Computer Networks II – Master degree in Computer Engineering
Exam session: 11/02/2009 – Teacher: Emiliano Trevisani

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.

Question 1.
Consider the IP network in the pictore and answer the 3 questions below, motivating your answer.

a. Write the routing table at router R_2

Destination	Next hop

a. Assume 2 contiguous C blocks are available for the whole network, starting at 200.100.10.0; using n_x to denote 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 satisfy the following constraints: $n_A=n_B=60$, $n_C=n_D=10$, $n_E=n_F=30$, $n_G=100$.

Subnet	Address	Mask

a. 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.

Question 2.
Consider the network given below and answer ther following 2 questions motivating your answers.

R1   R2
A
w=2   w=3
w=3   B   C   w=1
R3   R4   R5
w=2   w=2
w=3   D   w=1   E   w=3
w=2
F
R6   R7
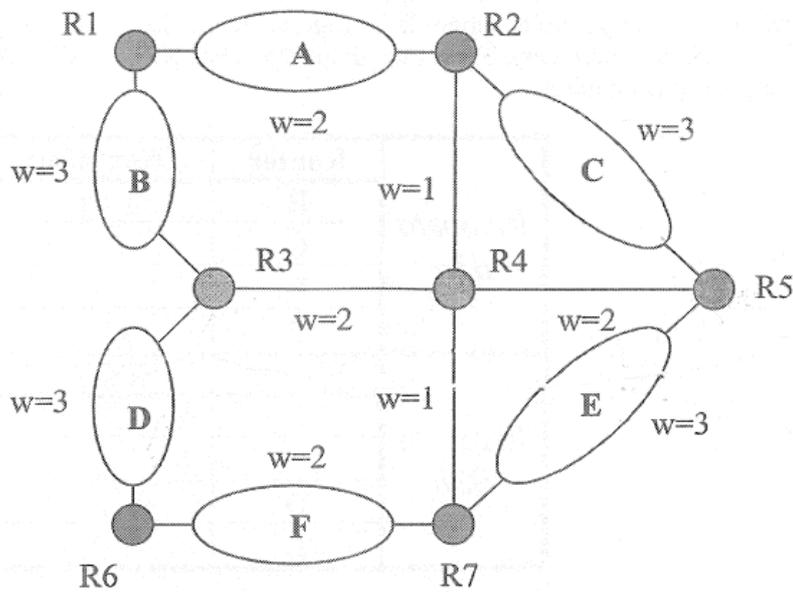
a. Assume RIP is used as an IGP protocol; assuming the metric used is the one given in the picture, write down R1's routing table.

	Destination	Net A	Net B	Net C	Net D	Net E	Net F
R1	**Distance**						
	Next hop						

a. Assuming router R4 faults, write down the Distance Vector sent by R2 in its next RIP message; to which routers is this message sent?

	Destination	Net A	Net B	Net C	Net D	Net E	Net F
R2	**Distance**						

Question 3.

Consider a network scenario in which IP private addressing is used and Internet accesss occurs over an IP router implementing port mapping based NAT. Assuming the following information:

- Host address is 192.168.0.5;
- An application [APP] executing on the host uses UDP and local port 7000.
- The terminal ignores the implemented NAT type;
- The following 2 STUN servers are available:
  - 212.216.112.100:3478
  - 212.216.212.200:3478

answer the following questions, motivating your answers.

a. How can the host check whether the implemented NAT type is symmetric?

a. Assuming a full cone NAT, describe how the STUN protocol can be used to find the mapping of the local IP address and UDP port used by APP.

Question 4.

Consider a graph in which 2 nodes x and y have shortest path distance K and assume Bellman-Ford algorithm is used to determine the shortest path spanning tree rooted at x. Is it possible to claim that the estimated shortest path between x and y at step K is surely the shortest path between the two nodes? Motivate your answer.

Question 5.
Considering the OSPF protocol, describe the 4 LSA types [Link State Advertisements]. In particular, **using OSPF terminology**, specify for every type: In particolare, **utilizzando terminologia OSPF**, si specifichi per ciascuna tipologia:

- Which routers exchanige the LSA
- The kind of carried information [topological update or preprocessed routing information]
- The diffusion technique used [flooding or point-to-point]

Question 6.
Describe the 'path vector routing' technique used in BGP, emphasizing its different with respect to 'link state routing' and 'distance vector routing' techniques.

Question 7.

Consider an MPLS and a traditional IP network architecture.

    a. Discuss the protocol overhead determined by MPLS with respect to the IP network .

    b. Describe the advantages of MPLS in termos of the efficiency of packet forwarding with respect to the IP network.