NETWORKS AND PROTOCOLS

Exercise Sheet 2

Exercise 1

Assuming a classful addressing, determine if the following addresses are network or host addresses. Furthermore, determine also the class they belong to.

Address	Is it a network address	Class (A/B/C)
130.192.0.0		
192.168.0.0		
80.45.0.0		
112.0.0.0		
198.0.1.0		
134.188.1.0		
224.0.0.3		
241.0.3.1		
235.0.0.0		

Exercise 2

Complete the following table:

IP Address	Network ID	Subnet ID	Host ID	Subnet mask	Broadcast Address
132.90.132.5				255.255.255.240	
	128.66	12.0	1	255.255.255.128	
			2		172.17.192.55
					200.35.1.111
10.255.255.135		255.255.4	7		

Exercise 3

Consider the router and the three attached subnets below (A, B, and C). The number of hosts is also shown below. The subnets share the 23 high-order bits of the address space: 10.187.160.0/23 Assign subnet addresses to each of the subnets (A, B, and C) so that the amount of address space assigned is minimal, and at the same time leaving the largest possible contiguous address space available for assignment if a new subnet were to be added. Then answer the questions below.

(a) Is the address space public or private?
(b) How many hosts can there be in this address space?
(c) What is the subnet address of subnet A? (CIDR notation)

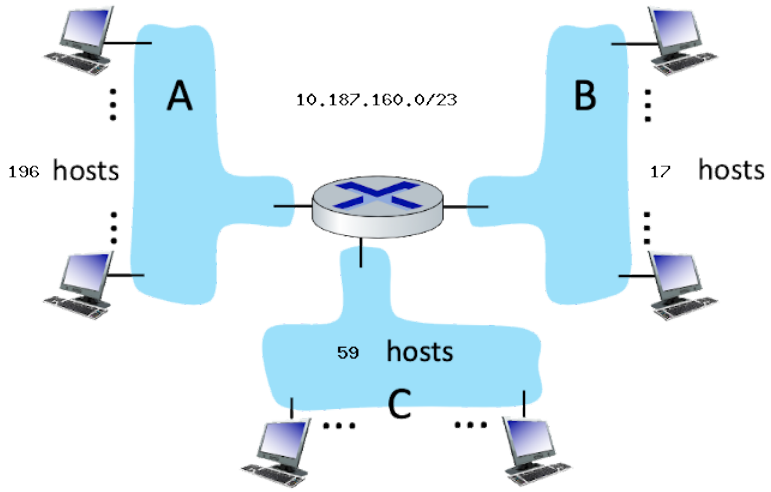

Figure 1: Exercise 3

(d) What is the broadcast address of subnet A?
(e) What is the starting address of subnet A?
(f) What is the ending address of subnet A?
(g) What is the subnet address of subnet B? (CIDR notation)
(h) What is the broadcast address of subnet B?
(i) What is the starting address of subnet B?
(j) What is the ending address of subnet B?
(k) What is the subnet address of subnet C? (CIDR notation)
(l) What is the broadcast address of subnet C?
(m) What is the starting address of subnet C?
(n) What is the ending address of subnet C?

Exercise 4

Define a classful addressing plan for the network depicted in the figure below. The chosen address ranges should belong to the private addressing space; use the first addresses available in classes A, B or C according to the size of each logical IP network.

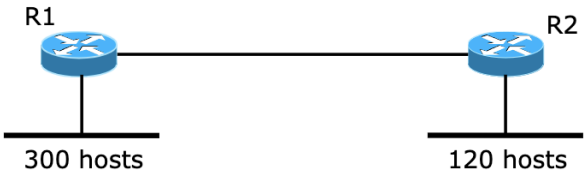

Figure 2: Exercise 4

Exercise 5

Define a classful addressing plan for the network depicted in the figure below. The chosen address ranges should belong to the private addressing space; use the first addresses available in classes A, B or C according to the size of each logical IP network.

