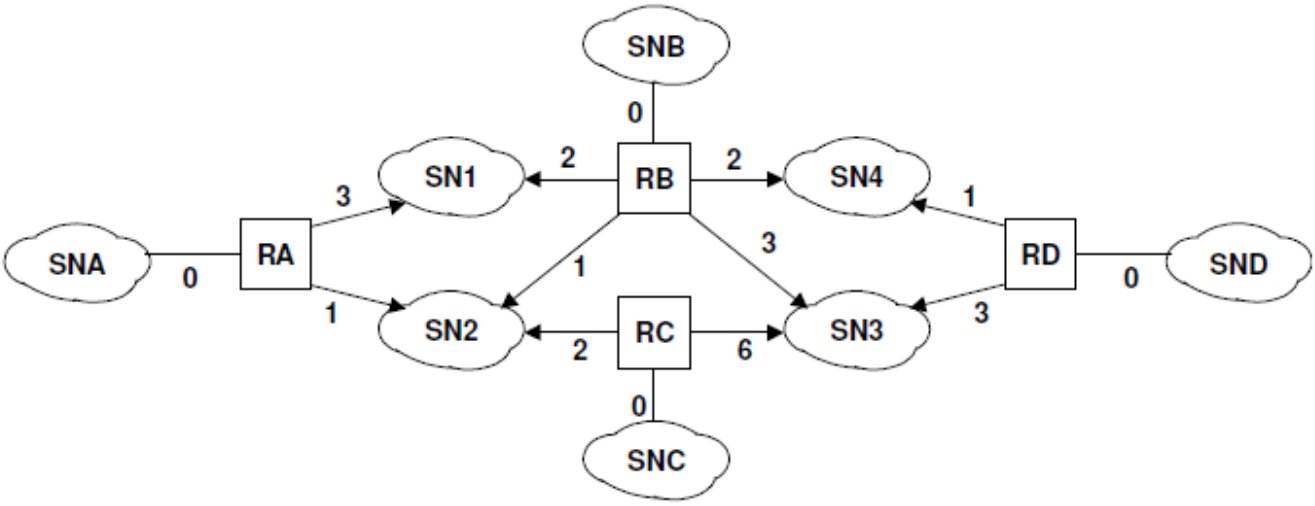
Computer Networks II – Master degree in Computer Engineering
Exam session: 12/01/2010 – Teacher: Luca Becchetti

Last name		Student Identification number	
First name			

- You are only allowed to use a pen and a pocket calculator
- Please write in a clear language and use a READABLE writing; it is important to MOTIVATE THE ANSWERS YOU GIVE.
- Please only use the blank spaces at the bottom of every question
  At the end of your exam, please return THESE sheets and those possibly received by the teacher to write a draft copy of your answers.
- The latter WILL NOT be considered during the process of correction.
- Students copying or consulting course material will be expelled from the exam.

Assignment 1. [7 points]

Consider the autonomous system in the picture and consisting of subnets and routers; in the picture, the costs of the links as seen from the different routers are indicated. Assume RIP is the used IGP protocol. Assume that router RX is identified, in a network, by HOST_ID = X. So, for example, router RC's address in network SN2 is 200.0.0.C.



assume the networks have the addresses given below:

Subnet	NET_ID	Subnet	NET_ID
SNA	215.0.0	SN1	195.0.0
SNB	218.0.0	SN2	200.0.0
SNC	220.0.0	SN3	205.0.0
SND	222.0.0	SN4	210.0.0

(Assignment 1 - continued)

a. Compute the routing table at router RC when the routing algorithm has converged to equilibrium.

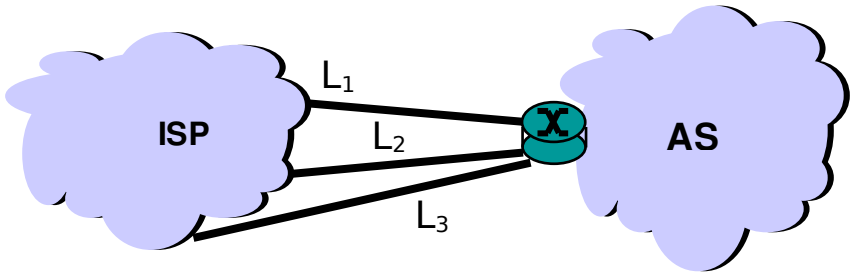
Subnet	Next hop	Subnet	Next hop
SNA		SN1	
SNB		SN2	
SNC		SN3	
SND		SN4	

b. Assume equilibrium has been reached. Next, assume that the value of the metric of the link leaving router RC towards subnet SN2 becomes 16. Complete the RIP message below [which includes this update], sent by router RC. When, and towards which nodes, is this message sent?

Subnet	Metric	Subnet	Metric
SNA		SN1	
SNB		SN2	
SNC		SN3	
SND		SN4	

c. Can the "counting to infinity" anomaly result from the event described at point b? Motivate your answer.

