Homework 2 - Docker Extended Topics

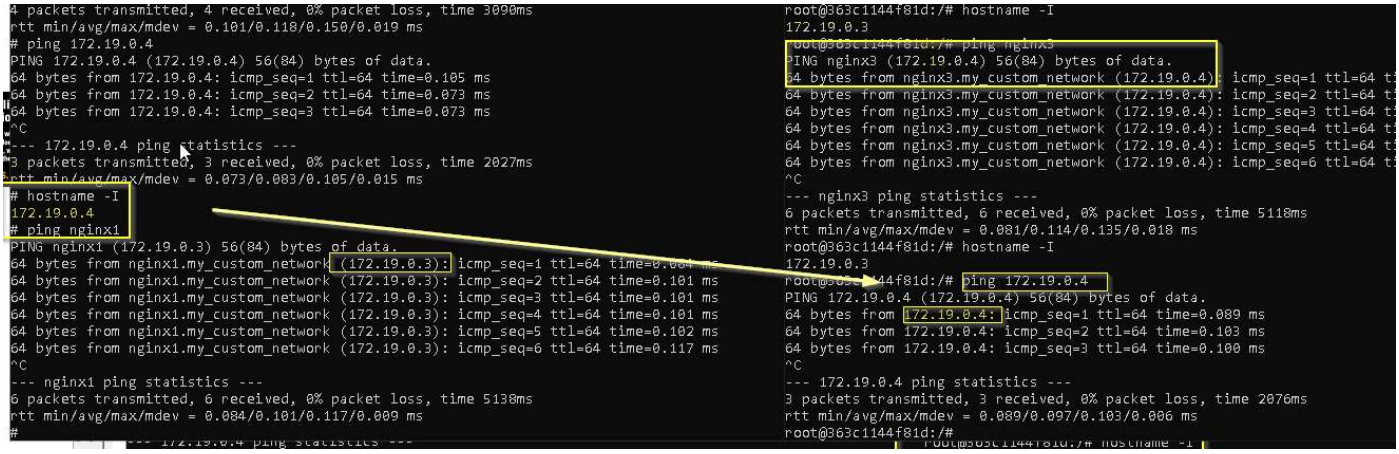
These exercises focus on Docker networking, volumes, bind mounts, Docker-in-Docker, resource limits, and restart policies.

Exercise 1

1. List all Docker networks.
2. Inspect the default Bridge network.
3. reate a **new bridge user-defined network**.
4. Run a container attached to it and inspect its IP.

```
ubuntu@k8s-instance-6:~$ docker network ls
NETWORK ID     NAME        DRIVER    SCOPE
c8fdc79ccbf3   bridge      bridge    local
5d251adbccf2   dockernet   bridge    local
bc25f39870f7   host        host      local
758346aa0c1a   none        null      local
ubuntu@k8s-instance-6:~$ docker network inspect bridge
[
    {
        "Name": "bridge",
        "Id": "c8fdc79ccbf36551c7c8446eb9913637e0b5dda928e436b5309
```

Exercise 2



1. Run two Nginx containers which have to be connected to that user-defined network created in Exercise 1.
2. Use ping within both containers to test communication each other by container name.

Exercise 3

1. Create a Docker volume: `mydata`.
2. Run a container using the volume.
3. Write a file inside `/data` from the container, then:
    1. Stop the container.
    2. Relaunch to verify persistence.

```
ubuntu@k8s-instance-6:~$ docker volume create my_data_volume
my_data_volume
ubuntu@k8s-instance-6:~$ docker run -dit --name vol_container -v my_data_volume:/data alpine
f0973978b47cd3ce09589c38684cb7f336d6773da8773f6784ff3edade685044
ubuntu@k8s-instance-6:~$ docker exec -it vol_container sh
/ # echo "Persistent data" > /data/hello.txt
/ # exit
ubuntu@k8s-instance-6:~$ docker stop vol_container
vol_container
ubuntu@k8s-instance-6:~$
```

```
ubuntu@k8s-instance-6:~$ docker run -dit --name vol_container -v my_data_volume:/data alpine
f0973978b47cd3ce09589c38684cb7f336d6773da8773f6784ff3edade685044
ubuntu@k8s-instance-6:~$ docker exec -it vol_container sh
/ # echo "Persistent data" > /data/hello.txt
/ # exit
ubuntu@k8s-instance-6:~$ docker stop vol_container
vol_container
ubuntu@k8s-instance-6:~$ docker start vol_container
vol_container
ubuntu@k8s-instance-6:~$ docker exec -it vol_container sh
/ # docker exec -it vol_container sh
sh: docker: not found
/ # cat /data/hello.txt
Persistent data
/ #
```

