Exam – example - 1

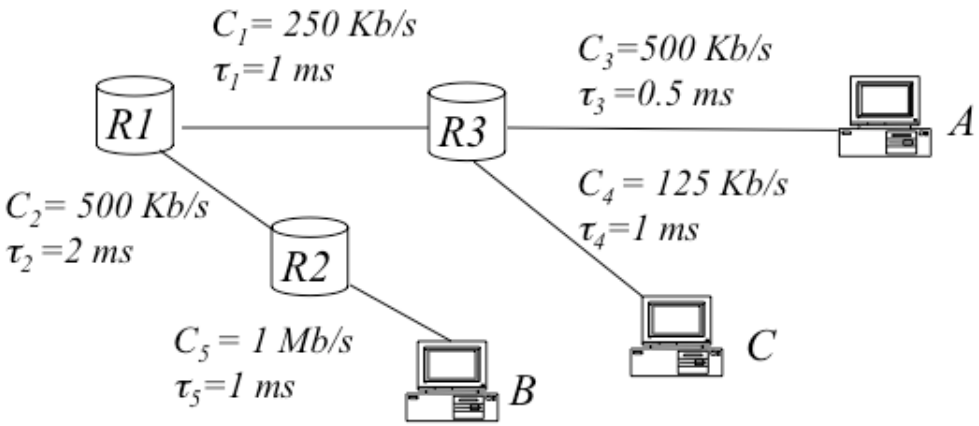
Surname	
Name	
Student ID	

Total time 2:00

Ex1 (6pt)	Ex2 (6pt)	Ex3 (6pt)	Ex4 (6 pt)	Ques (8 pt)

1 - Exercise (6 points)

Consider the network below. At time t=0 the output queue of R1 has 6 packets towards respectively A,A,B,B,C,C and the channel is available. Assuming packet length of 500 bits, calculate the instant of time each packet is completely received by destination.

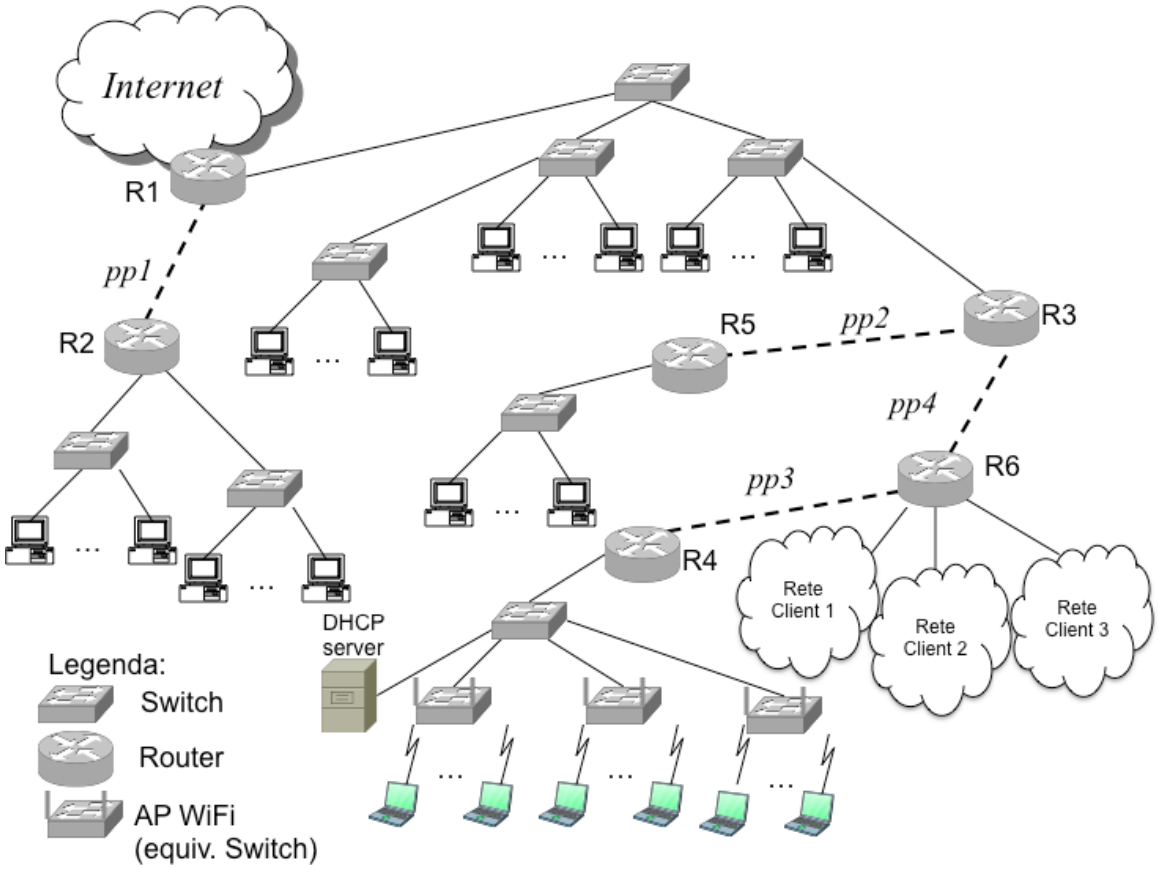


2 - Exercise (6 points)

A small ISP owns the following IP addressing space: 169.147.140.0 netmask 255.255.252.0. The ISP network is shown in the picture below. Assume Client Network1 and 2 need 250 addresses each, Client Network 3 needs 100 addresses, each switch connected to hosts has 26 ports, and that the DHCP server for the WiFi stations needs a pool of 100 addresses. Define an addressing plan for the network able to support all necessary addresses for each subnet (assume all switch ports connected to hosts).

