



**La Sapienza**

Università degli Studi di Roma

Dipartimento di Informatica e Sistemistica

# Computer Networks II

## Exercise collection 3 – Addressing

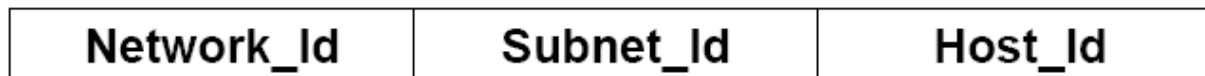
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**A.A. 2008/2009**

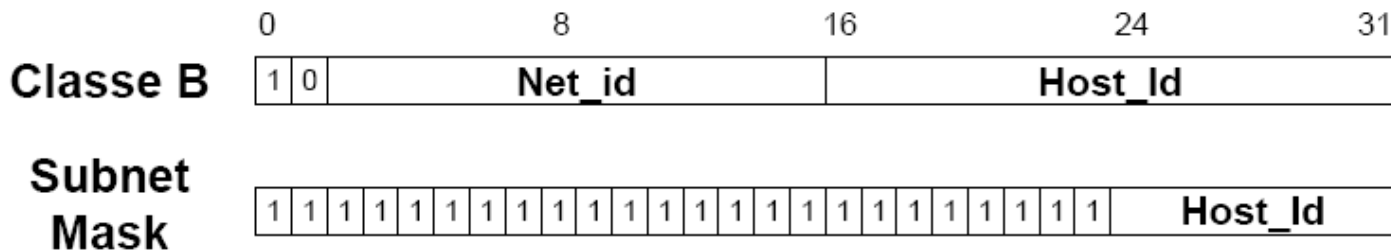
# Addressing scheme

- ❑ Two-level address structure enough at the start of Internet
- ❑ Third hierarchy level added in 1984
  - Subnet level
  - Use subset Host\_Id to encode Subnet\_Id



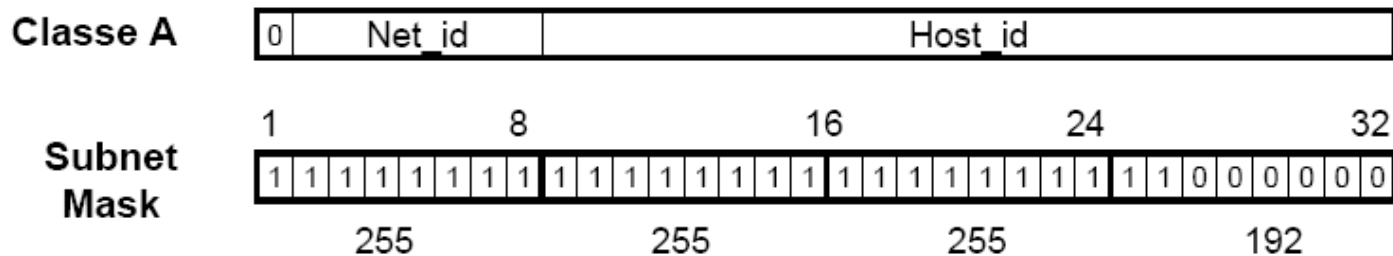
# Addressing scheme

- ❑ **Subnet\_Id** identified by “**Subnet Mask**”
- ❑ Subnet Mask: 32 bits word where:
  - Bits set to “1” identify positions of Net\_Id and Subnet\_Id bits
  - Bits set to “0” identify positions of Host\_Id bits
- ❑ **Subnet\_Id** only has a meaning at the router to which  
Sl



# Static subnetting

- All subnets of a network have same mask
- Example:



- numero massimo di sottoreti possibili =  $2^{18} - 2 = 226.143$
- numero massimo di host per sottorete =  $2^6 - 2 = 62$

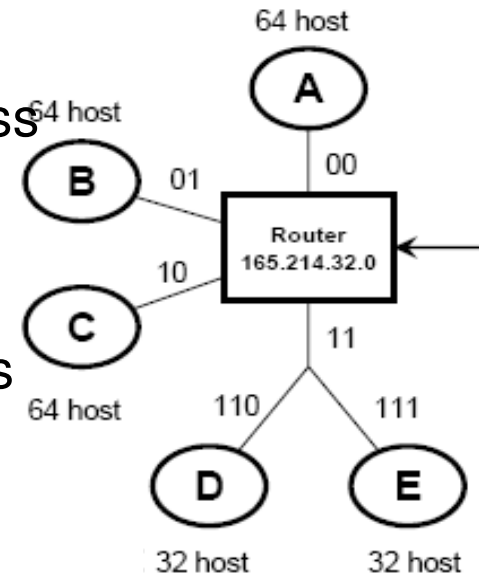
# Variable length subnetting

- Subnets may use different subnet masks
  - **Allows definition of subnets of variable size**

- Example: Router with class C address 165.214.32.0

- 5 subnets
  - Subnet A, Subnet B, Subnet C: 50 hosts
  - Subnet D, Subnet E: 30 hosts

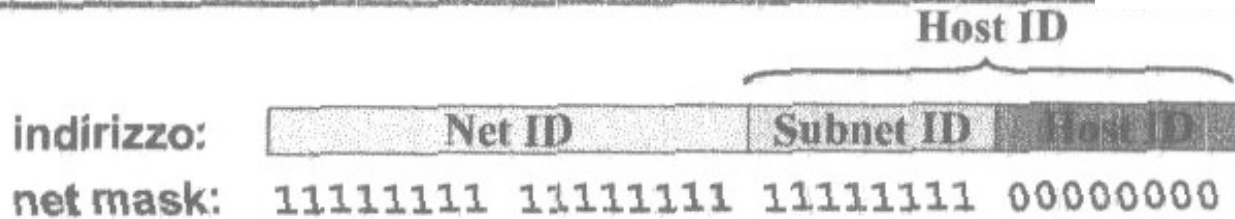
- Subnetting
  - 4 subnets each with 64 hosts (Host\_id: 6 bits) (subnet mask 255.255.255.192)
  - 1 subnet split into 2 further subnets with 32 host each (Host\_id: 5 bits, subnet mask 255.255.255.224)



