)' (unselected). At the bottom of the dialog are 'CREATE DATASET' and 'CANCEL' buttons. The status bar at the bottom right shows 'Trainer', 'ENG IN', '13-12-2021', and '15:45'.

## Sreekanth Santhosh-198642

The screenshot shows two instances of the Google Cloud Platform BigQuery web interface. The top instance displays the 'dataset1' dataset under the 'tarkshyas-1636464440135' project. A context menu is open over the 'dataset1' entry, with options 'Open', 'Delete', and 'Create table'. A notification at the bottom of the screen states "'dataset1' created." and includes a 'GO TO DATASET' link. The bottom instance shows the 'Create table' dialog box. In the 'Source' section, 'Create table from Upload' is selected, and a file named 'SHIB-USD.csv' is chosen via a 'BROWSE' button. In the 'Destination' section, the 'Project' is set to 'tarkshyas-1636464440135', the 'Dataset' is 'dataset1', and the 'Table' is 'shib1'. The 'Table type' is set to 'Native table'. At the bottom of the dialog, there are 'CREATE TABLE' and 'CANCEL' buttons.

**BigQuery Schema (Top Screenshot):**

Field name	Type	Mode	Policy Tags	Description
Date	DATE	NULLABLE		
Open	FLOAT	NULLABLE		
High	FLOAT	NULLABLE		
Low	FLOAT	NULLABLE		
Close	FLOAT	NULLABLE		
Adj_Close	FLOAT	NULLABLE		
Volume	INTEGER	NULLABLE		

**Create a Bucket (Bottom Screenshot):**

**Name your bucket:** shib-bucket

**Storage size:** 0.026 per GB-month

**Data retrieval size:** Free

**Object versioning:** Off

**Operations:**

- Class A operations: \$0.005 per 1,000 ops
- Class B operations: \$0.0004 per 1,000 ops

**Availability SLA:** 99.95%

**Monthly cost:** \$0.00

## Sreekanth Santhosh-198642

The screenshot displays two Google Cloud Platform interfaces side-by-side.

**Left Window: Cloud Storage**

The title bar shows "Google Cloud Platform" and "tarkshyas-1636464440135". The main content is titled "Bucket details" for "shib-bucket". It shows basic bucket information: Location (us (multiple regions in United States)), Storage class (Standard), Public access (Not public), and Protection (None). Below this are tabs for "OBJECTS", "CONFIGURATION", "PERMISSIONS", "PROTECTION", and "LIFECYCLE". A table lists one object: "shib-usd-max.csv" (28.6 KB, application/vnd.ms-excel, created Dec 13, 2021, last modified Dec 13, 2021).

**Right Window: BigQuery**

The title bar shows "Google Cloud Platform" and "bigquery?referer=search&project=tarkshyas-1636464440135&d=dataset1&p=tarkshyas-1636464440135&t=shib1&page=table". The main content is titled "Create table". The "Source" section is set to "Select file from GCS bucket" and has "shib-usd-max.csv" selected. The "Destination" section includes fields for "Project" (tarkshyas-1636464440135), "Dataset" (dataset1), and "Table" (shib1). The "Table type" is set to "Native table". At the bottom are "CREATE TABLE" and "CANCEL" buttons. A modal window titled "Choose a file" is open, showing the same "shib-usd-max.csv" file listed under "shib-bucket".

## Sreekanth Santhosh-198642

The screenshot shows the Google Cloud Platform BigQuery interface with two tabs open: 'shib1' and 'e\_commerce'. The 'shib1' tab displays its schema:

Field name	Type	Mode	Policy Tags	Description
Date	DATE	NULLABLE		
Open	FLOAT	NULLABLE		
High	FLOAT	NULLABLE		
Low	FLOAT	NULLABLE		
Close	FLOAT	NULLABLE		
Adj_Close	FLOAT	NULLABLE		
Volume	INTEGER	NULLABLE		

The 'e\_commerce' tab displays its preview data:

ID	Product ID	Product Name	Category	Price	Stock Level	Country		
14	536370	21731	RED TOADSTOOL LED NIGHT LIGHT	24	2010-12-01 08:45:00 UTC	1.65	12583	France
15	536370	22900	SET 2 TEA TOWELS I LOVE LONDON	24	2010-12-01 08:45:00 UTC	2.95	12583	France
16	536370	21913	VINTAGE SEASIDE JIGSAW PUZZLES	12	2010-12-01 08:45:00 UTC	3.75	12583	France
17	536370	22540	MINI JIGSAW CIRCUS PARADE	24	2010-12-01 08:45:00 UTC	0.42	12583	France
18	536370	22544	MINI JIGSAW SPACEBOY	24	2010-12-01 08:45:00 UTC	0.42	12583	France
19	536370	22492	MINI PAINT SET VINTAGE	36	2010-12-01 08:45:00 UTC	0.65	12583	France
20	536370	POST	POSTAGE	3	2010-12-01 08:45:00 UTC	18.0	12583	France
21	536385	22783	SET 3 WICKER OVAL BASKETS W LIDS	1	2010-12-01 09:56:00 UTC	19.95	17420	United Kingdom
22	536385	22961	JAM MAKING SET PRINTED	12	2010-12-01 09:56:00 UTC	1.45	17420	United Kingdom
23	536385	22960	JAM MAKING SET WITH JARS	6	2010-12-01 09:56:00 UTC	4.25	17420	United Kingdom
24	536378	22386	JUMBO BAG PINK POLKADOT	10	2010-12-01 09:37:00 UTC	1.95	14688	United Kingdom
25	536378	85099C	JUMBO BAG BAROQUE BLACK WHITE	10	2010-12-01 09:37:00 UTC	1.95	14688	United Kingdom
26	536378	21033	JUMBO BAG CHARLIE AND LOLA TOYS	10	2010-12-01 09:37:00 UTC	2.95	14688	United Kingdom
27	536378	20723	STRAWBERRY CHARLOTTE BAG	10	2010-12-01 09:37:00 UTC	0.85	14688	United Kingdom

## Sreekanth Santhosh-198642

The image shows two screenshots of the Google Cloud Platform BigQuery interface, one above the other. Both screenshots display a query editor window with a query being run against a dataset named 'dataset1.e\_commerce'.

