ORDRE DES INGÉNIEURS DU QUÉBEC

MAY 2018 SESSION

Open-book examination
Calculators : only authorized models
Duration : 3 hours

16-EL-B1 Information Technology Networks

Question 1 **(7 points)**

A. Give two reasons for using layered protocols. **(1 point)**

B. A system has an n-layer protocol hierarchy. Applications generate messages of M bytes. At each layer, a header of h bytes is added. What portion of the bandwidth is filled with these headers? **(1 point)**

C. When a file is transferred between two computers, two acknowledgement strategies are possible after the file has been split into packets. In the first one, the packets are individually acknowledged by the receiver, but not the entire file. In the second one, the entire file is acknowledged when it arrives, but not the packets individually. Compare the two approaches. **(1 point)**

D. Ethernet and wireless networks (Wi-Fi) have some similarities and some differences. One property of Ethernet is that only one frame at a time can be transmitted. Does the 802.11 standard (Wi-Fi) share this property with Ethernet? Justify your answer. **(1 point)**

E. Explain the specifications (or characteristics) of IP addresses (length, classes, subnet mask, IP address typesetting …). **(1 point)**

F. Consider some subnets with class C addresses. Each of them consists of 50 nodes. By optimizing the number of subnets, what subnet mask will be used and what is the number of available subnets? **(1 point)**

G. In the OSI layered model, which level do you associate with a switch? Justify why a switch is related to this layer. **(1 point)**

Question 2 **(5 points)**

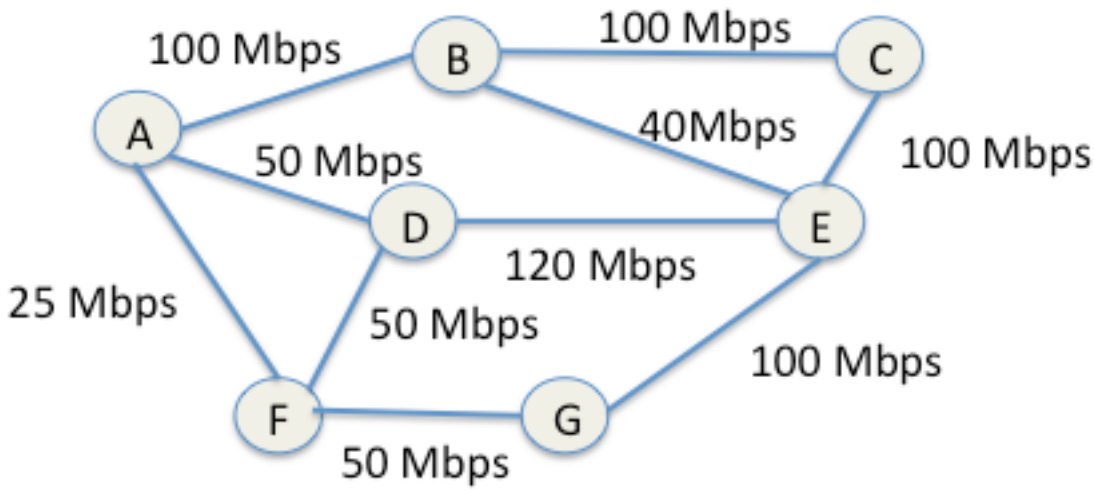

Figure 1.

Using the network shown in Figure 1:

a. Use OSPF protocol to determine the shortest paths as well as their cost between node A and each destination (B, C, D, E, F, G). To calculate the link cost, use the metric:
Link-cost$_{ij}$ = $\frac{100\,000\,000}{Cij}$. C_{ij} is the bandwidth between nodes i and j. **(3 points)**

b. Use RIP protocol to determine the shortest paths between node A and each destination (B, C, D, E, F, G). **(2 points)**

Question 3 **(5 points)**

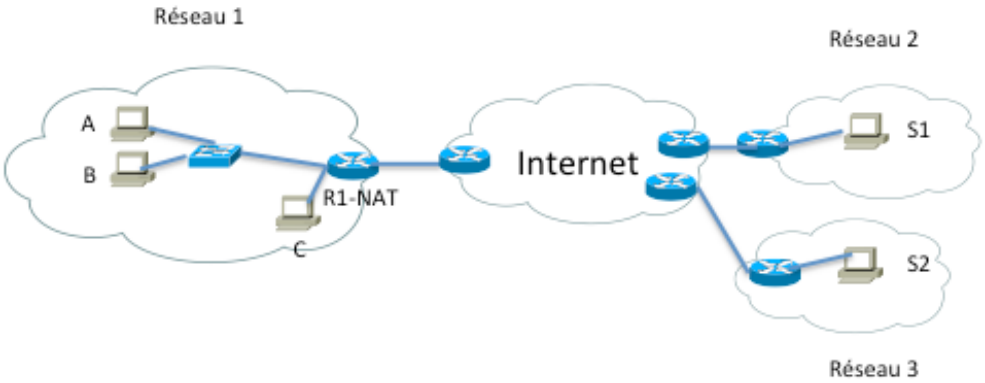

Figure 2. Network 1

Table 1 shows the configuration of the different computers and devices in the network 1 (Figure 2).