# Private addressing

- The Internet Assigned Number Authority (IANA) has reserved the following three blocks of the IP address space for private internets [RFC 1918]
  - 10.0.0.0 ÷ 10.255.255.255 [**10/8 prefix**]
  - 172.16.0.0 ÷ 172.31.255.255 [**172.16/12 prefix**]
  - 192.168.0.0 ÷ 192.168.255.255 [**192.168/16 prefix**]
- In pre-CIDR notation:
  - The first block is a single class A network number
  - The second block is a set of 16 contiguous class B network numbers
  - The third block is a set of 256 contiguous class C network numbers

# Subnetting



I valori possibili nei 4 byte che costituiscono la netmask sono:

128	1000	0000
192	1100	0000
224	1110	0000
240	1111	0000
248	1111	1000
252	1111	1100
254	1111	1110
255	1111	1111

# Quiz 1

- Consider an IP network with 25 nodes [hosts and/or routers]
  - a. Compute the maximum length subnet mask that allows managing the network
  - b. Assign IP addresses to the nodes addresses in the C class block 193.212.100.0 [255.255.255.0]

**subnet-mask: 255.255.255.224**



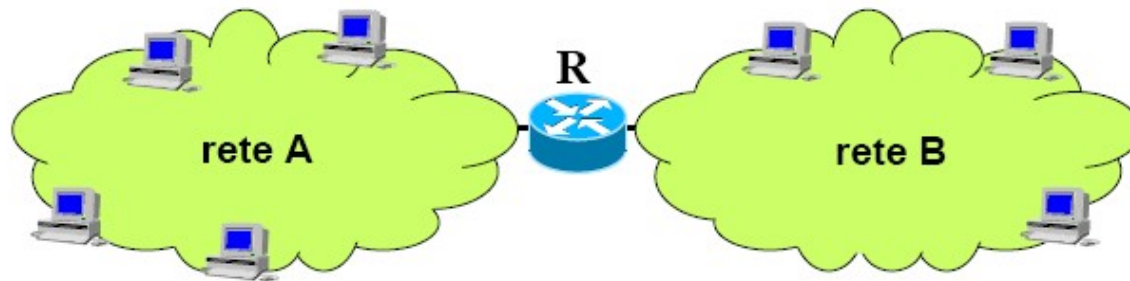
**Addresses from 192.212.100.1 to 193.212.100.30**

[30 available addresses; 193.212.100.31 is subnets' broadcast address]



## Quiz 2 - 1/3

- Consider 2 IP subnetworks [A e B] connected by router R. The overall number of hosts in the 2 subnets is 18.
  - Compute an allocation of hosts between A and B so as to minimize the overall number of unused IP addresses and provide the subnet masks corresponding to this partition
  - Assign IP addresses to single nodes using address in the class C block 193.200.10.0 [255.255.255.0] so that the address blocks assigned to the 2 subnets are contiguous

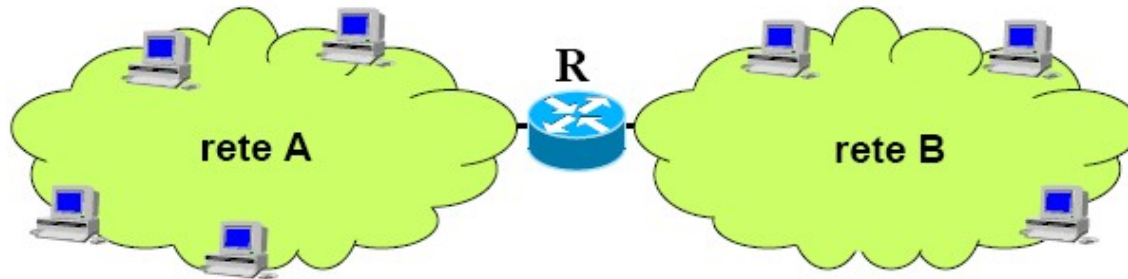


## Quiz 2 - 2/3

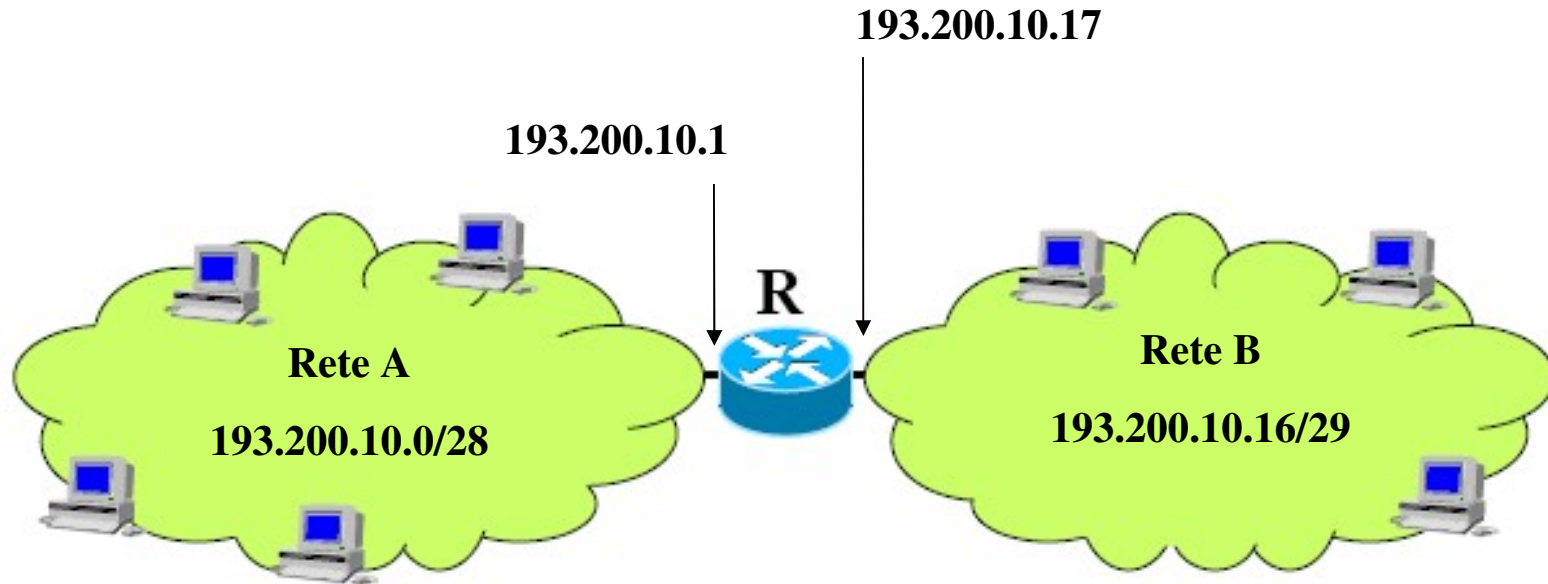
Subnet A	Hosts A	Subnet B	Hosts	Unusable addresses
255.255.255.224	18	-	0	$30-18 = 12$
255.255.255.240	14	255.255.255.248	4	$6-4 = 2$