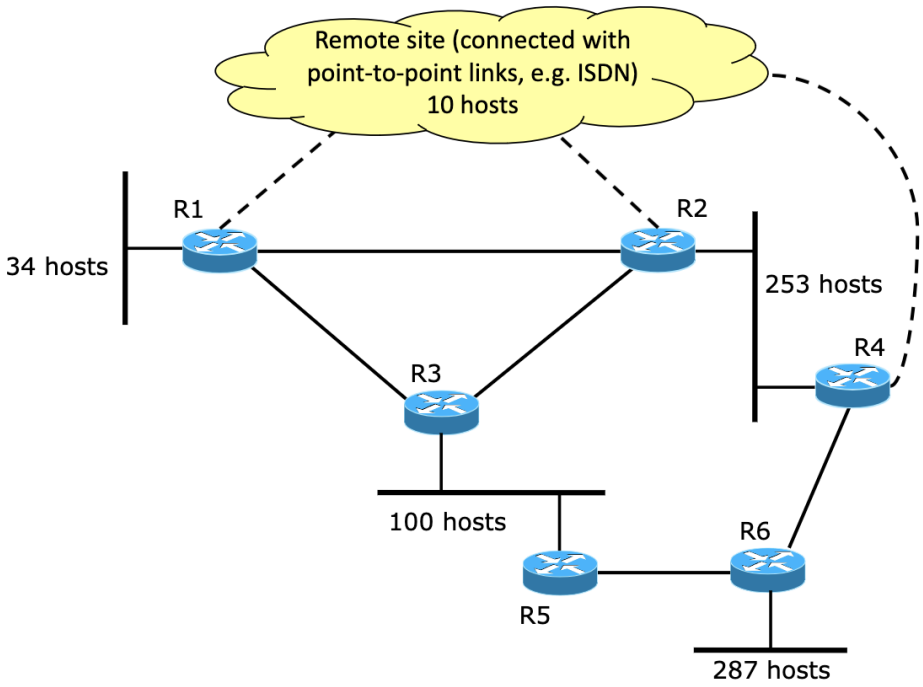

Figure 3: Exercise 5

Exercise 6

Define a classful addressing plan for the network depicted in the figure below. The chosen address ranges should belong to the public addressing space; use the first addresses available in classes A, B or C according to the size of each logical IP network.

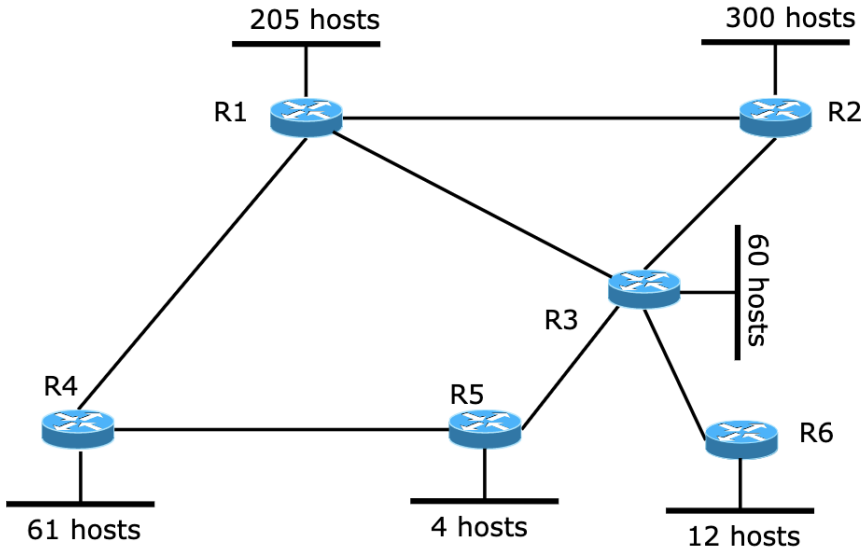

Figure 4: Exercise 6

Exercise 7

Assuming a classless addressing plan, define the address ranges (in the form "network address/prefix length") that can be used to handle a set of IP networks that include the number

of hosts shown in the table below. The address spaces assigned to the networks should be assigned in order, one immediately following the other, within the address range 192.168.0.0/16. Determine also the broadcast address for each network.

Number of hosts	Network address / prefix length	Broadcast address
2		
27		
5		
100		
10		
300		
1010		
55		
167		
1540		

Exercise 8

Assuming a classless addressing plan, define the IP networks that can be used to handle a LIN with the specified number of hosts (first column) within the given address range (second column). The student should specify the address range (in the form "network address/prefix length") that is the most appropriate to handle each IP network, considering that (a) no expansions (in terms of number of hosts) are expected in the future, and (2) each network is connected to the Internet and therefore a router is required. Furthermore, write also a possible address for the router and for the hosts.
Finally, in case the address range assigned to the network leads to a large waste of addresses, propose an alternative addressing based on the partitioning of the given network.