**Top Screenshot:**

- Query:**

```
1 SELECT InvoiceNo, StockCode, Description, Quantity, InvoiceDate, UnitPrice, CustomerID, Country
2 FROM `tarkshyas-1636464440135.dataset1.e_commerce`
3
4 WHERE
5   Country='France'
6   ORDER BY
7     UnitPrice DESC
8
9 LIMIT 1000
```
- Results:** The results table shows 4 rows of data from France. The columns are Row, InvoiceNo, StockCode, Description, Quantity, InvoiceDate, UnitPrice, CustomerID, and Country.

Row	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country
1	536370	POST	POSTAGE	3	2010-12-01 08:45:00 UTC	18.0	12583	France
2	536370	22726	ALARM CLOCK BAKELIKE GREEN	12	2010-12-01 08:45:00 UTC	3.75	12583	France
3	536370	22728	ALARM CLOCK BAKELIKE PINK	24	2010-12-01 08:45:00 UTC	3.75	12583	France
4	536370	22727	ALARM CLOCK BAKELIKE RED	24	2010-12-01 08:45:00 UTC	3.75	12583	France

**Bottom Screenshot:**

- Query:**

```
1 SELECT StockCode, Description, Quantity, InvoiceDate, UnitPrice, CustomerID, Country
2 FROM `tarkshyas-1636464440135.dataset1.e_commerce`
3
4 WHERE
5   Country='France'
6   GROUP BY
7     StockCode, Description, Quantity, InvoiceDate, UnitPrice, CustomerID, Country
8
9 LIMIT 1000
```
- Results:** The results table shows 5 rows of data from France. The columns are Row, StockCode, Description, Quantity, InvoiceDate, UnitPrice, CustomerID, and Country.

Row	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country
1	22728	ALARM CLOCK BAKELIKE PINK	24	2010-12-01 08:45:00 UTC	3.75	12583	France
2	22727	ALARM CLOCK BAKELIKE RED	24	2010-12-01 08:45:00 UTC	3.75	12583	France
3	22726	ALARM CLOCK BAKELIKE GREEN	12	2010-12-01 08:45:00 UTC	3.75	12583	France
4	21724	PANDA AND BUNNIES STICKER SHEET	12	2010-12-01 08:45:00 UTC	0.85	12583	France
5	91883	STARS GIFT TAPE	24	2010-12-01 08:45:00 UTC	0.65	12583	France

## Sreekanth Santhosh-198642

**shib-1**

Row	Date	Open	High	Low	Close	Adj_Close	Volume
1	2021-10-04	9e-06	1.5e-05	8e-06	1.3e-05	1.3e-05	5113996411
2	2021-10-10	2.7e-05	2.8e-05	2.5e-05	2.6e-05	2.6e-05	3597266431
3	2021-10-16	2.5e-05	2.7e-05	2.5e-05	2.6e-05	2.6e-05	1871226740
4	2021-10-11	2.6e-05	3.2e-05	2.6e-05	3.1e-05	3.1e-05	7321688785
5	2021-10-15	2.7e-05	2.7e-05	2.3e-05	2.5e-05	2.5e-05	4121246428
6	2021-10-24	3.4e-05	4.4e-05	3.4e-05	3.6e-05	3.6e-05	15337292521
7	2021-06-01	9e-06	9e-06	8e-06	9e-06	9e-06	795576484
8	2021-06-06	8e-06	9e-06	8e-06	9e-06	9e-06	359457882
9	2021-06-30	9e-06	9e-06	8e-06	9e-06	9e-06	774601888
10	2021-07-03	8e-06	9e-06	8e-06	9e-06	9e-06	387155665
11	2021-07-04	9e-06	9e-06	8e-06	9e-06	9e-06	382389431
12	2021-07-06	8e-06	9e-06	8e-06	9e-06	9e-06	695333646
13	2021-07-07	9e-06	9e-06	9e-06	9e-06	9e-06	400230047

**shib-2**

Row	Date	Market_Cap	Volume	Open	Close
1	2021-10-11	13053689094	3247920501.0	0.01	N/A
2	2021-10-10	13303342308	5792978516.0	0.01	\$0.00002612
3	2021-10-09	13623770372	10919585067.0	0.01	\$0.00002679
4	2021-10-08	1117093636	17979285473.0	0.01	\$0.00002751
5	2021-10-07	14232181765	12943843777.0	0.01	\$0.00002668
6	2021-10-06	8595878600	8379533674.0	0.01	\$0.00002845
7	2021-10-05	6672311853	4506541023.0	0.01	\$0.00001722
8	2021-10-04	4268713458	571169407.0	0.01	\$0.00001340
9	2021-09-30	3493531431	180694105.0	0.01	\$0.00000721
10	2021-09-29	3487524102	211113771.0	0.01	\$0.00000702
11	2021-09-27	3537643310	238516917.0	0.01	\$0.00000694
12	2021-09-26	3662700340	206572761.0	0.01	\$0.00000712
13	2021-09-20	4064114289	529108454.0	0.01	\$0.00000701

The screenshot shows the Google Cloud Platform BigQuery interface. The top navigation bar includes tabs for Mail, Subscription Details, shib-bucket, SQL workspace, and SQL Joins. The main title bar says "Google Cloud Platform" and "tarkshyas-1636464440135". The active tab is "bigquery".

The left sidebar has an "Explorer" section with a search bar and a list of pinned projects, including "tarkshyas-1636464440135" which contains datasets "dataset1" (with "e\_commerce" and "shib-1") and "shib-2".

The main area displays a query editor with the following SQL code:

```

1 SELECT a.Open, a.Close, b.Volume,b.Market_Cap
2 FROM `tarkshyas-1636464440135.dataset1.shib-1` AS a
3 JOIN `tarkshyas-1636464440135.dataset1.shib-2` AS b
4 ON a.Date=b.Date
    
```

A note indicates: "This query will process 13.8 kB when run."

The "Query results" section shows the output of the query. The table has columns: Row, Open, Close, Volume, and Market\_Cap. The data consists of 7 rows:

Row	Open	Close	Volume	Market_Cap
1	9.0E-6	1.3E-5	5.71169407E8	4268713458
2	2.7E-5	2.6E-5	5.792978516E9	13303342308
3	2.6E-5	3.1E-5	3.247920501E9	13053689094
4	9.0E-6	9.0E-6	8.28302106E8	4694241780
5	8.0E-6	9.0E-6	4.79285273E8	4166769446
6	9.0E-6	9.0E-6	1.052347177E9	4467885724
7	8.0E-6	9.0E-6	3.47189306E8	4150954164

Below the table, there are buttons for "SAVE RESULTS" and "EXPLORE DATA". The footer shows "PERSONAL HISTORY", "PROJECT HISTORY", and "SAVED QUERIES".