**255.255.255.240 [14 host]**

**255.255.255.248 [4 host]**



## Quiz 2 - 3/3



**Addresses from**  
**193.200.10.0 to**  
**193.200.10.15**

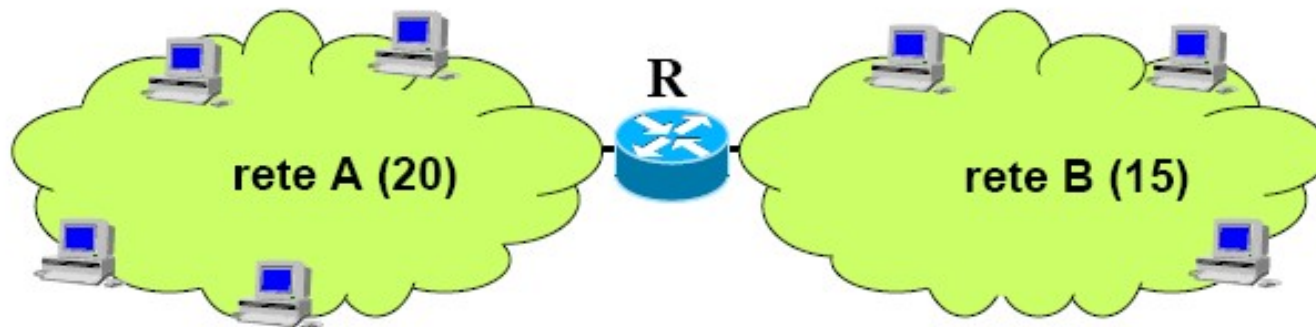
[14 available addresses:  
193.200.10.15 is  
broadcast address for  
subnets

**Addresses from**  
**193.200.10.16 to**  
**193.200.10.23**

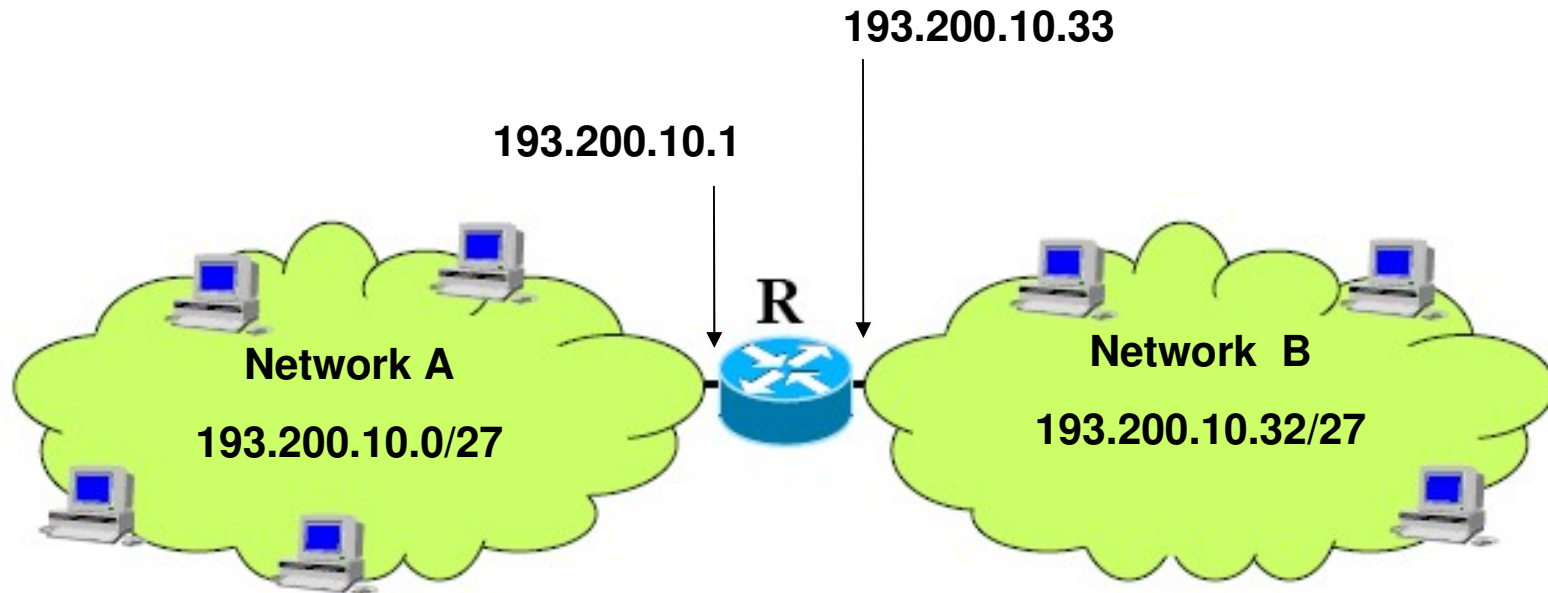
[6 available addresses:  
193.200.10.23 is  
broadcast address for  
subnets