Nbr hosts	Addres range	Network address / prefix length	Router address	Host address
2	192.168.0.0/24			
27	192.168.0.0/24			
30	192.168.0.0/24			
126	192.168.0.0/24			
140	192.168.0.0/24			
230	192.168.0.0/24			

Exercise 9

Define a classless addressing plan for the network in the figure below, using first the address range 192.168.0.0/22, and then the address range 192.168.4.0/23. The address ranges assigned to the LIN should form a contiguous space; consider also that no expansions (in terms of the number of hosts) are required in the future.

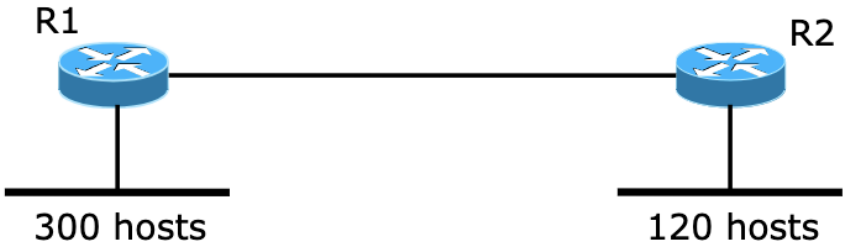

Figure 5: Exercise 9

Exercise 10

Define a classless addressing plan for the network in the figure below using the address range 192.168.0.0/23. The address ranges assigned to the LIN should form a contiguous space; consider also that no expansions (in terms of the number of hosts) are required in the future, except for the network at the bottom (as shown in the figure).

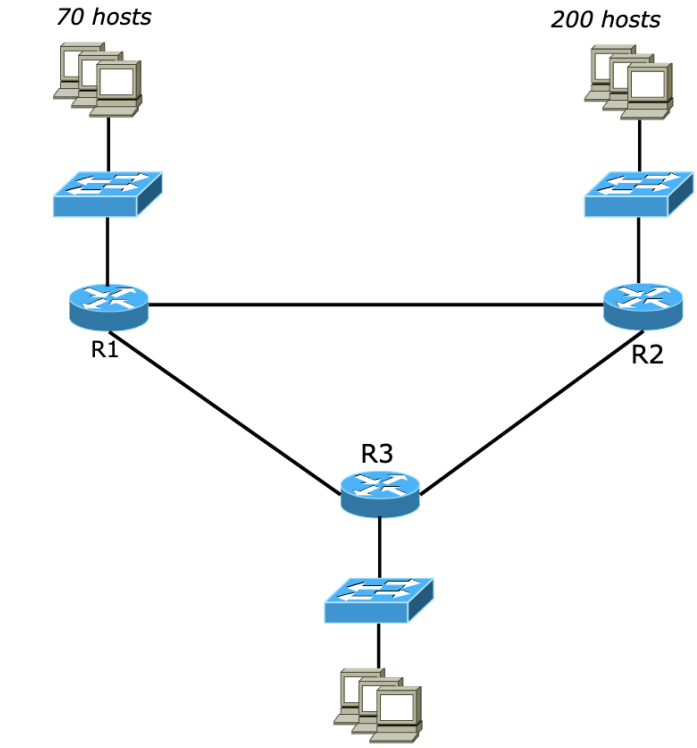

Figure 6: Exercise 10

Exercise 11

Consider the following routing tables:

R0		
	Subnet @	N. hop
C	172.16.192.0	–
C	172.17.64.0	–
C	172.17.128.0	–
R	192.168.1.0/24	172.16.128.1
R	192.168.2.0/24	172.16.192.1
R	192.168.3.0/24	172.17.128.2 172.16.192.1 172.17.64.2
R	192.168.4.0/24	172.16.128.2
R	192.168.5.0/24	172.17.64.2 172.16.128.2
R	192.168.6.0/24	172.17.64.2 172.16.128.2
R	192.168.7.0/24	172.17.64.2
C	192.168.8.0/24	–

