Exercise 1

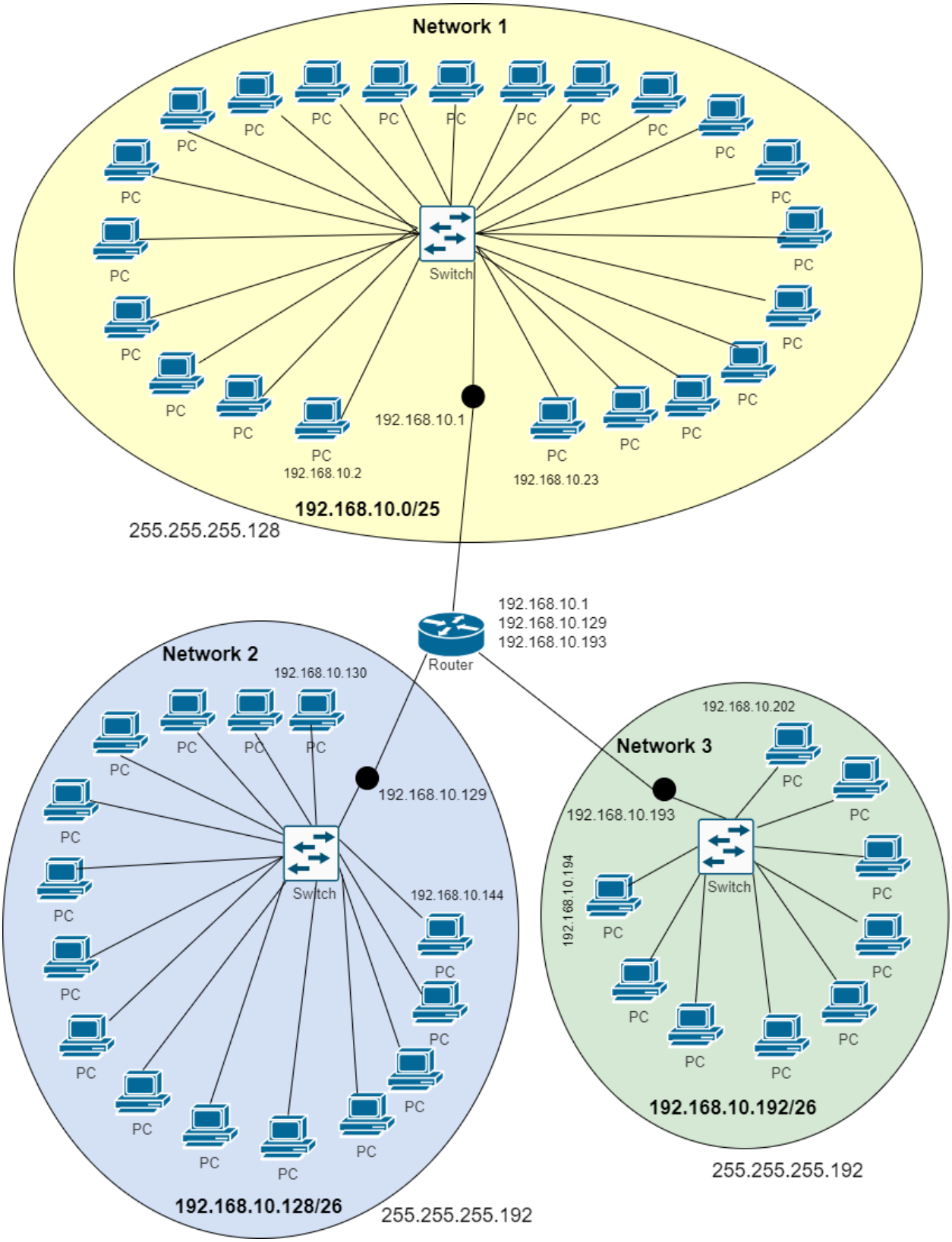
For this exercise, I have decided to create 3 subnets, with star topology, and connected between them via a central router, which contains 3 IP addresses, one from each of the subnets. Inside each network, there is also a switch, to make more efficient the communication between the devices.

To prevent infection between the different subnets, firewalls should be used, to prevent malware from reaching the router and being distributed to the other networks.

For the software developers, who need 2 IP addresses each, I have decided to assign 2 devices to each of them, with one IP per device. As an alternative, we could assign 2 IP addresses to each device by using IP dual stack, or we could also assign the second IP to a virtual machine of the device. However, to make the design simpler, I have decided to go for 2 computers per software developer, each of them with only 1 IP address.

To make the network diagram easier to read, only the first and the last IP address of the devices on each network are visible in the diagram. The complete list of the IP addresses can be found in the Part b of the exercise, in the tables.