## Quiz 3 – 1/2

- Consider 2 IP subnetworks (A e B) connected by a router R. Let the respective numbers of hosts be  $N_A=20$  and  $N_B = 15$ . The system administrator is assigned IP network address 193.200.10.0/24.
  - Assign addresses to hosts in the 2 subnets, using subnetting and ensuring that subnet masks of the same lengths are used for A and B



## Quiz 3 – 2/2



**Addresses from  
193.200.10.0 to  
193.200.10.31**

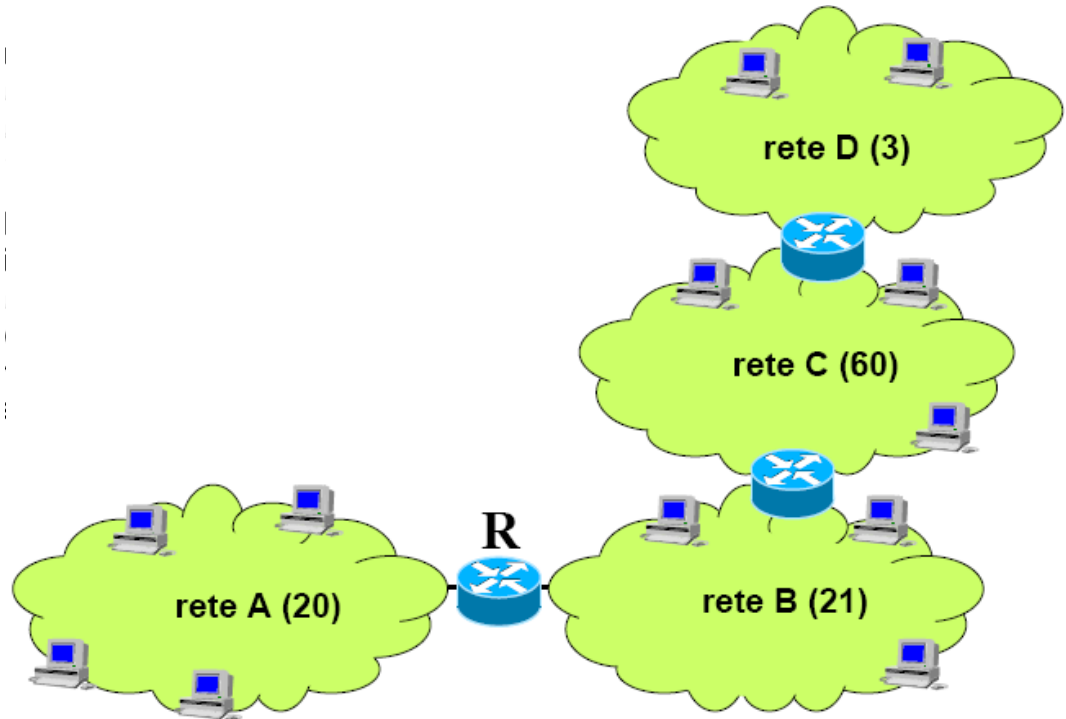
[30 available addresses;  
193.200.10.31 is  
broadcast address for  
subnetwork]

**Addresses from  
193.200.10.32 to  
193.200.10.63**

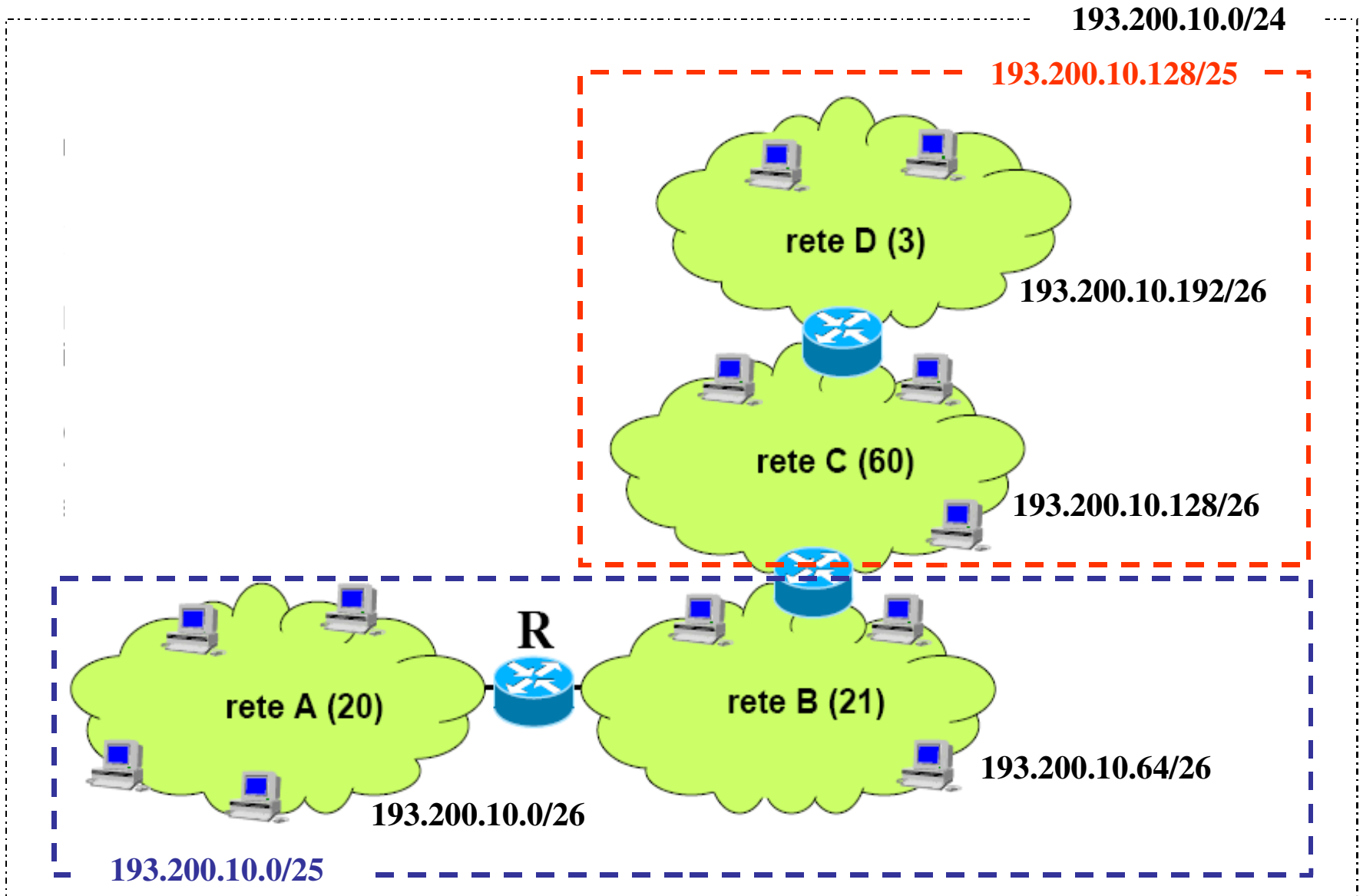
[30 available addresses;  
193.200.10.63 is  
broadcast address for  
subnetwork]

