

Assignment 1, Cloud Computing

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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/1FAIpQLSe0GyNdOYIvM1tX_I_CtlPod5jBf-ACLGdHZq1gVZbUeBzlg/viewform?usp=sf_link

Exercise 1: Understanding Cloud Computing Models

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

IaaS - leasing of computing capacity to launch your solutions and deploy the IT infrastructure of the company.

PaaS - rental of ready-made and customized platforms for specialized tasks.

SaaS - rental of ready-made services for specific functions - sending mail, maintenance of the client database, creation of a site.

Feature	IaaS	PaaS	SaaS
Control	High	Moderate	Low
Use case	Data centers, big data analytics	IoT applications, DevOps	Mail, CRM
Complexity	High, it needs technical understanding for maintenance	Medium, it needs basic setup	Low, prepared for end users

2. Which GCP services fall under each of these models?

GCP services of IaaS is Google Compute Engine, PaaS is Google App Engine and the last of GSP services of SaaS is Google Workspace.

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

IaaS Example:

For example, a startup is releasing a new web application with variable anticipated traffic. Google Compute Engine can be used to scale up or down in minutes without any investment in physical hardware.

PaaS Example:

For instance, the development team needs to build a new mobile application. Using Google App Engine, they just focus on writing code and deploy their application without having to take care of the server management for swift development and iteration.

SaaS Example:

For internal communication and document collaboration, tools are required. Using Google Workspace provides them with everything, from email to documents to spreadsheets, while they don't have to manage anything at all, even servers.

Exercise 2: Exploring Google Cloud Platform's Core Services

1. What is the primary use case of Compute Engine?

The main application of Compute Engine is to act as a service for allocating virtual machines needed to host applications, websites, or perform data-centric computational tasks where computing capacity can be acquired on demand.

2. How does Google Kubernetes Engine (GKE) simplify the management of containerized applications?

GKE automates much of the work associated with deploying, managing, and scaling containerized applications, such as the orchestration of container deployment, load-based scaling, managing updates, and overseeing networking. This lessens operational expenses and leaves developers free to work on application development.

3. What advantages does Cloud Storage offer for data management?

Cloud Storage delivers availability, a straightforward pricing scheme based on usage, and automatic security features right out of the box. It supports a range of data types and is compatible with several Google Cloud services.

4. Why would a business choose BigQuery for their data analysis needs?

The reason a business opts for BigQuery is its proficiency with large datasets, the advantage of serverless architecture which avoids infrastructure management, fast querying capabilities, and its integration with machine learning tools. This permits fast understanding and choices based on data.

Exercise 3: Creating and Managing Virtual Machines with Compute Engine

1. What steps did you follow to create the VM?

I turned to Compute Engine, pressed "Create Instance," customized the VM with information like name, region, machine type, and operating system, and finally hit "Create" to set it up.

2. How did you connect to the VM, and what commands did you use to install the web server?

Using the 'SSH' button in the Google Cloud Console, I connected to the VM. I performed sudo apt update to refresh the package index and then sudo apt install apache2 -y to install Apache, all while running sudo systemctl start apache2 to get it started.

```
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
akmaral_150400@instance-sabiyeva-akmaral:~$ sudo apt update
Get:1 file:/etc/apt/mirrors/debian.list Mirrorlist [30 B]
Get:5 file:/etc/apt/mirrors/debian-security.list Mirrorlist [39 B]

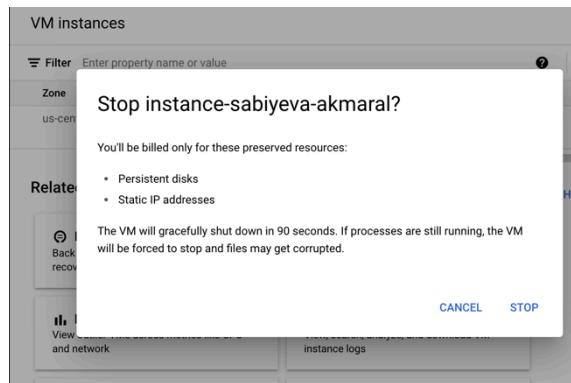
Building dependency tree... Done
Reading state information... Done
4 packages can be upgraded. Run 'apt list --upgradable' to see them.
akmaral_150400@instance-sabiyeva-akmaral:~$ sudo apt install apache2 -y
Reading package lists... Done
Building dependency tree... Done

→ /lib/systemd/system/apache-htcacheclean.service.
Processing triggers for man-db (2.11.2-2) ...
Processing triggers for libc-bin (2.36-9+deb12u8) ...
akmaral_150400@instance-sabiyeva-akmaral:~$ sudo systemctl start apache2
akmaral_150400@instance-sabiyeva-akmaral:~$
```



