Problem 1 Based on topology from slide page 21 (QoS, CAR), write a shell script that computes the average rate for the following traffic flows:

- From 11.0.0.1 with precedence 7
- From 11.0.0.1 with precedence 1
- From 12.0.0.1

captured at interface `R1-s1/0`. Use `tshark` application.

Deliver:

- A short PDF file commenting the results
- The capture file
- The script code

(1.5 points)

Problem 2 Based on topology from slide page 39 (QoS, CBWFQ), write a shell script that computes the percentage of bandwidth occupation at serial link `R1-R2` for each of the streams coming from `C1-tap0` and `C2-tap1`. Use `tshark` application.

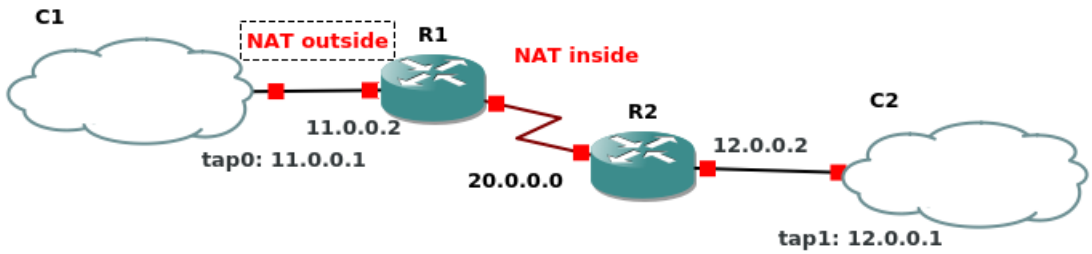
Deliver:

- A short PDF file commenting the results
- The capture file
- The script code

(1.5 points)

Problem 3 Considering the following topology:

```
ffmpeg -re -i videofile.mp4 -vcodec copy -an -sdp_file s.sdp -f rtp rtp://13.0.0.1:5004
```




```
ping 13.0.0.1 -s 1000 -i 0.01
```

```
ffplay -protocol_whitelist file,udp,rtp -i s.sdp
```

Answer the following questions:

1. Detail the required NAT related R1 configuration as well as the correct routing directives on your PC. Note that video stream must be delivered from 11.0.0.1 to 13.0.0.1
2. Detail the required priority queuing (PQ) related R1 configuration in order to provide high priority to video streaming and low priority to default traffic. Which is the maximum allowed speed transmission rate along the path ?
3. Download from here a video sample with the corresponding video bit rate encoding slightly below you maximum transmission rate. Detail the complete `ping` to achieve the same transmission rate that your video streaming.
4. While streaming video, measure the number of `RTP missed packets` (during 1 minute of transmission) by ffplayer when using PQ and without PQ. Explain how you obtain those measurements.
5. Repeat the last item adding a `ping` transmission at the same rate that the video streaming.

(3 points)