## Quiz 4 - 1/2

- Consider the following scenario [the number of hosts for every subnet is indicated in parentheses]. The system administrator is assigned network address 193.200.10.0/24.
  - Compute, for every subnet, network address and subnet mask, applying subnetting and using masks of the same length for all subnets

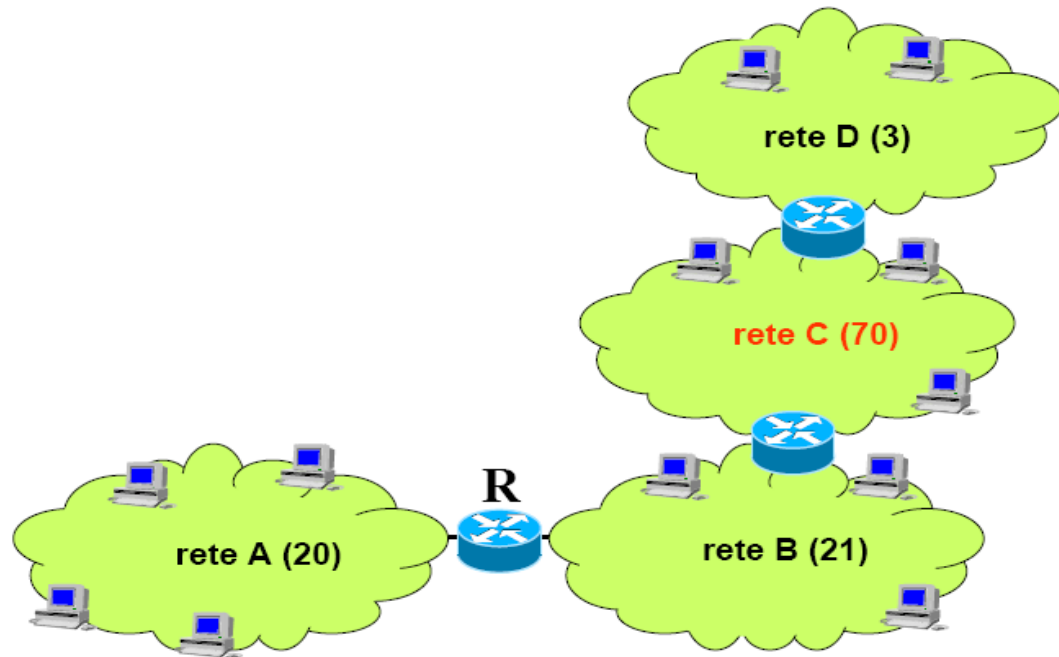


# Quiz 4 – 2/2



## Quiz 5 - 1/2

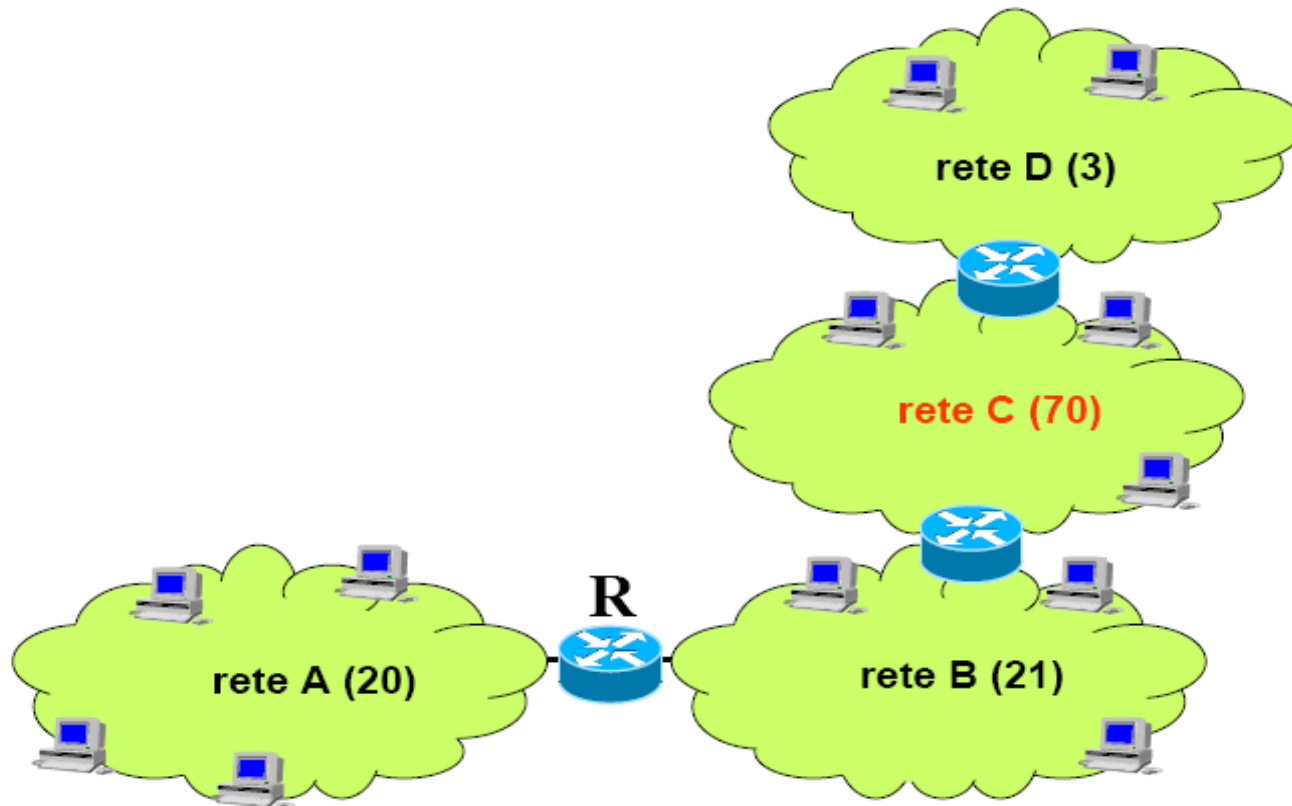
- Consider the following scenario [the number of hosts for every subnet is indicated in parentheses]. The system administrator is assigned network address 193.200.10.0/24.
  - Compute for every subnet, if possible, network address and subnet mask, applying subnetting and using masks of the same length for all subnets





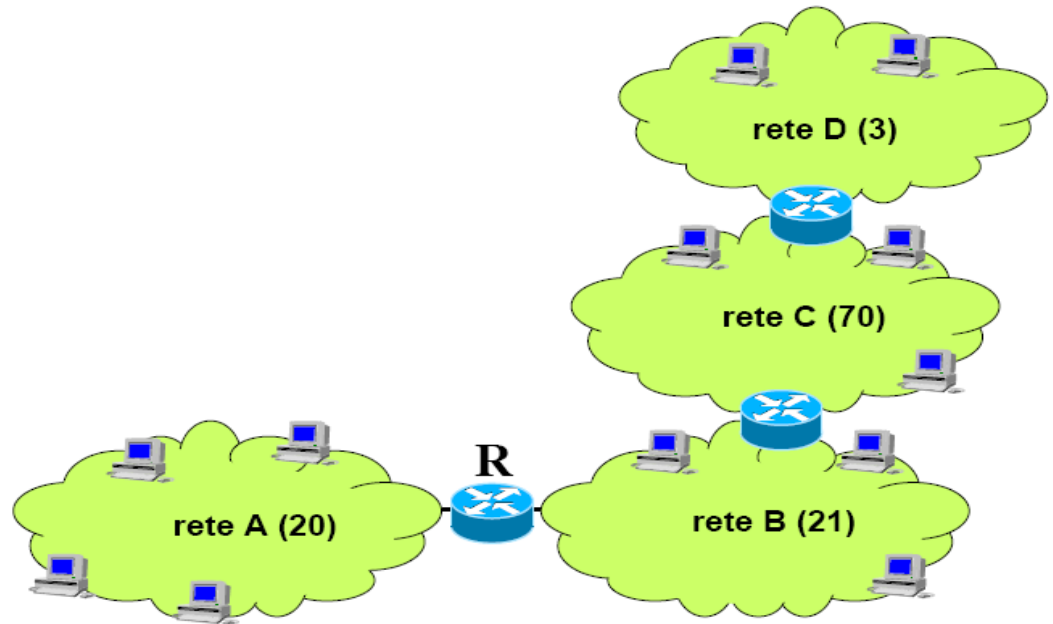
## Quiz 5 - 2/2

- Network C contains 70 hosts → 25 bit mask →  $2^{25} < 4$  possible subnets → no solution