**12.b) SQL BigQuery specific features (Partitioned Tables, Clustering);**

## Sreekanth Santhosh-198642

The screenshots illustrate the process of creating a new table in a BigQuery dataset.

**Top Screenshot (BigQuery Dataset View):**

- Shows the 'lockdown' table in the 'dataset1' of project 'tarkshyas-1638768744958'.
- Table schema: Row, Country\_Region, Province, Date, Type, Reference.
- Data rows (13 total):
  - Row 1: China, Anhui, 2020-01-23, Full, https://en.wikipedia.org/wiki/2020\_Hubei\_lockdowns
  - Row 2: China, Beijing, 2020-01-23, Full, https://en.wikipedia.org/wiki/2020\_Hubei\_lockdowns
  - Row 3: China, Chongqing, 2020-01-23, Full, https://en.wikipedia.org/wiki/2020\_Hubei\_lockdowns
  - Row 4: China, Fujian, 2020-01-23, Full, https://en.wikipedia.org/wiki/2020\_Hubei\_lockdowns
  - Row 5: China, Gansu, 2020-01-23, Full, https://en.wikipedia.org/wiki/2020\_Hubei\_lockdowns
  - Row 6: China, Guangdong, 2020-01-23, Full, https://en.wikipedia.org/wiki/2020\_Hubei\_lockdowns
  - Row 7: China, Guangxi, 2020-01-23, Full, https://en.wikipedia.org/wiki/2020\_Hubei\_lockdowns
  - Row 8: China, Guizhou, 2020-01-23, Full, https://en.wikipedia.org/wiki/2020\_Hubei\_lockdowns
  - Row 9: China, Hainan, 2020-01-23, Full, https://en.wikipedia.org/wiki/2020\_Hubei\_lockdowns
  - Row 10: China, Hebei, 2020-01-23, Full, https://en.wikipedia.org/wiki/2020\_Hubei\_lockdowns
  - Row 11: China, Heilongjiang, 2020-01-23, Full, https://en.wikipedia.org/wiki/2020\_Hubei\_lockdowns
  - Row 12: China, Henan, 2020-01-23, Full, https://en.wikipedia.org/wiki/2020\_Hubei\_lockdowns
  - Row 13: China, Hubei, 2020-01-23, Full, https://en.wikipedia.org/wiki/2020\_Hubei\_lockdowns

**Bottom Screenshot (BigQuery SQL Editor):**

- Shows the creation of a new table 'lockdown\_new' in the same dataset.
- SQL Query:

```
CREATE OR REPLACE TABLE tarkshyas-1638768744958.dataset1.lockdown_new
PARTITION BY Date
CLUSTER BY Province as
SELECT * FROM tarkshyas-1638768744958.dataset1.lockdown;
```
- Message: "This statement created a new table named tarkshyas-1638768744958.dataset1.lockdown\_new."

## Sreekanth Santhosh-198642

The screenshot shows the Google Cloud Platform BigQuery interface. On the left, the sidebar includes sections for Analysis (SQL workspace, Data transfers, Scheduled queries), Migration (SQL translation), Administration (Monitoring, Capacity management, BI Engine), and Release Notes. The main area displays the 'lockdown\_new' table from the 'dataset1' in the 'tarkshyas-1638768744958' project. The table has columns: Row, Country\_Region, Province, Date, Type, and Reference. The preview shows 11 rows of data, all from April 2020, mostly listing US states like Maine, Florida, Texas, Nevada, Pennsylvania, and others. The table is partitioned, as indicated by the note in the top right.

Row	Country_Region	Province	Date	Type	Reference
1	US	Maine	2020-04-02	Full	<a href="https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_the_United_States">https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_the_United_States</a>
2	US	Florida	2020-04-02	Full	<a href="https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_the_United_States">https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_the_United_States</a>
3	US	Texas	2020-04-02	Full	<a href="https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_the_United_States">https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_the_United_States</a>
4	US	Nevada	2020-04-02	Full	<a href="https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_the_United_States">https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_the_United_States</a>
5	US	Pennsylvania	2020-04-02	Full	<a href="https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_the_United_States">https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_the_United_States</a>
6	Botswana	null	2020-04-02	Full	<a href="https://voanews.com/science-health/coronavirus-outbreak/botswana-declares-e">https://voanews.com/science-health/coronavirus-outbreak/botswana-declares-e</a>
7	Cyprus	null	2020-03-25	Full	<a href="https://www.reuters.com/article/us-health-coronavirus-cyprus-lockdown/cyprus-announces-new-lockdown-restrictions-idUSKBN20U0JL">https://www.reuters.com/article/us-health-coronavirus-cyprus-lockdown/cyprus-announces-new-lockdown-restrictions-idUSKBN20U0JL</a>
8	Panama	null	2020-03-25	Full	<a href="https://news.yahoo.com/panama-orders-paraguay-closes-borders-07274803">https://news.yahoo.com/panama-orders-paraguay-closes-borders-07274803</a>
9	Kosovo	null	2020-03-25	Partial	<a href="https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_Kosovo">https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_Kosovo</a>
10	Colombia	null	2020-03-25	Full	<a href="https://www.theguardian.com/world/2020/mar/23/colombian-groups-exploiting-coronavirus-crisis">https://www.theguardian.com/world/2020/mar/23/colombian-groups-exploiting-coronavirus-crisis</a>
11	New Zealand	null	2020-03-25	Full	<a href="https://www.bbc.co.uk/news/av/world-52001578/coronavirus-new-zealand-announces-new-lockdown">https://www.bbc.co.uk/news/av/world-52001578/coronavirus-new-zealand-announces-new-lockdown</a>

## 12.c) BigQuery ML -create easily your machine learning models using SQL

### STEP 1 : Access the dataset

- [https://console.cloud.google.com/bigquery?p=data-to-insights&d=ecommerce&t=web\\_analytics&page=table](https://console.cloud.google.com/bigquery?p=data-to-insights&d=ecommerce&t=web_analytics&page=table)