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

Stopping a VM, enabling it to start again in the future. Nonetheless, all non-persistent disk data goes away. When a VM deleted, all its associated resources are gone, with the data recoverable only if it was on a persistent disk or backed up somewhere else.



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

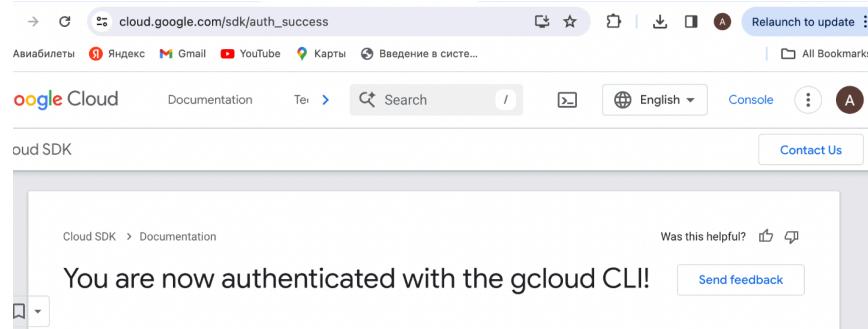
1. How did you create and push the Docker container to GCR?

I have use to create a docker file on terminal

```
FROM nginx:alpine
```

```
COPY index.html /usr/share/nginx/html
```

Then I build the image docker build -t gcr.io/my-web-app-project-437010/my-web-app .The I auth to gloud ,After building your image, push it to GCR using following command



```
sabiyeva15 -- zsh -- 80x24
"staging-k8s.gcr.io": "gcloud",
"marketplace.gcr.io": "gcloud"
}
Do you want to continue (Y/n)?
Docker configuration file updated.
[sabiyeva15@Sabiyevas-MBP ~ % docker push gcr.io/my-web-app-project-437010/
-app
Using default tag: latest
The push refers to repository [gcr.io/my-web-app-project-437010/my-web-ap
b35981569119: Pushed
dbc055046852: Layer already exists
4da863068df6: Layer already exists
```

2. What steps were involved in setting up the GKE cluster?

Then I go to Google CCloud Console,choose a Kubernetes Engine then create a cluster.
My cluster name akma-sab.

The screenshot shows the GCP Kubernetes Engine interface. At the top, there are buttons for 'CREATE', 'DEPLOY', and 'REFRESH'. Below the banner, there's a section for 'OVERVIEW', 'OBSERVABILITY', and 'COST OPTIMIZATION'. A table lists the cluster details:

Status	Name	Location	Number of nodes	Total vCPUs	Total mem
Green	akma-sab	us-central1	0	0	0