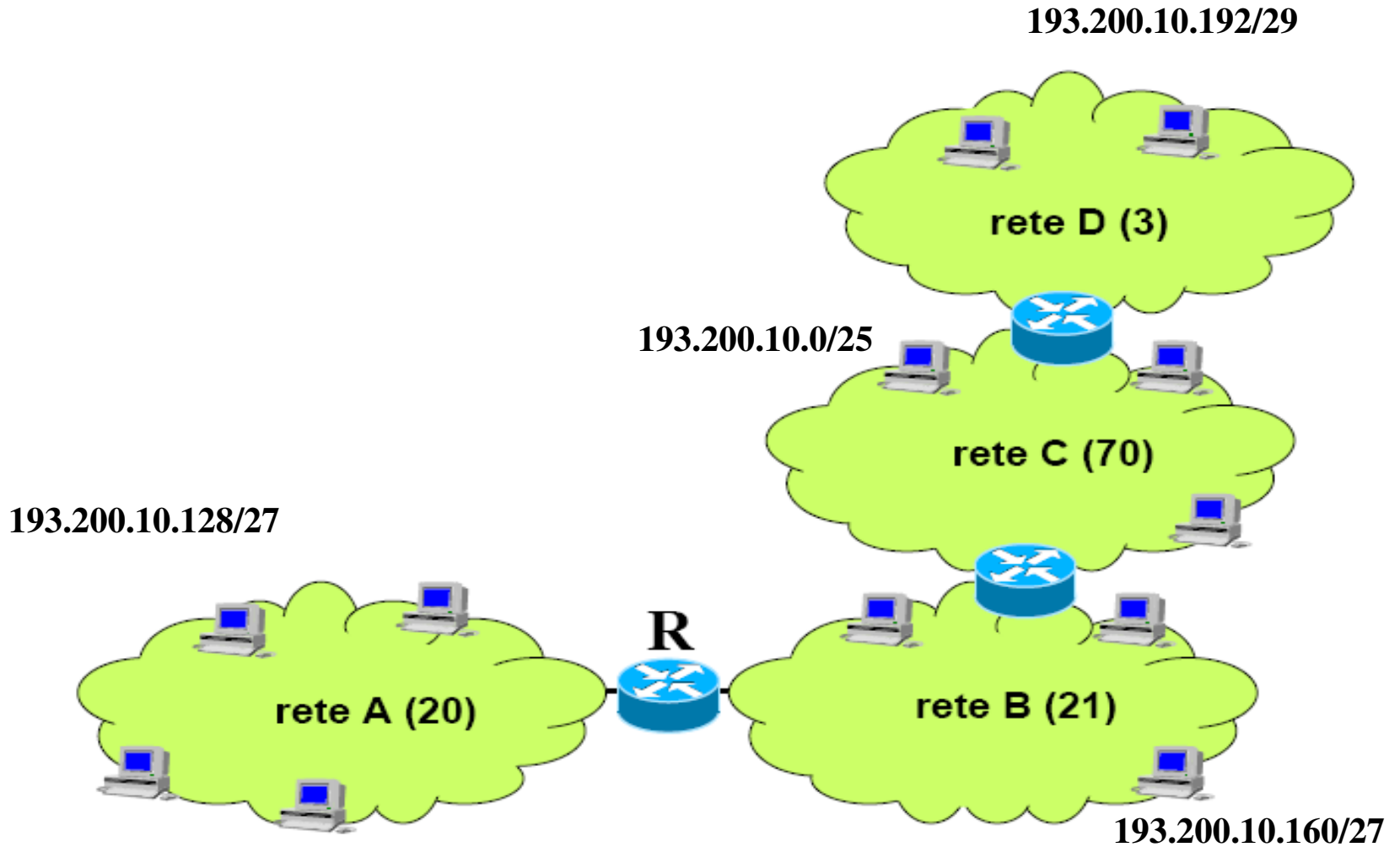


## Esercizio 6 - 1/2

- Consider the following scenario [the number of hosts for every subnet is indicated in parentheses]. The system administrator is assigned network address 193.200.10.0/24.
  - Compute, for every subnet, the network address and the subnet mask, applying subnetting and *possibly* using masks of *different* lengths for the subnets