The screenshot shows the Google Cloud Platform BigQuery interface. The left sidebar displays a project structure under 'tarkshyas-1636464440135'. The main panel is titled 'web\_analytics' and shows the 'SCHEMA' tab selected. The table schema is listed as follows:

Field name	Type	Mode	Policy Tags	Description
visitorId	INTEGER	NULLABLE		
visitNumber	INTEGER	NULLABLE		
visitId	INTEGER	NULLABLE		
visitStartTime	INTEGER	NULLABLE		
date	STRING	NULLABLE		
totals	RECORD	NULLABLE		
trafficSource	RECORD	NULLABLE		
device	RECORD	NULLABLE		
geoNetwork	RECORD	NULLABLE		
customDimensions	RECORD	REPEATED		
hits	RECORD	REPEATED		
fullVisitorId	STRING	NULLABLE		

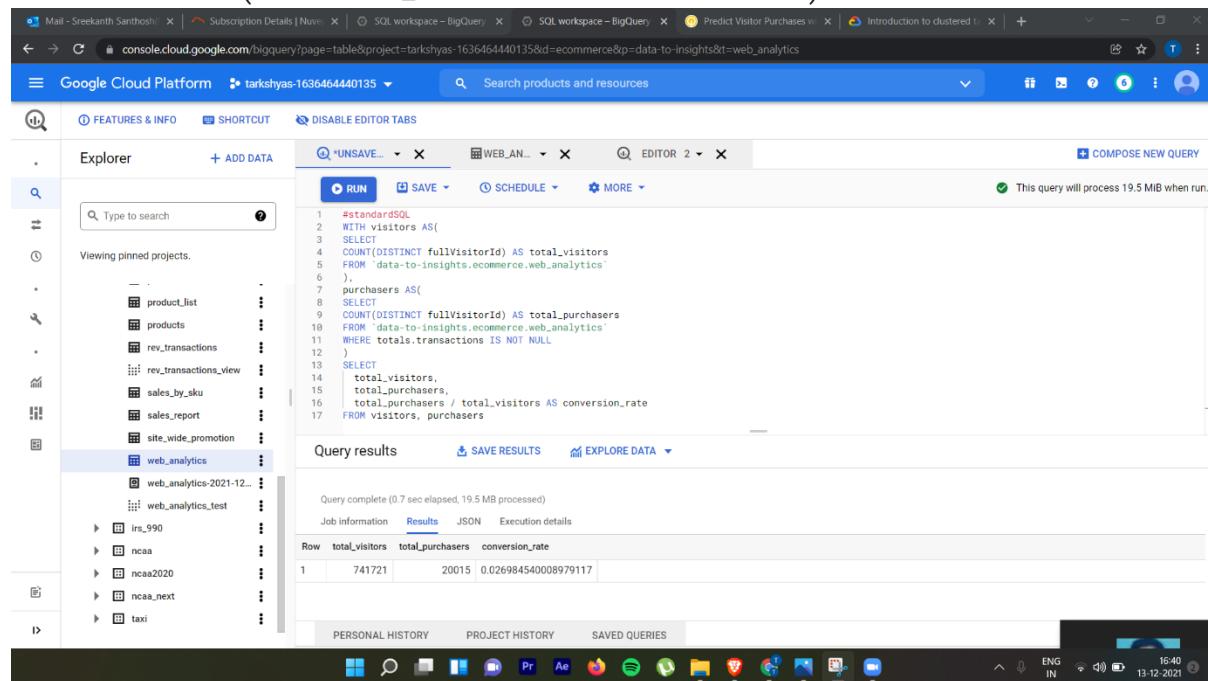
We are working on 'ecommerce' dataset 'web\_analytics' table

The screenshot shows the Google Cloud Platform BigQuery interface. The left sidebar displays a project structure under 'tarkshyas-1636464440135'. The main panel is titled 'web\_analytics' and shows the 'SCHEMA' tab selected. The table schema is listed as follows:

Field name	Type	Mode	Policy Tags	Description
product_list	INTEGER	NULLABLE		
products	INTEGER	NULLABLE		
rev_transactions	STRING	NULLABLE		
rev_transactions_view	RECORD	NULLABLE		
sales_by_sku	RECORD	NULLABLE		
sales_report	RECORD	NULLABLE		
site_wide_promotion	RECORD	NULLABLE		
web_analytics	RECORD	NULLABLE		
web_analytics-2021-12...	RECORD	NULLABLE		
web_analytics_test	RECORD	NULLABLE		
irs_990	STRING	NULLABLE		
ncaa	STRING	NULLABLE		
ncaa2020	STRING	NULLABLE		
ncaa_next	STRING	NULLABLE		
taxi	STRING	NULLABLE		

CASE 1: Out of the total visitors who visited our website, what % made a purchase?

The result: 2.69% (conversion \_rate : 0.026984540008979117)