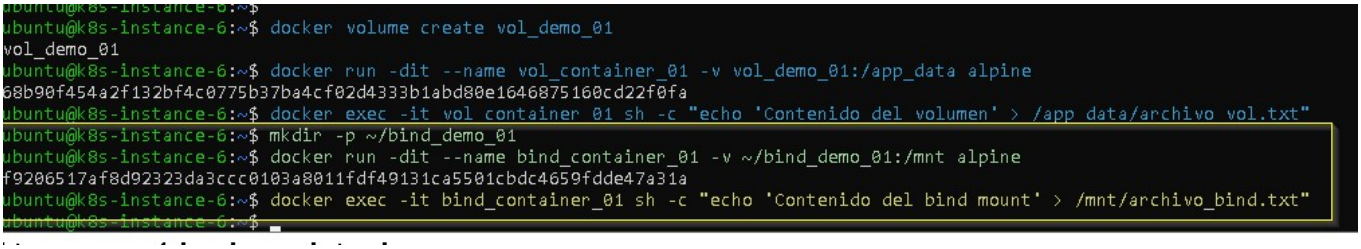
Exercise 4

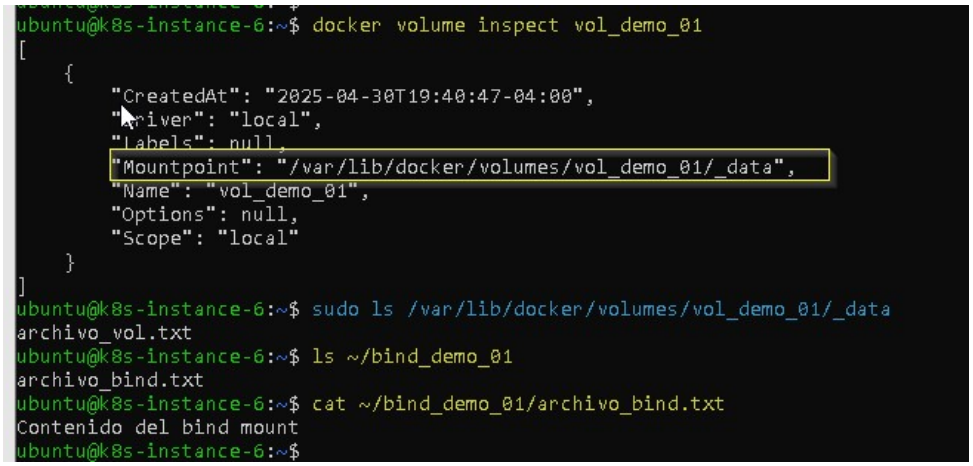
1. Create a directory on your host.
2. Run a container with a bind mount.
3. Create a file in `/mnt` from the container and check the host.

```
ubuntu@k8s-instance-6:~$ mkdir -p ~/docker_bind_test
ubuntu@k8s-instance-6:~$ docker run -dit --name bind_container -v ~/docker_bind_test:/mnt alpine
83d773883eb54dc6a48762b55b85c61ef8289726 8f3e5f43644e5977945c452b
ubuntu@k8s-instance-6:~$ docker exec -it bind_container sh
/ # echo "Hello from container" > /mnt/testfile.txt
/ # exit
ubuntu@k8s-instance-6:~$ cat ~/docker_bind_test/testfile.txt
Hello from container
ubuntu@k8s-instance-6:~$
```

Exercise 5

1. Create a file in a named volume.
2. Create a file using a bind mount.
3. Observe where data is stored on the host with docker volume inspect and ls