R1		
	Subnet @	N. hop
C	172.16.64.0	–
C	172.17.32.0	–
C	172.17.128.0	–
R	192.168.3.0/24	172.16.0.2
R	192.168.5.0/24	172.16.64.2
R	192.168.7.0/24	172.17.128.1 172.16.64.2 172.17.32.2
C	192.168.4.0	–
R	192.168.1.0/24	172.17.128.1 172.17.32.1
R	192.168.2.0/24	172.17.128.1 172.17.32.1
R	192.168.6.0/24	172.16.64.2
R	192.168.8.0/24	172.17.128.1

R2		
	Subnet @	N. hop
C	172.16.0.0	–
C	172.16.192.0	–
C	192.168.1.0	–
C	192.168.2.0	–
R	192.168.3.0/24	172.16.0.2
R	192.168.4.0/24	172.16.0.2 172.16.192.2
R	192.168.8.0/24	172.16.128.2
R	192.168.5.0/24	172.16.0.2 172.16.192.2
R	192.168.6.0/24	172.16.0.2 172.16.192.2
R	192.168.7.0/24	172.16.0.2 172.16.192.2

R3		
	Subnet @	N. hop
C	172.16.0.0	–
C	172.17.0.0	–
C	172.17.32.0	–
C	192.168.3.0	–
R	192.168.1.0/24	172.16.0.1
R	192.168.2.0/24	172.16.0.1
R	192.168.7.0/24	172.17.0.2
R	192.168.4.0/24	172.16.32.2
R	192.168.5.0/24	172.16.32.2 172.17.0.2
R	192.168.6.0/24	172.16.32.2 172.17.0.2
R	192.168.8.0/24	172.16.32.2 172.17.0.2 172.16.0.1

R4		
	Subnet @	N. hop
C	172.16.128.0	–
C	172.17.0.0	–
C	172.16.64.0	–
C	192.168.7.0	–
R	192.168.5.0/24	172.16.128.2
R	192.168.2.0/24	172.17.64.1 172.17.0.1
R	192.168.3.0/24	172.16.64.1
R	192.168.8.0/24	172.16.64.1
R	192.168.1.0/24	172.17.64.1 172.17.0.1
R	192.168.6.0/24	172.16.128.2
R	192.168.4.0/24	172.16.128.2 172.17.64.1 172.17.0.1

R5		
	Subnet @	N. hop
C	172.16.64.0	–
C	172.16.128.0	–
C	192.168.5.0	–
C	192.168.6.0	–
R	192.168.7.0/24	172.17.128.1
R	192.168.2.0/24	172.16.64.1 172.16.128.1
R	192.168.3.0/24	172.16.64.1 172.16.128.1
R	192.168.4.0/24	172.16.64.1
R	192.168.1.0/24	172.16.64.1 172.16.128.1
R	192.168.8.0/24	172.16.64.1 172.16.128.1

(a) Draw the topology according to the routing tables
(b) give network interface addresses
(c) What do you think was the "optimal" mask given?
(d) Are routing tables complete? If not, complete them.
(e) Find and correct errors in routing tables.

(f) The following subnet address is proposed: 10.0.255.128/27. Propose new IP addresses for router interfaces.

Exercise 12

Consider the network configuration described in the figure 9.

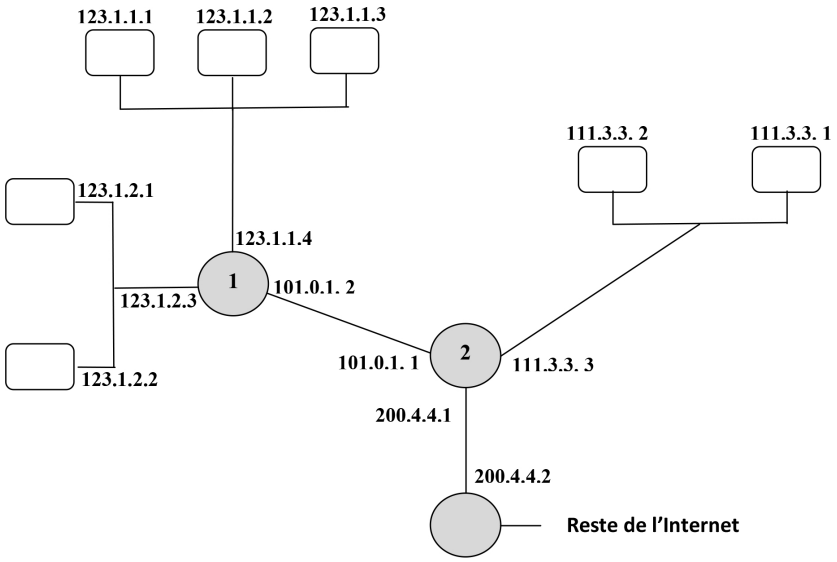

Figure 7: Network configuration.