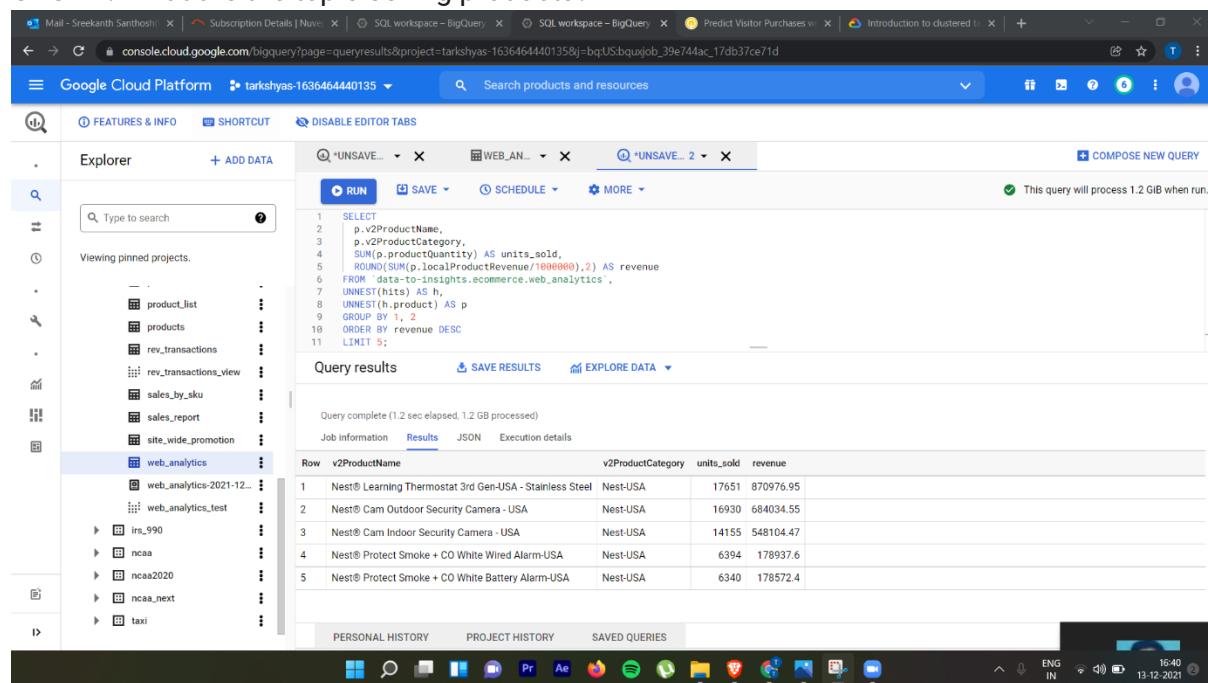
```

#standardSQL
WITH visitors AS(
SELECT
  COUNT(DISTINCT fullVisitorId) AS total_visitors
  FROM `data-to-insights.ecommerce.web_analytics`
),
purchasers AS(
SELECT
  COUNT(DISTINCT fullVisitorId) AS total_purchasers
  FROM `data-to-insights.ecommerce.web_analytics`
  WHERE totals.transactions IS NOT NULL
)
SELECT
  total_visitors,
  total_purchasers,
  total_purchasers / total_visitors AS conversion_rate
FROM visitors, purchasers

```

Row	total_visitors	total_purchasers	conversion_rate
1	741721	20015	0.026984540008979117

CASE 2: What are the top 5 selling products?



```

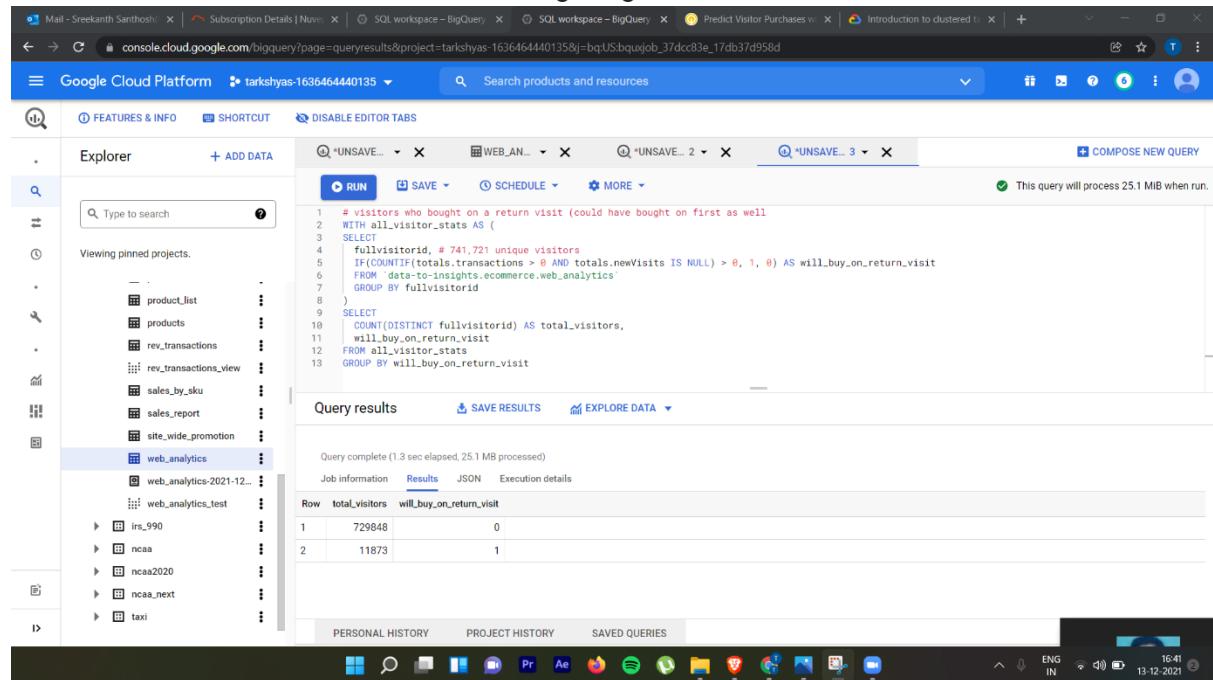
SELECT
  p.v2ProductName,
  p.v2ProductCategory,
  SUM(p.productQuantity) AS units_sold,
  ROUND(SUM(p.localProductRevenue/1000000),2) AS revenue
  FROM `data-to-insights.ecommerce.web_analytics` ,
  UNNEST(hits) AS h,
  UNNEST(h.product) AS p
  GROUP BY 1,2
  ORDER BY revenue DESC
  LIMIT 5;

```

Row	v2ProductName	v2ProductCategory	units_sold	revenue
1	Nest® Learning Thermostat 3rd Gen-USA - Stainless Steel	Nest-USA	17651	870976.95
2	Nest® Cam Outdoor Security Camera - USA	Nest-USA	16930	684034.55
3	Nest® Cam Indoor Security Camera - USA	Nest-USA	14155	548104.47
4	Nest® Protect Smoke + CO White Wired Alarm-USA	Nest-USA	6394	178937.6
5	Nest® Protect Smoke + CO White Battery Alarm-USA	Nest-USA	6340	178572.4

### CASE 3: How many visitors bought on subsequent visits to the website?

Analysing the results, you can see that  $(11873 / 741721) = 1.6\%$  of total visitors will return and purchase from the website. This includes the subset of visitors who bought on their very first session and then came back and bought again.