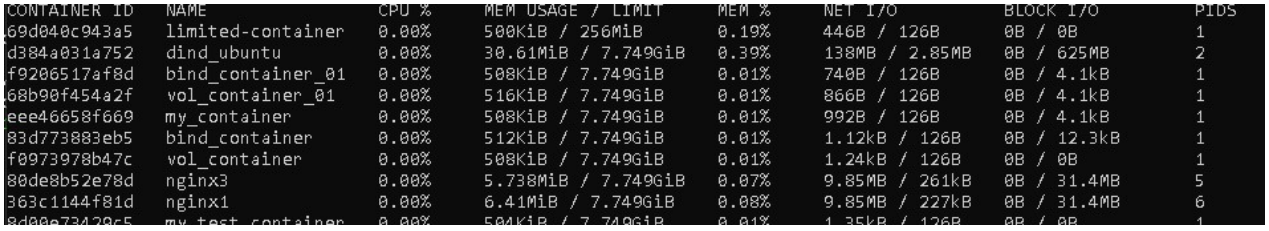
Exercise 6

1. Run an Ubuntu container with the necessary options to enable Docker in Docker (DinD).
2. Exec into the container and run `docker version` .

```
ubuntu@k8s-instance-6:~$ docker run -dit \
>   --name dind_ubuntu \
>   -v /var/run/docker.sock:/var/run/docker.sock \
>   ubuntu
d384a031a75273d04b9e35d8f866ec8ed4bb0243e1eef010bbdcdeb1e57d7dcd
ubuntu@k8s-instance-6:~$ docker exec -it dind_ubuntu bash
root@d384a031a752:/# docker exec -it dind_ubuntu bash
bash: docker: command not found
root@d384a031a752:/# apt update
Get:1 http://archive.ubuntu.com/ubuntu noble InRelease [256 kB]
```

```
Processing triggers for ca-certificates (20240203) ...
Updating certificates in /etc/ssl/certs...
0 added, 0 removed; done.
Running hooks in /etc/ca-certificates/update.d...
done.
root@d384a031a752:/# docker version
Client:
 Version:           26.1.3
 API version:       1.45
 Go version:        go1.22.2
 Git commit:        26.1.3-0ubuntu1~24.04.1
 Built:             Mon Oct 14 14:29:26 2024
 OS/Arch:           linux/amd64
 Context:           default

Server: Docker Engine - Community
 Engine:
  Version:          28.1.1
  API version:      1.49 (minimum version 1.24)
  Go version:       go1.23.8
  Git commit:       01f442b
  Built:            Fri Apr 18 09:52:14 2025
  OS/Arch:          linux/amd64
  Experimental:     false
 containerd:
  Version:          1.7.27
  GitCommit:        05044ec0a9a75232cad458027ca83437aae3f4da
 runc:
  Version:          1.2.5
  GitCommit:        v1.2.5-0-g59923ef
 docker-init:
  Version:          0.19.0
  GitCommit:        de40ad0
root@d384a031a752:/#
```

Exercise 7

1. Run a container with memory and CPU limits:
    1. Memory = 256m
    2. CPU = 0.5
2. Check resource usage stats .
3. 

CONTAINER ID	NAME	CPU %	MEM USAGE / LIMIT	MEM %	NET I/O	BLOCK I/O	PIDS
69d040c943a5	limited-container	0.00%	500KiB / 256MiB	0.19%	446B / 126B	0B / 0B	1
d384a031a752	dind_ubuntu	0.00%	30.61MiB / 7.749GiB	0.39%	138MB / 2.85MB	0B / 625MB	2
f9206517af8d	bind_container_01	0.00%	508KiB / 7.749GiB	0.01%	740B / 126B	0B / 4.1kB	1
68b90f454a2f	vol_container_01	0.00%	516KiB / 7.749GiB	0.01%	866B / 126B	0B / 4.1kB	1
eee46658f669	my_container	0.00%	508KiB / 7.749GiB	0.01%	992B / 126B	0B / 4.1kB	1
83d773883eb5	bind_container	0.00%	512KiB / 7.749GiB	0.01%	1.12kB / 126B	0B / 12.3kB	1
f0973978b47c	vol_container	0.00%	508KiB / 7.749GiB	0.01%	1.24kB / 126B	0B / 0B	1
80de8b52e78d	nginx3	0.00%	5.738MiB / 7.749GiB	0.07%	9.85MB / 261kB	0B / 31.4MB	5
363c1144f81d	nginx1	0.00%	6.41MiB / 7.749GiB	0.08%	9.85MB / 227kB	0B / 31.4MB	6
8d00e73420c5	my_test_container	0.00%	504KiB / 7.749GiB	0.01%	1.35kB / 126B	0B / 0B	1