Table 1.

Computer or device	IP Address	Mask	Default gateway	MAC Address
A	192.168.15.16	255.255.255.224	192.168.15.1	11 :22 :33 :44 :55 :66
B	192.168.15.17	255.255.255.224	192.168.15.1	22 :33 :44 :55 :66 :77
C	192.168.15.165	255.255.255.224	192.168.15.161	33 :44 :55 :66 :77 :88
S1	132.170.17.45	255.255.0.0		
S2	167.145.67.85	255.255.0.0		
R1	192.168.15.1/ 192.168.15.161			11 :11 :11 :11 :11 :11
NAT	165.135.185.33			

Table 2 shows the different communications existing between the computers of the network 1 and the servers S1 and S2.

Table 2.

Communication	IP source	Port source	IP destination	Port destination
A → S1	192.168.15.16	4200	132.170.17.45	4000
A → S2	192.168.15.16	4300	167.145.67.85	4000
B → S1	192.168.15.17	4200	132.170.17.45	4300
C → S2	192.168.25.165	4200	167.145.67.85	6000
A → C	192.168.15.16	4400	192.168.25.165	5000

a) Is it possible for server S1 to know the IP address of computer A (communication A→S1)? Explain clearly. **(2 Points)**

b) Is it possible for server S2 to know the MAC address of computer A (communication A→S2)? Explain clearly. **(1 point)**

c) Is it possible for server S2 to start a communication with computer C? Explain clearly. **(1 point)**

d) Is it possible for server S2 to know the MAC address of computer C using ARP protocol? Explain clearly. **(1 point)**

Question 4 **(3 points)**

Consider the network presented in Figure 3 (network address 167.253.0.0).

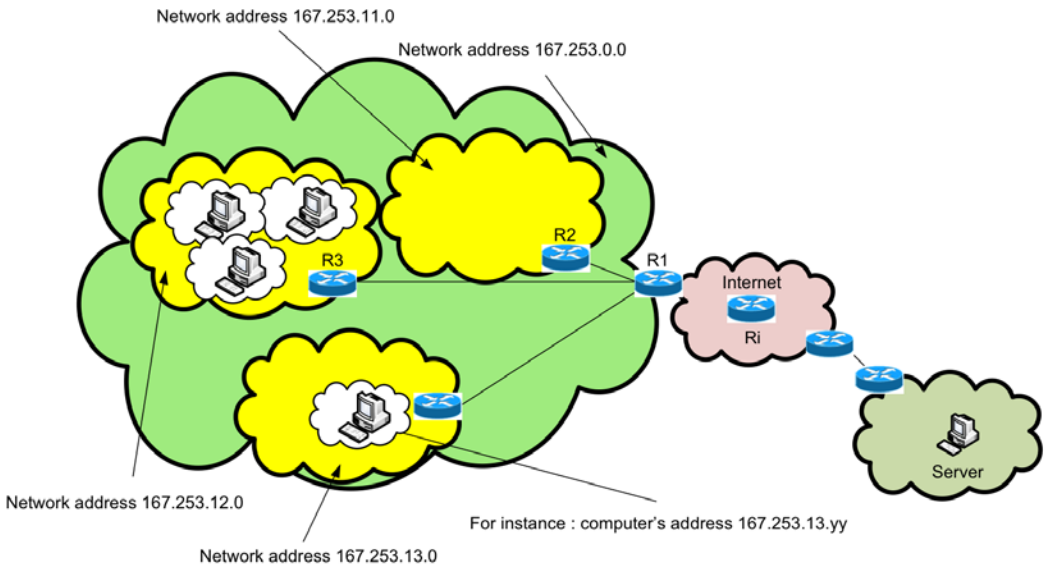

Figure 3

Figure 3.

a) Assume that there is a communication between the server and one node of the network 167.253.12.0/28. What netmask, in decimal format and abbreviated format, should be used by the router R3 for the routing? **(1 point)**

b) The administrator decides to manage the network 167.253.0.0 using some subnets. For this purpose, he uses the third byte. He also decides to separate the subnet 167.253.12.0 into 16 subnets. What subnet mask, in decimal format and abbreviated format, should be used inside the subnet 167.253.12.0 for the routing? **(1 point)**

c) Do the computers 167.253.12.23 and 167.253.12.83 belong to the same subnet? Justify your answer. **(1 point)**