After the cluster is created, configure `kubectl`

```
sabiyeval5 -- zsh -- 80x24
 ive account specified by the [core/account] property.
d Could not find [akma-sab] in [us-east4-c].
Did you mean [akma-sab] in [us-central1]?
[sabiyeval5@Sabiyevas-MBP ~ % y
zsh: command not found: y
[sabiyeval5@Sabiyevas-MBP ~ % gcloud container clusters get-credentials akma-sab
--zone us-central1
Fetching cluster endpoint and auth data.
kubeconfig entry generated for akma-sab.
[sabiyeval5@Sabiyevas-MBP ~ % kubectl create deployment my-web-app --image=gcr.i
/my-web-app-project-437910/my-web-app
Warning: autopilot-default-resources-mutator:Autopilot updated Deployment defau
t/my-web-app: defaulted unspecified 'cpu' resource for containers [my-web-app]
see http://g.co/gke/autopilot-defaults).
deployment.apps/my-web-app created
sabiyeval5@Sabiyevas-MBP ~ % kubectl expose deployment my-web-app --type=LoadBa
ancer --port 80
service/my-web-app exposed
sabiyeval5@Sabiyevas-MBP ~ % kubectl get deployments
NAME      READY   UP-TO-DATE   AVAILABLE   AGE
my-web-app   0/1     1           0          36s
sabiyeval5@Sabiyevas-MBP ~ %
```

3. How did you verify that your application was successfully deployed and accessible?

I have created a deployment using Docker image:I use this one.

`kubectl create deployment my-web-app`

`--image=gcr.io/YOUR_PROJECT_ID/my-web-app`

```
10  zsh: command not found: y
11  [sabiyeval5@Sabiyevas-MBP ~ % gcloud container clusters get-credentials akma-sab
12  --zone us-central1
13  Fetching cluster endpoint and auth data.
14  kubeconfig entry generated for akma-sab.
15  [sabiyeval5@Sabiyevas-MBP ~ % kubectl create deployment my-web-app --image=gcr.io
16  /my-web-app-project-437910/my-web-app
17  Warning: autopilot-default-resources-mutator:Autopilot updated Deployment defau
t/my-web-app: defaulted unspecified 'cpu' resource for containers [my-web-app]
( see http://g.co/gke/autopilot-defaults).
deployment.apps/my-web-app created
sabiyeval5@Sabiyevas-MBP ~ % kubectl expose deployment my-web-app --type=LoadBal
ancer --port 80
```

Step 2: Expose the Application

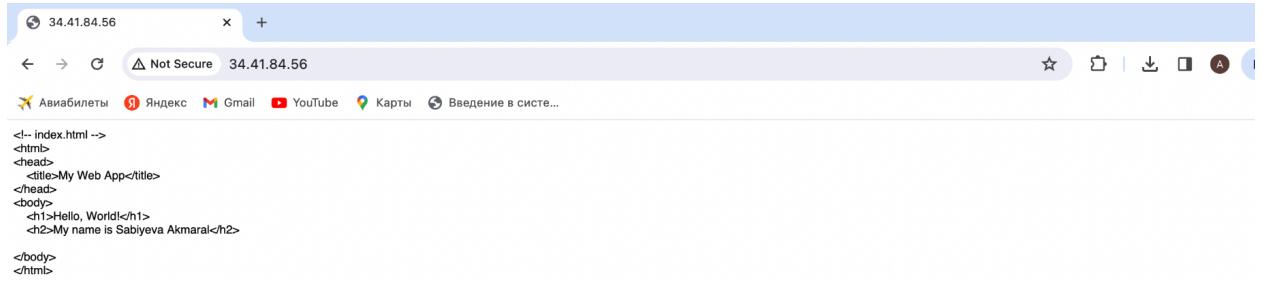
```

0 => [internal] load build context          0.0s
0 => transferring context: 798             0.0s
1 => [1/2] FROM docker.io/library/nginx:alpine@sha256:a5127daff3d6f4606be3 0.0s
1 => CACHED [2/2] COPY index.html /usr/share/nginx/html   0.0s
2 => exporting to image                      0.0s
2 => exporting layers                       0.0s
3 => => writing image sha256:4571ae26bd11777db9c8c4b672698887912ef2bef663e 0.0s
3 => => naming to gcr.io/my-web-app-project-437018/my-web-app               0.0s
4 What's next:
5   View a summary of image vulnerabilities and recommendations → docker scout q
6 quickview
6 sabiyevas1@Sabiyevas-MBP my-web-app % kubectl get services
7
8 NAME           TYPE      CLUSTER-IP    EXTERNAL-IP   PORT(S)    AGE
8 kubernetes     ClusterIP   34.118.224.1   <none>        443/TCP   62m
8 my-web-app     LoadBalancer 34.118.234.156  34.41.84.56  80:32710/TCP 34m
9 sabiyevas1@Sabiyevas-MBP my-web-app %