4. Check disk usage (docker system).

```
ubuntu@k8s-instance-6:~$ docker system df
TYPE            TOTAL     ACTIVE    SIZE      RECLAIMABLE
Images          4         4         647.1MB   0B (0%)
Containers      18        15        551.4MB   56.85MB (10%)
Local Volumes   4         4         133.8MB   0B (0%)
Build Cache     0         0         0B        0B
ubuntu@k8s-instance-6:~$
```

```
ubuntu@k8s-instance-6:~$ docker run -dit \
>    --name limited-nginx \
>    --memory=256m \
>    --cpus=0.5 \
>    -p 8080:80 \
>    nginx
3d6c5162cfd60af5b2c9b7345b0ca6dbf2b4a360b6d516154146dfbdfbe2e6e4
ubuntu@k8s-instance-6:~$ docker stats limited-nginx
```

Exercise 8

1. Run a container with policy –restart on -failure .
2. Kill the container and observe how it restarts

```
ubuntu@k8s-instance-6:~$ docker run -dit \
>    --name failing-container \
>    --restart=on-failure \
>    alpine sh -c "sleep 5 && exit 1"
8a557e4cc59a0ace16c06476a0cc8c211fc8ba3ce210fde6e530eb0ce4be1108
ubuntu@k8s-instance-6:~$ docker kill failing-container
failing-container
ubuntu@k8s-instance-6:~$ docker ps -a
CONTAINER ID   IMAGE          COMMAND                  CREATED              STATUS
8a557e4cc59a   alpine         "sh -c 'sleep 5 && e…"   39 seconds ago       Exited (137) 7 seconds ago
ainer
3d6c5162cfd6   nginx          "/docker-entrypoint.…"   About a minute ago   Up About a minute
x
69d040c943a5   alpine         "sh"                     4 minutes ago        Up 4 minutes
```

3. Try with the policy —restart unless -topped

```
ubuntu@k8s-instance-6:~$ docker run -dit \
>    --name persistent-nginx \
>    --restart=unless-stopped \
>    nginx
d12d85afdc630eaaef9c698a00c444b67990ab8497268dc314ea740aa6ed7142
ubuntu@k8s-instance-6:~$ docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED          STA
d12d85afdc63   nginx          "/docker-entrypoint.…"   8 seconds ago    Up
```

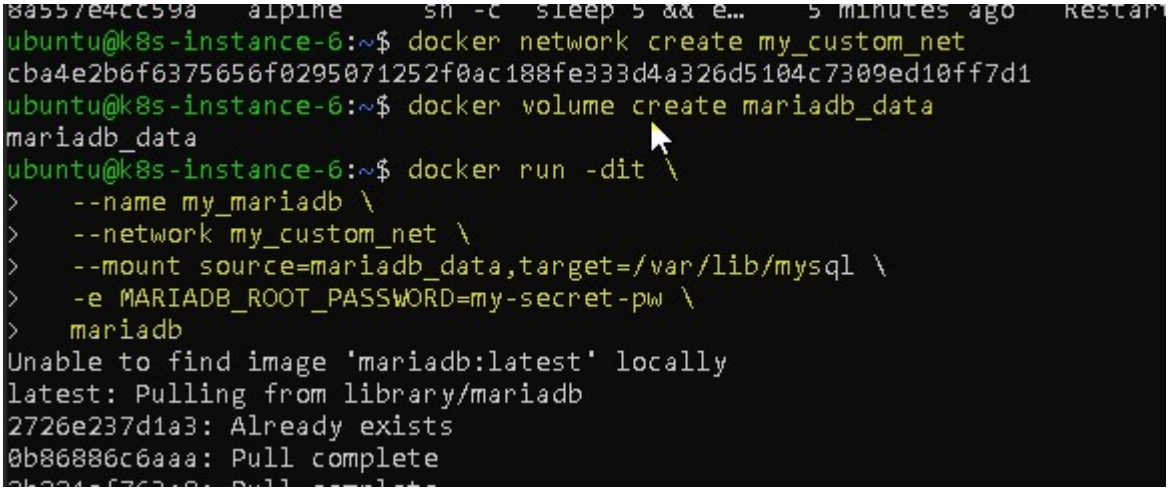
4. Reboot the system and see what happens.