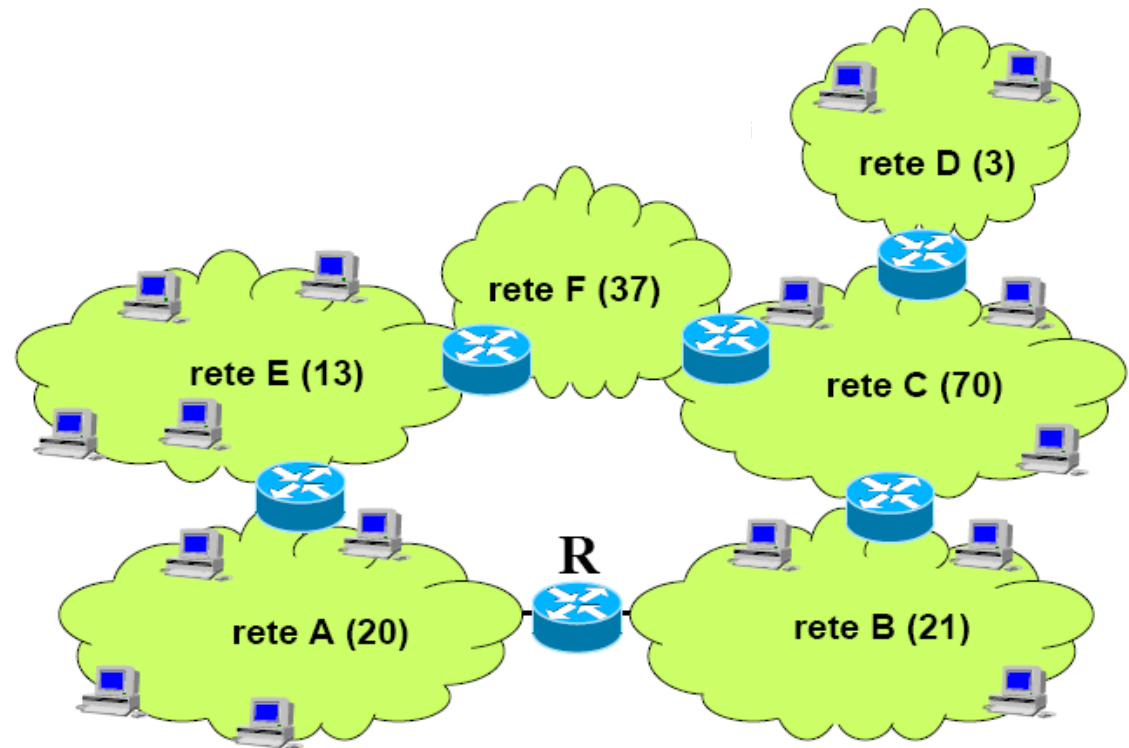


# Quiz 6 - 2/2



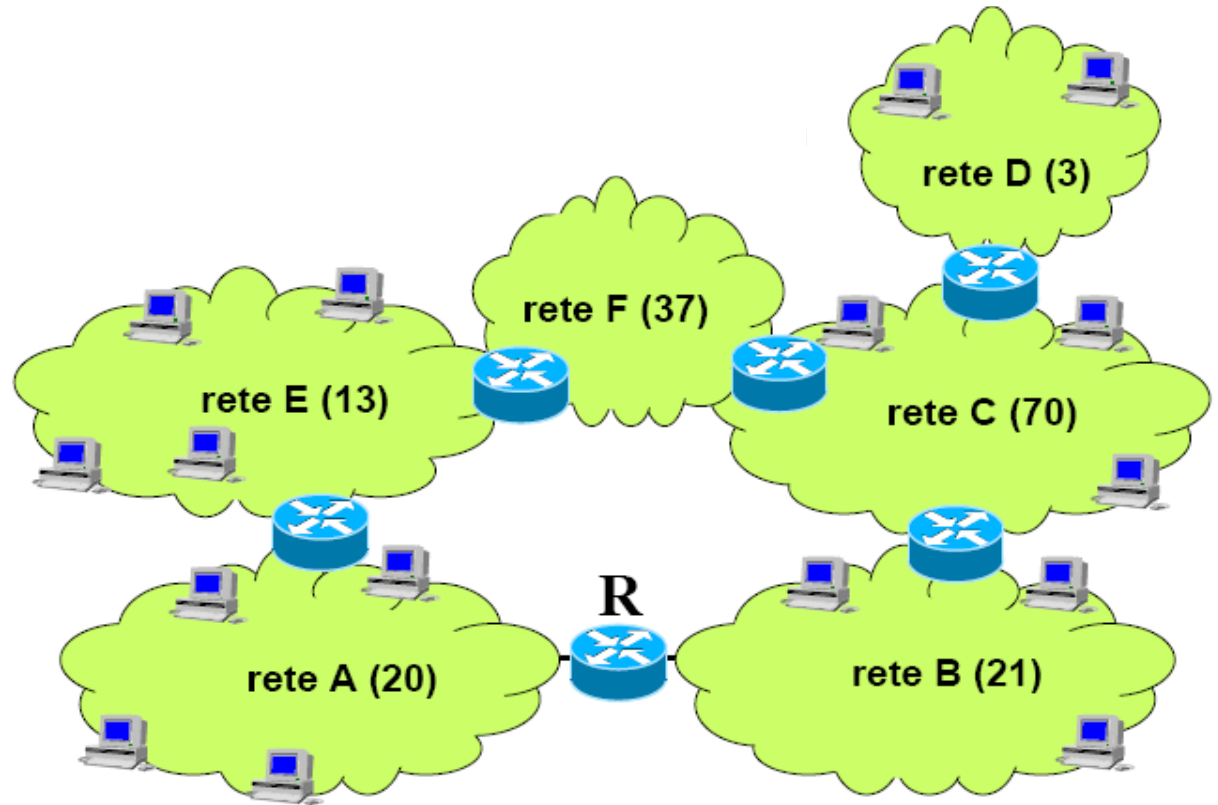
## Quiz 7 - 1/2

- Consider the following scenario [the number of hosts for every subnet is indicated in parentheses]. The system administrator is assigned network address 193.200.10.0/24.
  - Using subnetting determine, if possible, the network address and subnet mask of every subnet.