```

	90.0	90.0	90.0	Jumping Jacks
...	---	---	---	---

It's successfully done. My external IP is 34.41.84.56



Exercise 5: Storing and Accessing Data in Google Cloud Storage

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

By going to the Storage section in the Google Cloud Console, clicking 'Create Bucket,' and using an unique name sabi-akmaral, location, storage class, and access control options (Uniform or Fine-grained), I can create a bucket.

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

On public access every person can see and utilize the files, which is convenient for the hosting of public assets such as images or videos.

On private access only users or service accounts that are indicated are able to access the files. This is more safe and usually serves for sensitive data.

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

In the Cloud Console, I can control access permissions by choosing a file, then clicking on the Permissions tab, and adding specific users or groups with roles correspondent to Viewer, Editor, or Owner for that file.e. This permits control regarding which individuals can access individual objects.

Grant access to "sabi-akmaral"

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
📁 sabi-akmaral

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

New principals * [X](#) [?](#)

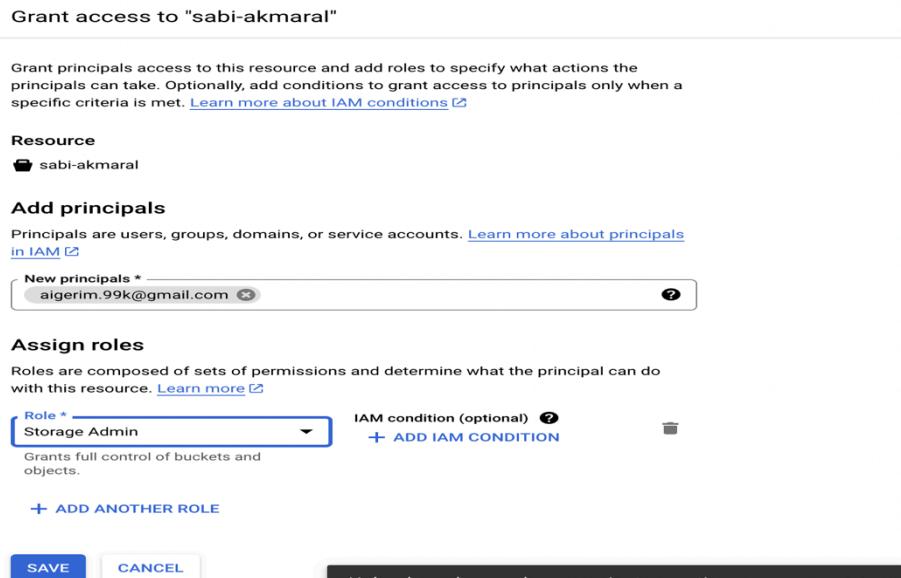
Assign roles
Roles are composed of sets of permissions and determine what the principal can do with this resource. [Learn more](#)

Role * [?](#) [+](#) [ADD IAM CONDITION](#) [-](#)

Grants full control of buckets and objects.

[+](#) [ADD ANOTHER ROLE](#)

[SAVE](#) [CANCEL](#)



Exercise 6: Analyzing Data with BigQuery

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

I used the Google Cloud Console to access BigQuery, created a Dataset ID, and then imported a sample dataset from kaagle to generate a table, all using a csv format.

The screenshot shows the Google Cloud BigQuery interface. The top navigation bar indicates the project is 'my web-app-project'. The left sidebar shows the 'Explorer' section with 'my-web-app-project-437010' expanded, and 'akma15' selected. The main area displays 'Dataset info' for 'akma15'. A context menu is open over the dataset ID, showing options like 'Open', 'Create table', 'Share', 'Copy ID', 'Refresh contents', and 'Delete'. Below the dataset info, there's a 'SUMMARY' tab showing 'akma15' and 'my-web-app-project-437010' under 'Data' and 'Tables' respectively. To the right, there's a 'Dataset replica info' section with a 'Primary location' set to 'US'.