Assignment 2. [7 points]
Consider the autonomous system in the picture, corresponding to the block of addresses 131.12.0/20.



Assume that L_1, L_2 and L_3 have respective bandwidths 20, 10 and 10 Mbyte/s. Answer the following questions:

a. Assume that incoming traffic to B is in the average uniformly distributed among the addresses of the block 131.12.0/20. Propose, if possible, a policy of announcements on the links L_1, L_2 and L_3 such that, in the average, every link receives an amount of incoming traffic proportional to its bandwidth. Give explicitely the address blocks that are announced on every link.

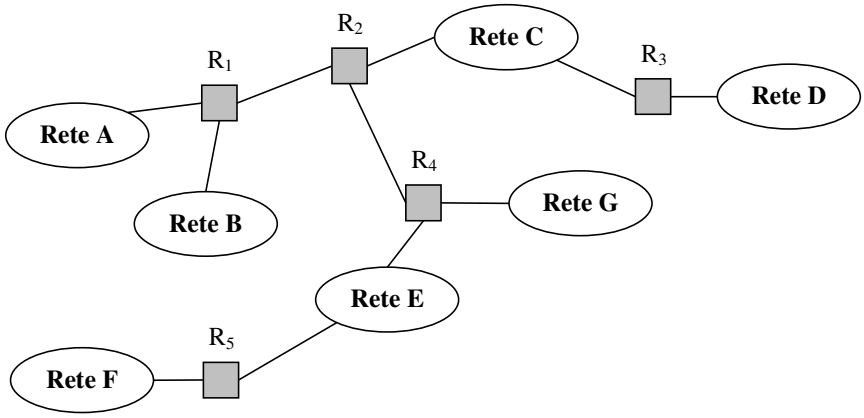
(Assignment 2 - continued)

b. Discuss how to use the MED (Multi Exit Discriminator) attribute and the announcements described at point a above, so as to achieve the following goal: if a link faults, the incoming traffic carried on it will eventually be rerouted on the link with highest capacity among the ones that are still up (ties broken arbitrarily). Under which conditions is such a MED-based policy applicable?

c. Briefly say how it is possible to achieve the same goals as in question b when one cannot rely on the use of the MED attribute.

Assignment 3. [7 points]

Consider the IP network in the picture and answer the 3 questions below, motivating your answer.



(Assignment 3 - continued)

a. Write the routing table at router R_2.

Destination	Next hop

b. Assume 4 contiguous C blocks are available for the whole network, starting at 200.100.10.0 and assume n_x denotes the number of hosts in subnet x. Assign, starting from the above given initial address, addresses to A,B,C,D,E,F,G, using subnetting so as to optimize address space usage and so as to meet the following constraints: $n_A=n_B= n_G=100$, $n_C= n_D=200$, $n_E=n_F=60$.

Network	Address	Network mask

c. Describe how, using CIDR notation, you can represent the whole network and the number of bits analyzed by a generic external router in order to route to the network under consideration.

Assignment 4. [2 points]

Briefly descrive the registration procedure of a mobile host in Mobile-IP. **Use Mobile-IP terminology.**

(Assignment 4 - continued)

Assignment 5. [2 points]

With reference to OSPF protocol, describe the 4 LSA types [Link State Advertisements]. In particular, and **using OSPF terminology**, specify for each LSA type:

- the (kind of) routers involved in the LSA exchange
- the nature of the information carried by the LSA [topology update or pre-processed, routing information]
- Used diffusion technique [flooding or point-to-point transmission]

(Assignment 5 - continued)

Assignment 6. [2 points] (NOT FOR 5 CFUs EXAM'S STUDENTS)
Consider a resource allocation mechanism using Token Bucket as a model to represent traffic sources. Discuss the inefficiency deriving from the model. [You are suggested to use an exemplifying diagram].

Assignment 7. [3 points] (NOT FOR 5 CFUs EXAM'S STUDENTS)

Consider a network scenario in which private IP addressing is used and access to the Internet occurs iver a router implementing a NAT service based on port mapping. Assume the following information is available:

- The IP router only has one public IP address;
- Let H be a host in the private network, with IP address 192.168.0.10;
- An application [APP_1] running on H uses the UDP protocol on local port 8000; assume the application continuously generates traffic.
- Let APP_x_NATTED_IP and APP_x_NATTED_PORT respectively denote the public IP address and the NAT port used to map traffic generated by APP_x

Answer the following questions, motivating your answers.

a. Can we claim that APP_1_NATTED_PORT is equal to 8000?
b. Let APP_2 denote another application running on H and using the TCP protocol on local port 8000; assuming APP_1_NATTED_PORT is known, what can we **certainly** say about APP_2_NATTED_PORT?
c. Let P be an UDP packet reaching the router and with destination port Sia P un pacchetto UDP che arriva al router diretto alla porta APP_1_NATTED_PORT. Can we claim that P is in any case routed to application APP_1 running on H using the NAT function?

I herewith authorize the teacher to publish the results of my exam on the Web, according to law 675 of 31/12/96

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