The screenshot shows the Google Cloud Platform BigQuery interface. The left sidebar displays various datasets and tables under the project 'tarkshyas'. The main area contains a query editor with the following SQL code:

```

1 # visitors who bought on a return visit (could have bought on first as well
2 WITH all_visitor_stats AS (
3   SELECT
4     fullvisitorid, # 741,721 unique visitors
5     IF(COUNTIF(totals.transactions > 0 AND totals.newVisits IS NULL) > 0, 1, 0) AS will_buy_on_return_visit
6   FROM data-to-insights.ecommerce.web_analytics
7   GROUP BY fullvisitorid
8 )
9 SELECT
10   COUNT(DISTINCT fullvisitorid) AS total_visitors,
11   will_buy_on_return.visit
12 FROM all_visitor_stats
13 GROUP BY will_buy_on_return.visit

```

The 'Query results' section shows the following data:

Row	total_visitors	will_buy_on_return_visit
1	729848	0
2	11873	1

### STEP 2: Create a Dataset 'ecommerce' under Tarkshyas project

CASE 4: There are the two model types to choose from: Forecasting and Classification.

Since you are bucketing visitors into "will buy in future" or "won't buy in future", use `logistic_reg` in a classification model.

The following query creates a model and specifies model options. Run this query to train your model:

The screenshot shows the Google Cloud Platform BigQuery interface. The top navigation bar includes 'Sign out', 'Subscription Details | Nuvo', 'SQL workspace - BigQuery', 'SQL workspace - BigQuery', 'Predict Visitor Purchases', and 'Introduction to clustered'. The main header has 'Google Cloud Platform' and 'tarkshyas-1636464440135' with a search bar 'Search products and resources'.

The left sidebar is titled 'Explorer' and shows a tree view of pinned projects, including 'tarkshyas-1636464440135' which contains 'dataset1', 'ecommerce', and 'data-to-insights' which further contains 'AJ\_Retail', 'AJ\_Retail\_Partitioned', 'advanced', 'bitcoin\_blockchain', 'customer\_insights', 'ecommerce', 'irs\_990', 'ncaa', 'ncaa2020', 'ncaa\_next', and 'taxi'.

The central area has two tabs: 'EDITOR' and 'EDITOR 2'. The 'EDITOR 2' tab is active, showing a query in progress:

```

1 CREATE OR REPLACE MODEL `ecommerce.classification_model`
2 OPTIONS
3   model_type='logistic_reg',
4   labels = ['will_buy_on_return_visit']
5 )
6 AS
7 #standardSQL
8 SELECT
9   * EXCEPT(fullVisitorId)
10  FROM
11    # features
12  (SELECT
13
  
```

The status bar at the bottom indicates 'Processing location: US'.

The right side shows the 'Query results' section with tabs for 'Job information', 'Results', and 'Execution details'. The 'Elapsed time' is listed as '-298.2 sec'. The 'Stages' section shows a single stage named 'Preprocess'.

Wait for the model to train (5 - 10 minutes).

This screenshot shows the same Google Cloud Platform BigQuery interface after the model has been trained. The 'EDITOR 2' tab now displays a different query:

```

1 SELECT
2   roc_auc,
3   CASE
4     WHEN roc_auc > .9 THEN 'good'
5     WHEN roc_auc > .8 THEN 'fair'
6     WHEN roc_auc > .7 THEN 'decent'
7     WHEN roc_auc > .6 THEN 'not great'
8     ELSE 'poor' END AS model_quality
9   FROM
10  ML.EVALUATE(MODEL ecommerce.classification_model, (
11    SELECT
12      * EXCEPT(fullVisitorId)
13    FROM
14      # features
15    (SELECT
  
```

A message in the top right corner states: 'This query will process 41.8 MB when run.'

The 'Query results' section shows the output of the evaluation query. It includes a table with columns 'Row', 'roc\_auc', and 'model\_quality'. The first row is shown:

Row	roc_auc	model_quality
1	0.7238321678321679	decent

## SELECT “Go to Model”

The screenshot shows two consecutive views of the Google Cloud Platform BigQuery interface.

**Top View:** A query editor window titled "UNSAVE...". The code input area contains the following SQL:

```

1 CREATE OR REPLACE MODEL `ecommerce.classification_model`
2 OPTIONS
3 (
4   model_type='logistic_reg',
5   labels = ['will_buy_on_return_visit']
6 )
7 AS
8 #standardSQL
9 SELECT
10   EXCEPT(fullVisitorId)
11   FROM
12   #features
13   (SELECT
14     fullVisitorId,
15     IFNULL(totals.bounces, 0) AS bounces,

```

The status bar indicates: "This query will process 41.8 MiB (ML) when run."

**Bottom View:** A results page for the created model. The title is "classification\_model". The "TRAINING" tab is selected. It displays two charts: "Loss" (a line graph showing loss decreasing from ~0.8 to ~0.2 over 8 iterations) and "Duration (seconds)" (a bar chart showing duration increasing from ~1.5 to ~2.5 seconds over 8 iterations).

## Sreekanth Santhosh-198642

The screenshots show the Google Cloud Platform interface for managing machine learning models. The top screenshot displays the 'classification\_model' page under the 'TRAINING' tab, featuring a 'Learn rate' graph that shows a sharp increase in learn rate around iteration 8. The bottom screenshot displays the same model under the 'EVALUATION' tab, showing aggregate metrics and score thresholds.