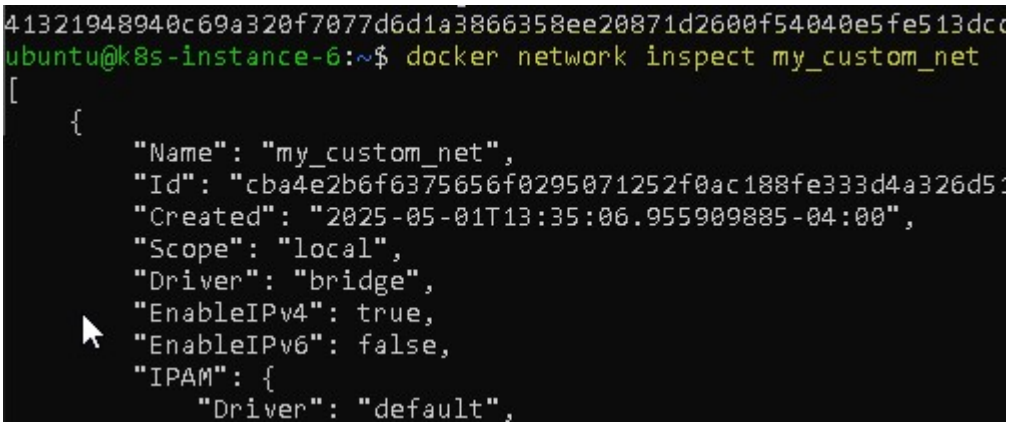
```
e99d6647747f   nginx          "/docker-entrypoint.…"   5 days ago      Up 5 days      80/tcp                                  webserver4
c16aebbd6bc6   nginx          "/docker-entrypoint.…"   5 days ago      Up 5 days      80/tcp                                  webserver
7d9cf0cbc726   nginx          "/docker-entrypoint.…"   6 days ago      Up 6 days      0.0.0.0:80->80/tcp, [::]:80->80/tcp     docker-nginx
786b9961c76a   nginx          "/docker-entrypoint.…"   6 days ago      Up 6 days      80/tcp                                  nginx2
ubuntu@k8s-instance-6:~$ sudo reboot

Broadcast message from root@k8s-instance-6 on pts/1 (Thu 2025-05-01 13:27:35 -04):

The system will reboot now!

ubuntu@k8s-instance-6:~$ Connection to 10.26.32.177 closed by remote host.
Connection to 10.26.32.177 closed.
noemi@NGUZMANO-DH01:~$ ssh -i k8s-instance-6 ubuntu@10.26.32.177
ubuntu@k8s-instance-6:~$ docker ps
CONTAINER ID   IMAGE     COMMAND                  CREATED         STATUS                              PORTS     NAMES
d12d85afdc63   nginx     "/docker-entrypoint.…"   3 minutes ago   Up About a minute                   80/tcp    persistent-nginx
8a557e4cc59a   alpine    "sh -c 'sleep 5 && e…"   5 minutes ago   Restarting (1) 15 seconds ago                 failing-container
ubuntu@k8s-instance-6:~$
```