Indicate graphically on the figure the IP subnets (identify boundaries and assign a letter). For each subnet define address, netmask, direct broadcast address.

Write routing table for router R3 in the most compact way possible (assign first addresses to all interfaces of routers R3 is connected to).



3 - Exercise (6 points)

A multiple access system based on TDMA has a carrier rate of 4 Mb/s and is used to transmit N data channels with a rate of 200 kb/s. Each slot requires 4 guard bits, and the system is dimensioned for an efficiency of 90%.

a. Calculate
   1. The maximum number (N_{max}) of channels that can be supported.
   2. The number of bits of the burst.
   3. The duration of the frame and that of the slot.

b. Design a multi-frame system that, with a higher carrier rate, is able to support in addition to the N_{max} at 200 kb/s, also N_{max} signaling channels at 40 kb/s. Keep constant the number of slots per frame (N_{max}) and the number of bits per slot. Calculate:
   1. The number of frames in the multi-frame and the multi-frame duration.
   2. The duration of the frame and the carrier rate.

4 - Exercise (6 points)

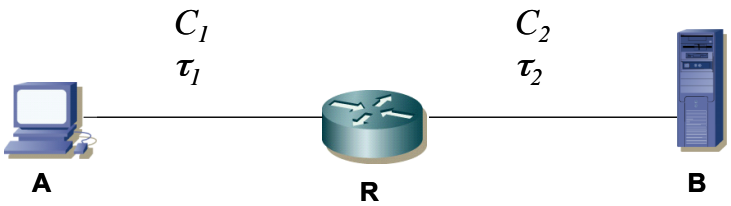
In the network shown below, host A establishes a TCP connectiion with host B.
Assuming:

- Header and ACK lengths negligible;
- Bidirectional links;
- MSS = 1000 [byte]
- RCWND = 16000 [byte]
- SSTHRESH = 8000 [byte]

a1) Calculate the time necessary to transfer a file of 50 [kbyte] from A to B (From TCP connection setup to reception of the last ACK packet) assuming C_1=2Mb/s, C_2=4Mb/s, τ_1=100ms, τ_2=100ms.

b1) Repeat calculation in the case C_1=2Mb/s, C_2=4Mb/s, τ_1=10ms, τ_2=6ms.

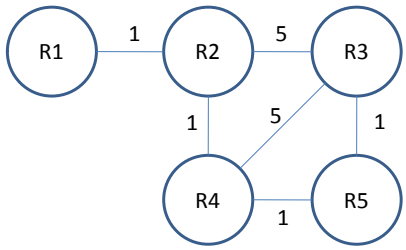
(1 [byte] = 8 [bit], 1 [kbyte] = 1000 [byte] = 8000 [bit])



Questions (8 points)

Q1

The network in the figure uses a routing protocol based on *distance-vector*. Link costs are indicated in the figure. Assuming routing tables are stable:



a. Write the content of *distance vectors* sent by R4, assuming *Split horizon* mode with *Poisonous Reverse*.

b. As above for router R3

Q2
A *router* has the following routing table and interface configuration:.

Interface	IP address	Netmask	Max MTU
Eth0	145.170.123.76	255.255.255.128	500[byte]
Eth1	145.174.124.169	255.255.255.128	600 [byte]

Network	Netmask	Next hop
145.170.122.128	255.255.255.128	145.174.124.254
145.170.122.0	255.255.254.0	145.170.123.1
145.174.124.0	255.255.255.128	145.170.123.2
145.174.122.0	255.255.254.0	145.170.123.3
0.0.0.0	0.0.0.0	145.174.124.253

Indicate how the router handles each of the packets for which in the table the following parameters are indicated: Destination IP address, reception interface, packet size, value of the header *flag do-not-fragment,* and the value of the *Time To Live (TTL)*.

Packet	**Dest. IP address**	**Reception interface**	**Size**	**Flag D**	**TTL**
1	**145.170.123.127**	**Eth1**	**600 [byte]**	**D=1**	**18**
2	**145.174.123.12**	**Eth0**	**500[byte]**	**D=1**	**2**
3	**145.170.123.6**	**Eth1**	**700[byte]**	**D=1**	**16**
4	**145.170.122.66**	**Eth1**	**400 [byte]**	**D=0**	**16**
5	**145.174.124.136**	**Eth0**	**400[byte]**	**D=0**	**1**

Q3
A TCP connection using the *fast retransmit/fast recovery* mechanism, receives three duplicate ACKs when the parameters are the following:

- CWND=16MSS
- SSTHRESH=24MSS
- MSS=1 [kbyte]

Indicate the new values of the parameters after the reception of the three duplicate ACKs.