2. How did you write and execute SQL queries in BigQuery?

I opened a new query editor, wrote SQL queries to filter label with name “Jumping Jacks”. I used my dataset ID.

The screenshot shows the Google Cloud BigQuery query editor. The top navigation bar has 'Untitled query' selected. The left sidebar shows 'my-web-app-project-437010' expanded, with 'akma15' selected and 'Halloween' listed under it. The main area shows two SQL queries in the 'Untitled query' tab:

```

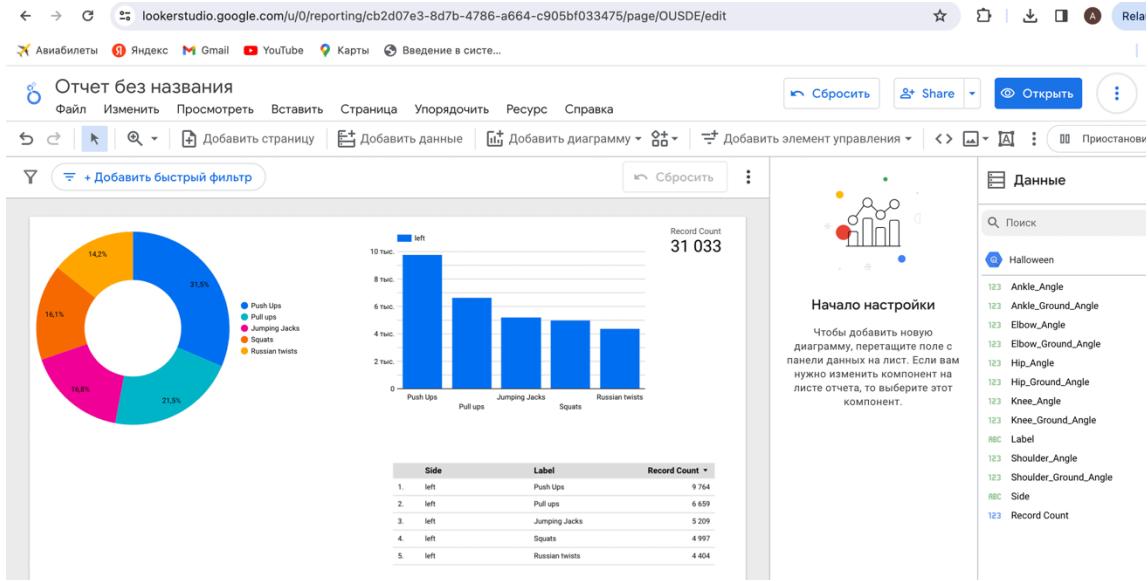
1 --SELECT FROM `my-web-app-project-437010.akma15.Halloween` LIMIT 1000
2 SELECT * FROM `my-web-app-project-437010.akma15.Halloween` WHERE Label = 'Jumping Jacks';
3

```

Below the queries, the 'Query results' section displays a table with the following data:

Row	Side	Shoulder_Angle	Elbow_Angle	Hip_Angle	Knee_Angle
1	left	10.63920803404...	174.4668131474...	174.7851426131...	179.8481395084
2	left	10.59034173772...	174.4287057637...	174.7650415497...	179.7752149526
3	left	10.54674599247...	174.4894310799...	174.7857900346...	179.6600166976
4	left	10.48768235372...	174.6149130687...	174.7595418048...	179.6142226991
5	left	10.41210678671...	174.7585025514...	174.7377209901...	179.5705637846
6	left	10.33375012200...	174.8964779722...	174.7176097672...	179.5372861535

3. What insights were you able to derive from the data analysis?



I used looker studio and connected to Big Query. In this dashboard, I can see the overall recent counts, and I used histogram and table to see the share of percent of labels. I can find a popular categories it is more understandable.