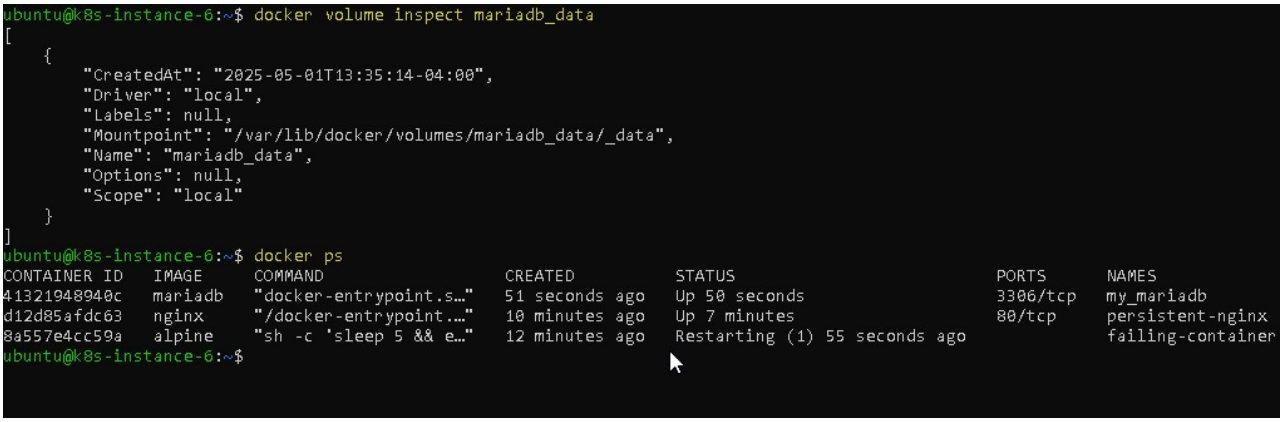
Exercise 9

1. Create a network `dbnet`.

2. Create a volume `dbdata`.
3. Run a MariaDB container with the following requirements:
    1. Attached to volume `dbdata`.
    2. Attached to network `dbnet`.
    3. Do NOT expose ANY port.







Exercise 10

1. Run a PHPMyAdmin container with the following requirements:
    1. Attached to network `dbnet` (created in Exercise 9).

2. Use a bind mount to persist the web app configuration.

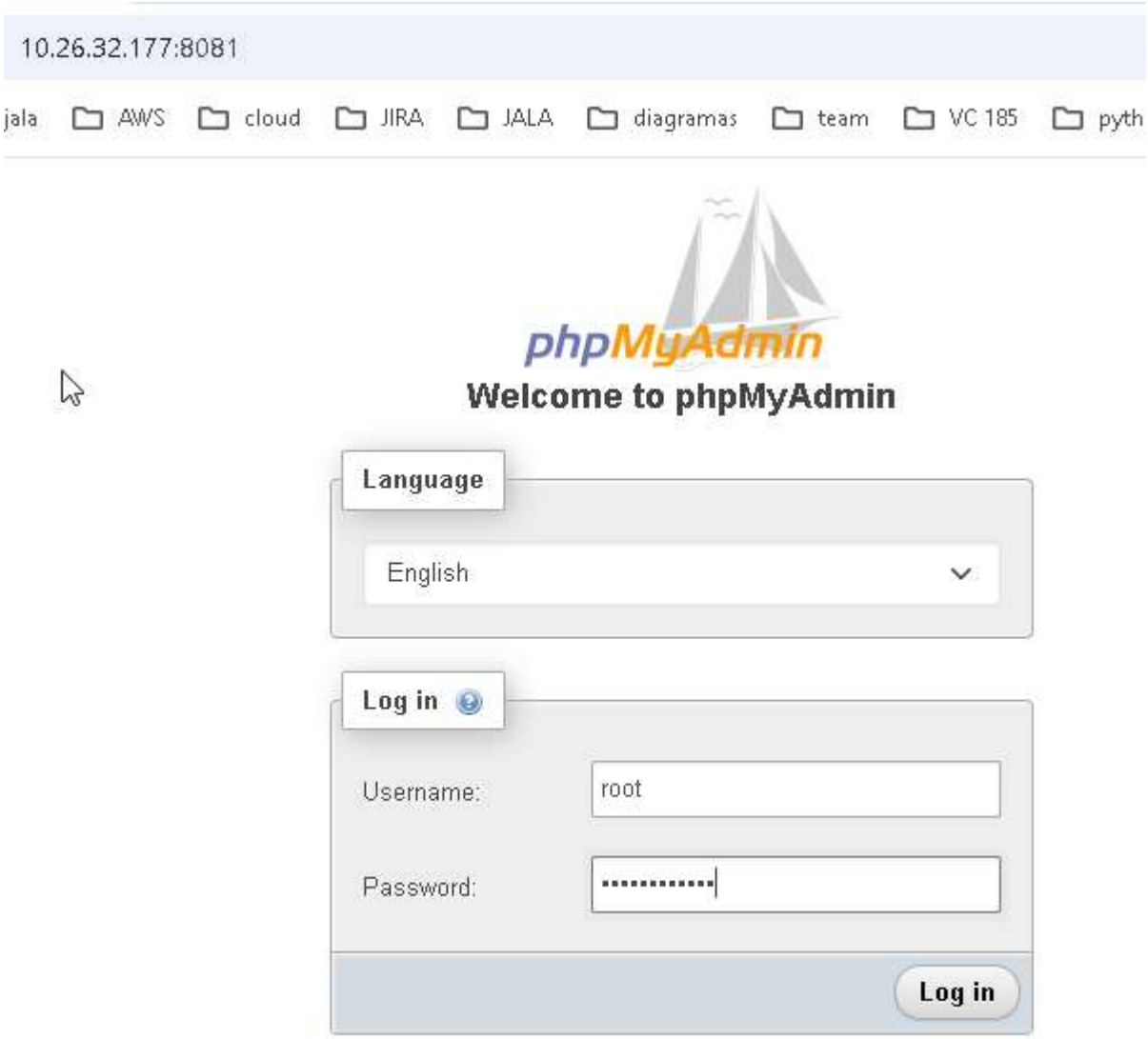
```
ubuntu@k8s-instance-6:~$ mkdir -p ~/phpmyadmin_config
ubuntu@k8s-instance-6:~$ docker run -dit \
>    --name my_phpmyadmin \
>    --network my_custom_net \
>    --mount type=bind,source=$HOME/phpmyadmin_config,target=/etc/phpmyadmin \
>    -e PMA_HOST=my_mariadb \
>    -e PMA_PORT=3306 \
>    -p 8081:80 \
>   phpmyadmin
Unable to find image 'phpmyadmin:latest' locally
latest: Pulling from library/phpmyadmin
254e724d7786: Pull complete
```