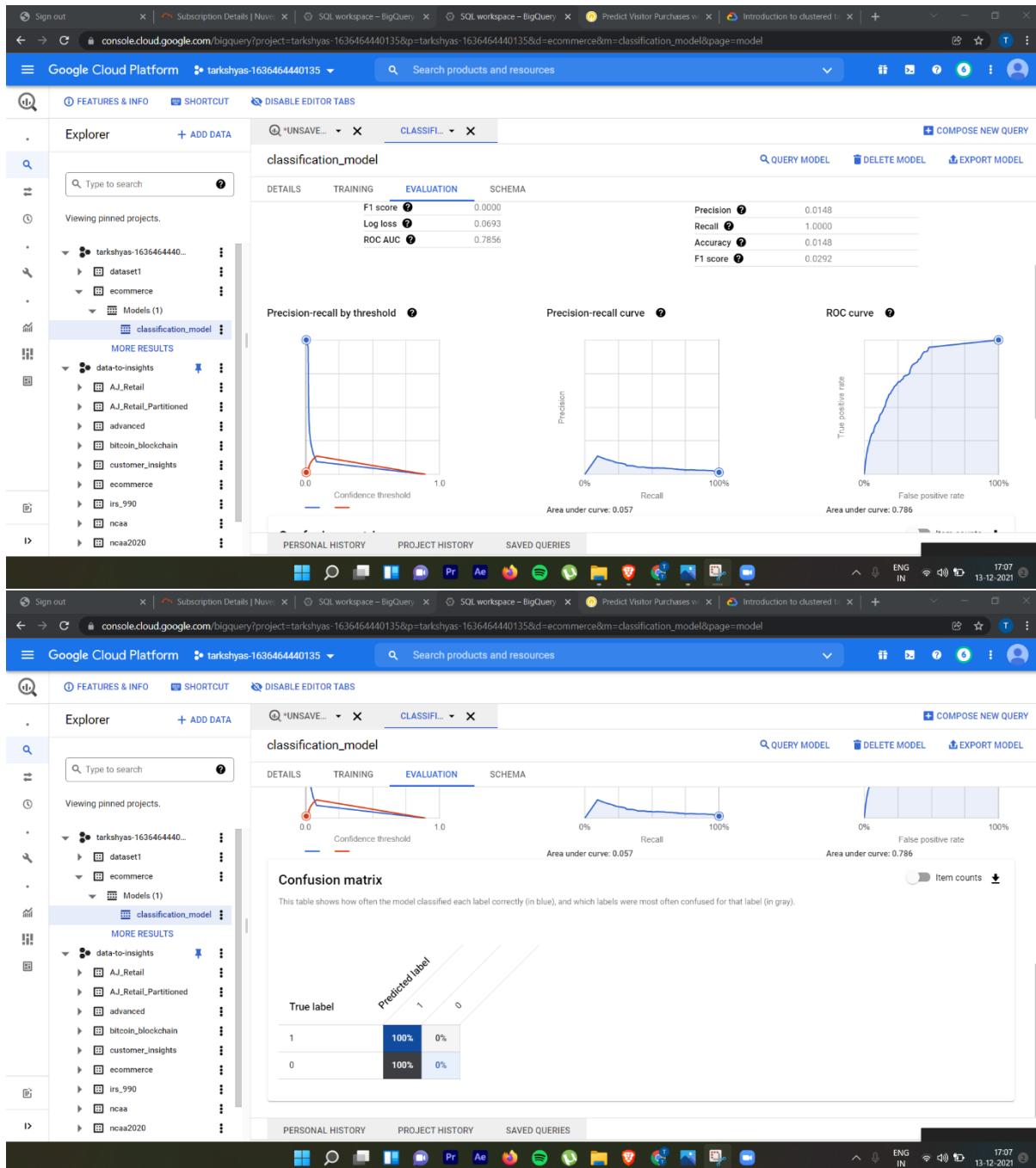
**Aggregate Metrics**

Metric	Value
Threshold	0.5000
Precision	0.0000
Recall	0.0000
Accuracy	0.9847
F1 score	0.0000
Log loss	0.0693
ROC AUC	0.7856

**Score threshold**

Threshold	Value
Positive class threshold	0.0070
Positive class	1
Negative class	0
Precision	0.0148
Recall	1.0000
Accuracy	0.0148
F1 score	0.0292

## Sreekanth Santhosh-198642



## Sreekanth Santhosh-198642

Google Cloud Platform - tarkshyas-163646440135

Search products and resources

**Explorer** + ADD DATA

Type to search

Viewing pinned projects.

- tarkshyas-163646440135
  - dataset1
  - ecommerce
  - Models (1)
    - classification\_model
- MORE RESULTS
  - data-to-insights
    - AJ\_Retail
    - AJ\_Retail\_Partitioned
    - advanced
    - bitcoin\_blockchain
    - customer\_insights
    - ecommerce
    - irs\_990
    - ncaa
    - ncaa2020

**CLASSIFI... 2**

**RUN** **SAVE** **SCHEDULE** **MORE**

This query will process 41.8 MB when run.

```

1 SELECT
2   `roc_auc`,
3   CASE
4     WHEN `roc_auc` > .9 THEN 'good'
5     WHEN `roc_auc` > .8 THEN 'fair'
6     WHEN `roc_auc` > .7 THEN 'decent'
7     WHEN `roc_auc` > .6 THEN 'not great'
8     ELSE 'poor' END AS model_quality
9   FROM
10   ML.EVALUATE(MODEL ecommerce.classification_model,
11   SELECT * EXCEPT(fullVisitorId)
12   FROM
13   `# features
14   (SELECT
15

```

**Query results** **SAVE RESULTS** **EXPLORE DATA**

Query complete (1.1 sec elapsed, 41.8 MB processed)

Row	roc_auc	model_quality
1	0.7238601398601399	decent

**PERSONAL HISTORY** **PROJECT HISTORY** **SAVED QUERIES**

Google Cloud Platform - tarkshyas-163646440135

Search products and resources

**Explorer** + ADD DATA

Type to search

Viewing pinned projects.

- tarkshyas-163646440135
  - dataset1
  - ecommerce
  - Models (2)
    - classification\_model
    - classification\_model\_2
- MORE RESULTS
  - data-to-insights
    - AJ\_Retail
    - AJ\_Retail\_Partitioned
    - advanced
    - bitcoin\_blockchain
    - customer\_insights
    - ecommerce
    - irs\_990
    - ncaa

**CLASSIFI... 3**

**CLASSIFI... 4**

**QUERY MODEL** **DELETE MODEL** **EXPORT MODEL**

**EVALUATION**

**DETAILS** **TRAINING** **EVALUATION** **SCHEMA**

**Aggregate Metrics**

Threshold	0.5000
Precision	0.2000
Recall	0.0263
Accuracy	0.9834
F1 score	0.0465
Log loss	0.0582
ROC AUC	0.9221

