Operating Systems and Systems Programming
Semester 1, 2023
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Exercise 1

Deadline: 16 October,11:00am

This exercise does not contribute to the module mark. Automated marking scripts which you can run will be released after the deadline.

Write a program which extracts simple rules for a firewall and tests whether a packet with a given destination and port should be accepted. A rule is of the form

```
<IPAddresses> <ports>
```

where `<IPAddresses>` is either a single IP address, which has the form `xxx.xxx.xxx.xxx`, where `xxx` is a number between 0 and 255, or `<IPAddress1>-<IPAddress2>`, where `<IPAddress1>` and `<IPaddress2>` are IP addresses, and `<IPAddress1>` is smaller than `<IPaddress2>`. Assume that IP addresses and ports are separated by exactly one space character.

Similarly, `<ports>` is either a single port number, which is a number between 0 and 65535, or `<port1>-<port2>`, where `<port1>` and `<port2>` are ports and `<port1>` is smaller than `<port2>`.

Examples of such rules would be

```
147.188.193.0-147.188.194.255 21-22
147.188.192.41 443
```

You should write the following programs:

1. A program `readFirewall` which reads the firewall rules and outputs the rules sorted according to port number and IP address. Each line of this file contains one rule. If the port numbers are given as`<port1>-<port2>` or the IP addresses are given as `<IPAddress1>-<IPAddress2>`, you should use `<port1>` and `<IPAddress1>` for sorting, respectively. For any line with an ill-formed rule, you should output "Ill formed rule:" followed by the line with the ill-formed rule. The program should be called with `readFirewall <filename>`.

2. Extend the program `readFirewall` to produce a programm `checkPacket` which checks whether for a given set of firewall rules a packet with a destination IP address and a port should be accepted. This program should be called with `checkPacket <filename> <IPaddress> <port>`. The output should be "Packet from `IP-address` and port `port` accepted" or "Packet from `IP-address` and port `port` rejected", as appropriate.

Hints:

1. To check the details for a library function `<function>`, type the command `man <function>`.

2. To read a line from a file, first open the file using `fopen`. This function returns a stream (type `FILE *`), which you use in the fucnction `getline` to read lines from the file. Finally you close the file via `fclose`.

3. For parsing the file with the firewall rules, the `strpbrk`-function might be useful.

4. For converting strings to integers, the `strtol`-function might be useful.

5. There are also library functions for sorting , eg `qsort`.

6. An archive containing a Makefile and skeleton files is available on canvas.

7. Submission is on canvas - we will release marking scripts for you to run after the deadline.