Giving the routing table in each router (Router 1 and Router 2) by assuming that each subnet includes a block of 256 addresses.

Exercise 13

Write the routing table of each router in the format (destination router - next hop router).

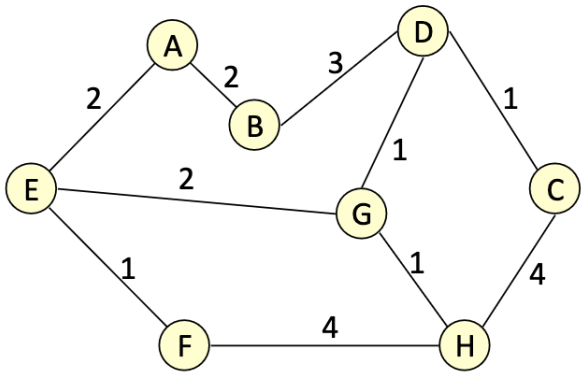

Figure 8: Network configuration.

Exercise 14

Given the network in figure, determine the routing table of R1 by aggregating the routes in a way such as:

- the addressing spaces are exactly equivalent to the original ones
- (or) there are the fewest possible entries in the routing table

Numbers in italic represent the cost of the link; assume unitary costs when not explicitly indicated in the figure.

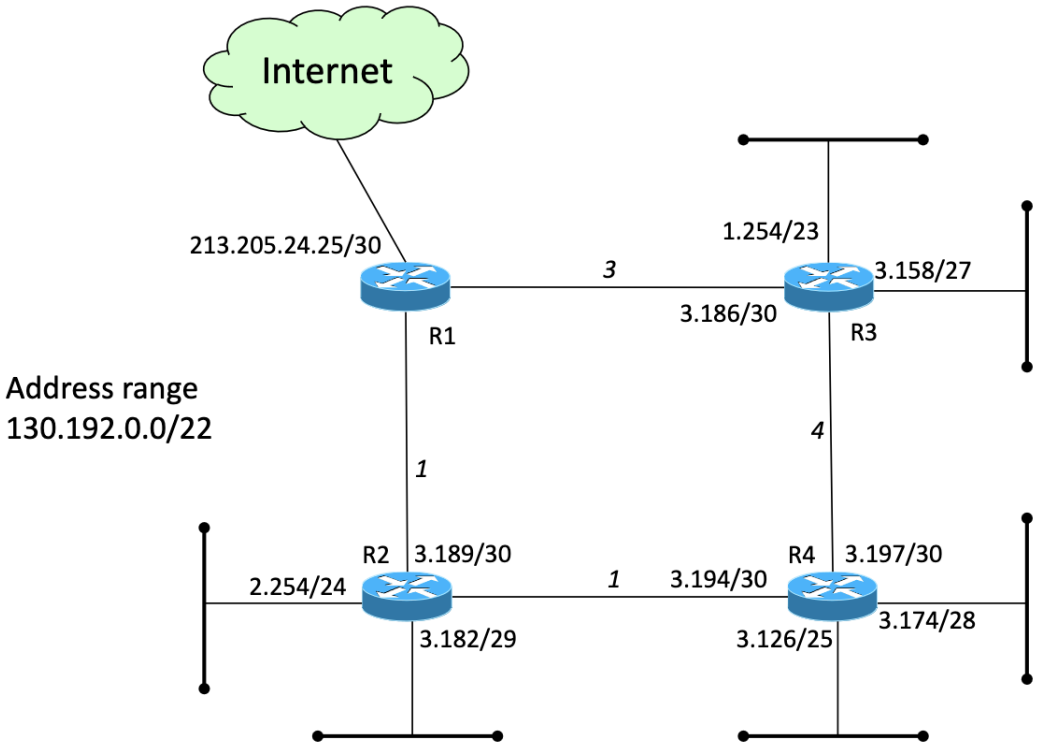

Figure 9: Network configuration.