PART A


Network 1
PC
Switch
192.168.10.1
192.168.10.2
192.168.10.23
192.168.10.0/25
255.255.255.128
Router
192.168.10.1
192.168.10.129
192.168.10.193
Network 2
192.168.10.130
192.168.10.129
192.168.10.144
192.168.10.128/26
255.255.255.192
Network 3
192.168.10.202
192.168.10.193
192.168.10.194
192.168.10.192/26
255.255.255.192

PART B

Subnet	Network Address	Broadcast Address	Mask	Number of usable hosts
1	192.168.10.0	192.168.10.127	255.255.255.128	126
2	192.168.10.128	192.168.10.191	255.255.255.192	62
3	192.168.10.192	192.168.10.255	255.255.255.192	62

Network 1 (software developers)

Device	IP
Router	192.168.10.1
Device 1 (software developer 1)	192.168.10.2
Device 2 (software developer 1)	192.168.10.3
Device 3 (software developer 2)	192.168.10.4
Device 4 (software developer 2)	192.168.10.5
Device 5 (software developer 3)	192.168.10.6
Device 6 (software developer 3)	192.168.10.7
Device 7 (software developer 4)	192.168.10.8
Device 8 (software developer 4)	192.168.10.9
Device 9 (software developer 5)	192.168.10.10
Device 10 (software developer 5)	192.168.10.11
Device 11 (software developer 6)	192.168.10.12
Device 12 (software developer 6)	192.168.10.13
Device 13 (software developer 7)	192.168.10.14
Device 14 (software developer 7)	192.168.10.15
Device 15 (software developer 8)	192.168.10.16
Device 16 (software developer 8)	192.168.10.17
Device 17 (software developer 9)	192.168.10.18
Device 18 (software developer 9)	192.168.10.19
Device 19 (software developer 10)	192.168.10.20
Device 20 (software developer 10)	192.168.10.21
Device 21 (system administrator 1)	192.168.10.22
Device 22 (system administrator 2)	192.168.10.23
Empty IPs range	192.168.10.24 to 192.168.10.126

Network 2 (economics)

Device	IP
Router	129.168.10.129
Device 1	192.168.10.130
Device 2	192.168.10.131
Device 3	192.168.10.132
Device 4	192.168.10.133
Device 5	192.168.10.134

Device 6	192.168.10.135
Device 7	192.168.10.136
Device 8	192.168.10.137
Device 9	192.168.10.138
Device 10	192.168.10.139
Device 11	192.168.10.140
Device 12	192.168.10.141
Device 13	192.168.10.142
Device 14	192.168.10.143
Device 15	192.168.10.144
Empty IPs range	192.168.10.145 to 192.168.10.190

Network 3 (IoT devices)

Device	**IP**
Router	192.168.10.193
Device 1	192.168.10.194
Device 2	192.168.10.195
Device 3	192.168.10.196
Device 4	192.168.10.197
Device 5	192.168.10.198
Device 6	192.168.10.199
Device 7	192.168.10.200
Device 8	192.168.10.201
Device 9	192.168.10.202
Empty IPs range	192.168.10.203 to 192.168.10.254

Central Router

Device	**IPs**
Router	192.168.10.1 / 192.168.10.129 / 192.168.10.193

Exercise 2

SECTION D

These are all the commands (written within quotes "") needed for this section, and all the steps followed:

- *"docker network create private-network"* → command to create a network for the containers.
- *"docker run --rm -d -p 8001:8001 --name redis --network private-network redis/redis-stack:latest"* → command to run the Redis container in the private network previously created.
- The Dockerfile is modified with the appropriate Redis_server value, which is the name assigned to the redis container.
- From the directory where the Dockerfile is saved, execute *"docker build -t flask-image ."* → command to build the image after modifying the Dockerfile (content details below)
- *" cd app/"* → to change to the app directory in the host machine.
- *"docker run -d -p 5000:5000 -v $(pwd):/app --name flask-server --network private-network flask-image"* → command to launch the flask server in a container mapped to our app directory, and to our port 5000. The container will be run in the same network as the Redis container, so they can communicate.
- http://localhost:5000 shows the incremental counter.

The final content of the Dockerfile is:

FROM python:3.8-slim

COPY requirements.txt .

RUN pip install --no-cache-dir -r /requirements.txt

ENV FLASK_APP=app.py

ENV FLASK_RUN_HOST=0.0.0.0

ENV FLASK_ENV=development

ENV REDIS_SERVER=redis

WORKDIR /app

ENTRYPOINT ["flask", "run", "--host=0.0.0.0", "--debug"]