**Score threshold**

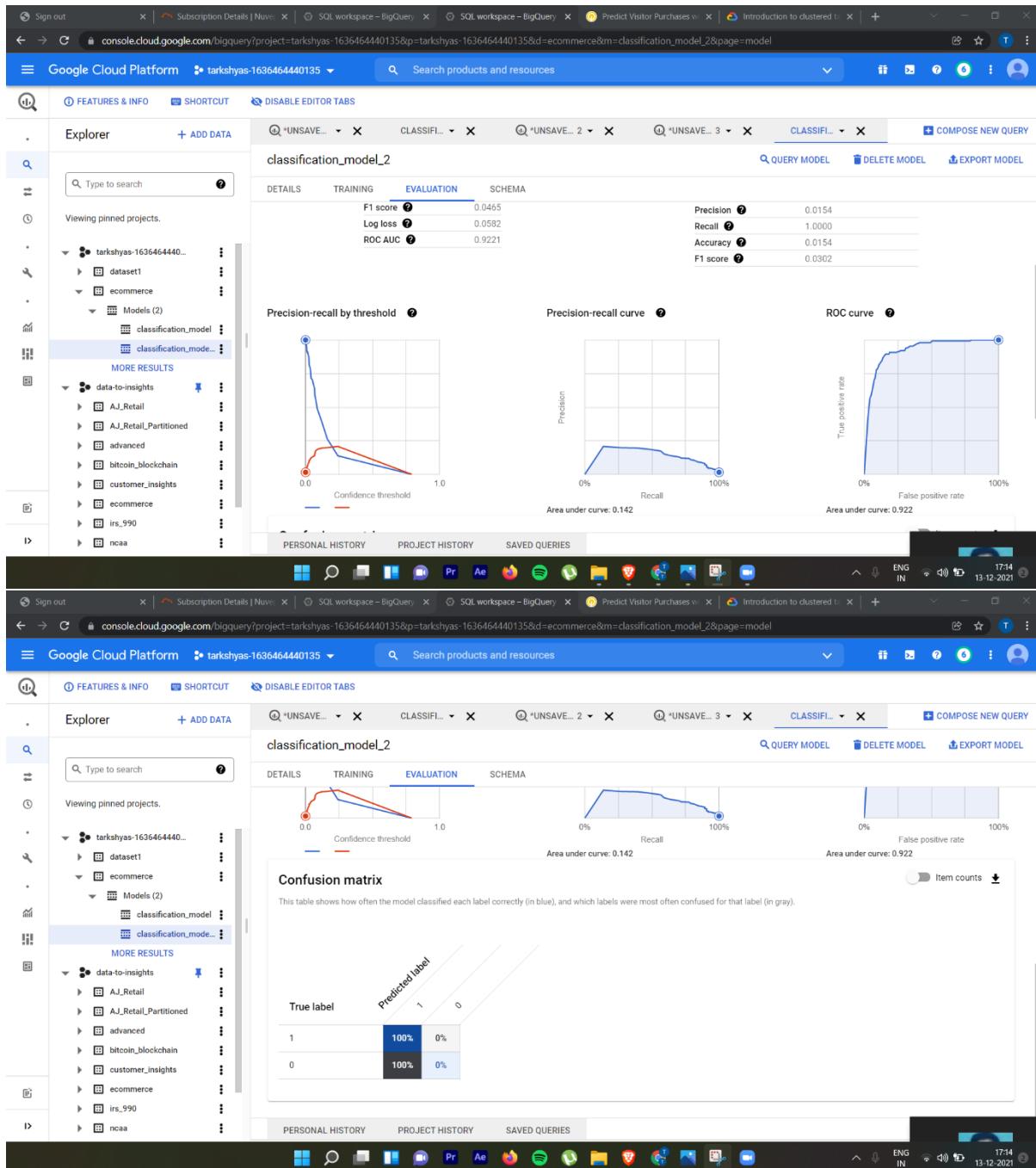
Positive class threshold	0.00021
Negative class	1
Precision	0.0154
Recall	1.0000
Accuracy	0.0154
F1 score	0.0302

**Precision-recall by threshold**

**Precision-recall curve**

**ROC curve**

**PERSONAL HISTORY** **PROJECT HISTORY** **SAVED QUERIES**



## Sreekanth Santhosh-198642

Google Cloud Platform - tarkshyas-1636464440135

Search products and resources

Explorer + ADD DATA

Type to search

Viewing pinned projects.

- tarkshyas-1636464440135
  - dataset1
  - ecommerce
    - Models (2)
      - classification\_model
      - classification\_model\_2
- data-to-insights
  - AJ\_Retail
  - AJ\_Retail\_Partitioned
  - advanced
  - bitcoin\_blockchain
  - customer\_insights
  - ecommerce
  - irs\_990
  - ncaa

MORE RESULTS

Classification Model 2

MAX(CAST(b.ecommerceAction.action\_type AS INT64)) AS latest\_ecommerce\_progress,  
 IFNULL(totals.bounces, 0) AS bounces,  
 IFNULL(totals.timeOnSite, 0) AS time\_on\_site,  
 totals.pageviews,  
 # where the visitor came from  
 trafficSource.source,  
 trafficSource.medium,  
 channelGrouping,  
 # mobile or desktop  
 totals.deviceCategory,  
 # geographic  
 IFNULL(geoNetwork.country, '') AS country  
 FROM `data-to-insights.ecommerce.web\_analytics`  
 UNNEST(hits) AS h

Query results

Row	roc_auc	model_quality
1	0.9094875124875125	good

PERSONAL HISTORY PROJECT HISTORY SAVED QUERIES

---

Sign out Subscription Details Nov 2021 SQL workspace - BigQuery SQL workspace - BigQuery Predict Visitor Purchases ... Introduction to clustered ...

Google Cloud Platform - tarkshyas-1636464440135

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MORE RESULTS

Classification Model 2

```
1 SELECT
2 *
3 FROM
4   ml.PREDICT(MODEL `ecommerce.classification_model_2`,
5   (
6     WITH all_visitor_stats AS (
7       SELECT
8         fullvisitorid,
9         IF(COUNTIF(totals.transactions > 0 AND totals.newVisits IS NULL) > 0, 1, 0) AS will_buy_on_return_visit
10        FROM `data-to-insights.ecommerce.web_analytics`
11       GROUP BY fullvisitorid
12     )
13     SELECT
14       CONCAT(fullvisitorid, "-", CAST(visid AS STRING)) AS unique_session_id,
15       # labels
```

Query results

Row	predicted_will_buy_on_return_visit	predicted_will_buy_on_return_visit_probs.label	predicted_will_buy_on_return_visit_probs.prob	unique_session_id	will_buy_on_return_visit	late
1	1	1	0.5396342390817304	378694987863139254-1500618786	0	
2	1	0	0.46036576091826964	0		

Rows per page: 100 1 - 100 of 59602 First page < Last page >

PERSONAL HISTORY PROJECT HISTORY SAVED QUERIES