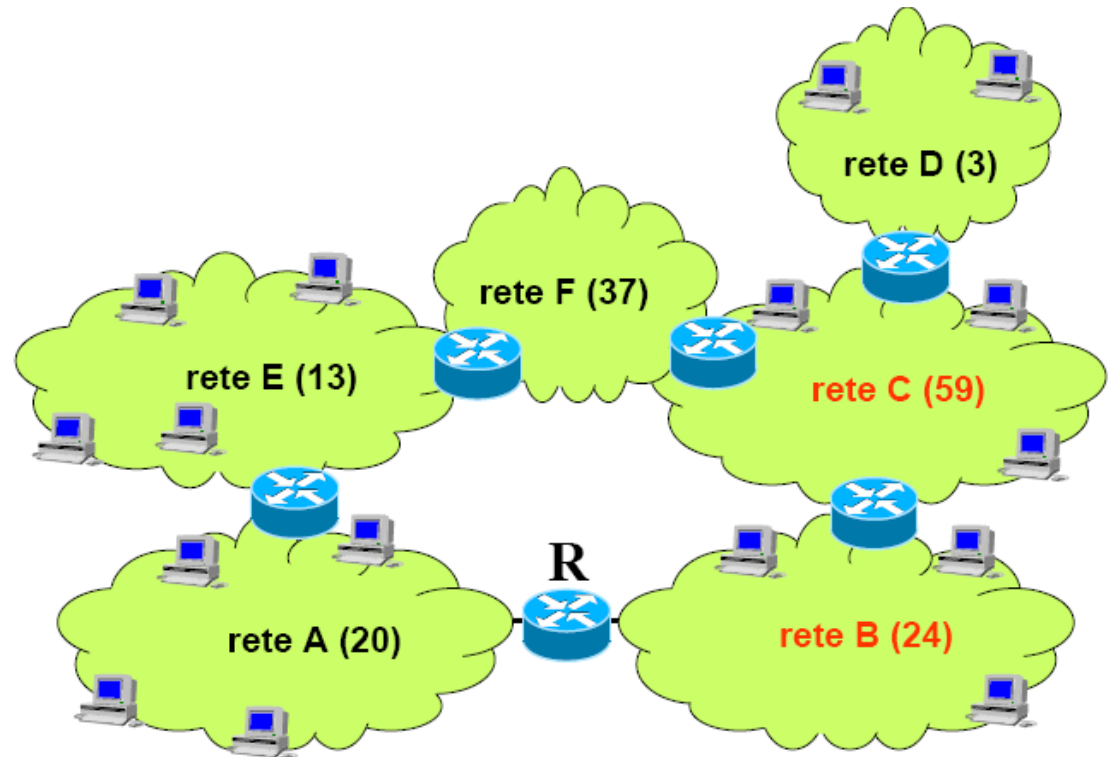
## Quiz 7 - 2/2

- Available addresses [254] not sufficient → no solution



## Quiz 8 – 1/2

- Consider the following scenario [the number of hosts for every subnet is indicated in parentheses]. The system administrator is assigned network address 193.200.10.0/24.
  - Using subnetting determine, if possible, the network address and subnet mask of every subnet.



# Quiz 8 – 2/2