3. Linked to the previous MariaDB container (created in Exercise 9)

4. Open a browser to display the PHPMyAdmin Login Form.

```
ubuntu@k8s-instance-6:~$ ping http://localhost:8081
ping: http://localhost:8081: Name or service not known
ubuntu@k8s-instance-6:~$ curl http://127.0.0.1:8081
<!doctype html>
<html lang="en" dir="ltr">
<head>
  <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1">
  <meta name="referrer" content="same-origin">
  <meta name="robots" content="noindex,nofollow,notranslate">
  <meta name="google" content="notranslate">
  <style id="cfs-style">html{display: none;}</style>
  <link rel="icon" href="favicon.ico" type="image/x-icon">
  <link rel="shortcut icon" href="favicon.ico" type="image/x-icon">
  <link rel="stylesheet" type="text/css" href="./themes/pmahomme/jquery/jquery-ui.css"
  <link rel="stylesheet" type="text/css" href="js/vendor/codemirror/lib/codemirror.css
  <link rel="stylesheet" type="text/css" href="js/vendor/codemirror/addon/hint/show-hi
  <link rel="stylesheet" type="text/css" href="js/vendor/codemirror/addon/lint/lint.cs
  <link rel="stylesheet" type="text/css" href="./themes/pmahomme/css/theme.css?v=5.2.2
  <title>phpMyAdmin</title>
    <script data-cfasync="false" type="text/javascript" src="js/vendor/jquery/jquery.m
  <script data-cfasync="false" type="text/javascript" src="js/vendor/jquery/jquery-mig
  <script data-cfasync="false" type="text/javascript" src="js/vendor/sprintf.js?v=5.2.
  <script data-cfasync="false" type="text/javascript" src="js/dist/ajax.js?v=5.2.2"></
  <script data-cfasync="false" type="text/javascript" src="js/dist/keyhandler.js?v=5.2
  <script data-cfasync="false" type="text/javascript" src="js/vendor/jquery/jquery-ui.
  <script data-cfasync="false" type="text/javascript" src="js/dist/name-conflict-fixes
  <script data-cfasync="false" type="text/javascript" src="js/vendor/bootstrap/bootstr
```

5. Login with the DB credentials.


10.26.32.177:8081
jala
AWS
cloud
JIRA
JALA
diagramas
team
VC 185
pyth
phpMyAdmin
Welcome to phpMyAdmin
Language
English
Log in
Username:
root
Password:
Log in

6.