| Computer Networks Technologies and Services	June 19th, 2017
First and last name	Student ID ....….....

NOTES

i. Nothing else than what is needed to write (pen, eraser), a piece of ID, and possibly water and food can be taken to the seat where you take your exam. Please leave any other item you might have (coat, bag, phone, calculator, and any other object) at the front or back of the classroom.

ii. The answers to each question must be written exclusively on the same page of the question, which is the only material that will be graded.

iii. Do not forget to write your name and student ID in each one of the marked spaces on the exam paper.

iv. In case you will use part of pages containing the questions as a scratch pad, please indicate it clearly and possibly cross out such parts before handing in the exam.

v. The score assigned to answers varies from zero to the maximum score reported at the end of the question. Please notice that the maximum scores of all questions do not necessarily sum up to 30.

vi. When answering questions, please feel free to use drawings whenever they can help expressing and clarifying the answer.

vii. Answers that are not understandable (for example because written badly or with bad handwriting) might be considered wrong.

viii. During the test, any communication with other classmates is prohibited and will cause the student to be sent away from the classroom

ix. The instructors and the assistants that are present during the test are there for the sole purpose of verifying proper progress of the exam. Their role is not giving any support to the interpretation of the text, neither helping the students to correctly formulate the answers. Please avoid any such request.

Question 1) A SIP user alice@iptel.org, already registered and connected to its own service provider, would like to make a phone call to another SIP user, bob@iptel.org. Assuming that the caller does not know yet the IP address of the callee, list all the messages sent and received by all the involved entities from the beginning of the call establishment procedure to the end of the call. Consider messages of all possible involved protocols. An answer based on a graphical representation is preferable. (10 points)
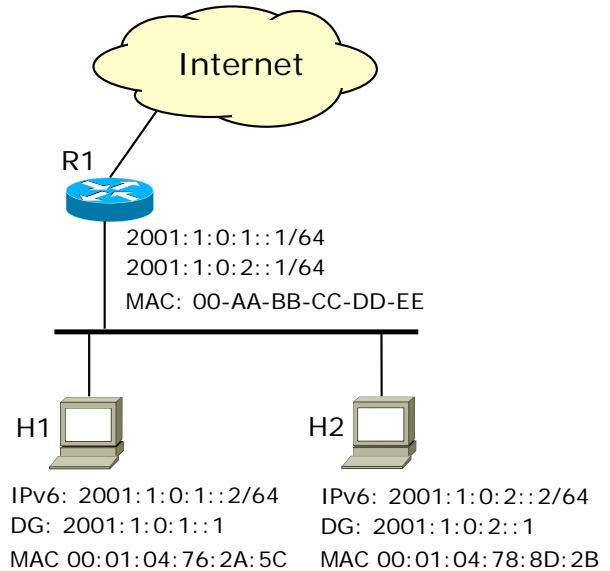
Question 2) Given the network in the following figure, specify the steps required for setting up an LSP to carry traffic from the label edge router indicated by the arrow to destination 135.3.0.0/16. Explicitly indicate each action executed either directly on the figure (close to the device taking such action or the link carrying the corresponding message) or in the blank space below (in this case clearly showing the device executing each action or pair of devices exchanging messages corresponding to an action), using the following notation:

- binding: `B, <FEC>, <label>`

- distribution: `D, <FEC>, <label>`

- mapping: `M, <input label or FEC>, <output label>, <next hop>`

where the first letter identifies an action and what follows are the corresponding parameters. Please consider the letter besides each interface in the figure as the IP address assigned to the interface itself. (12 points)
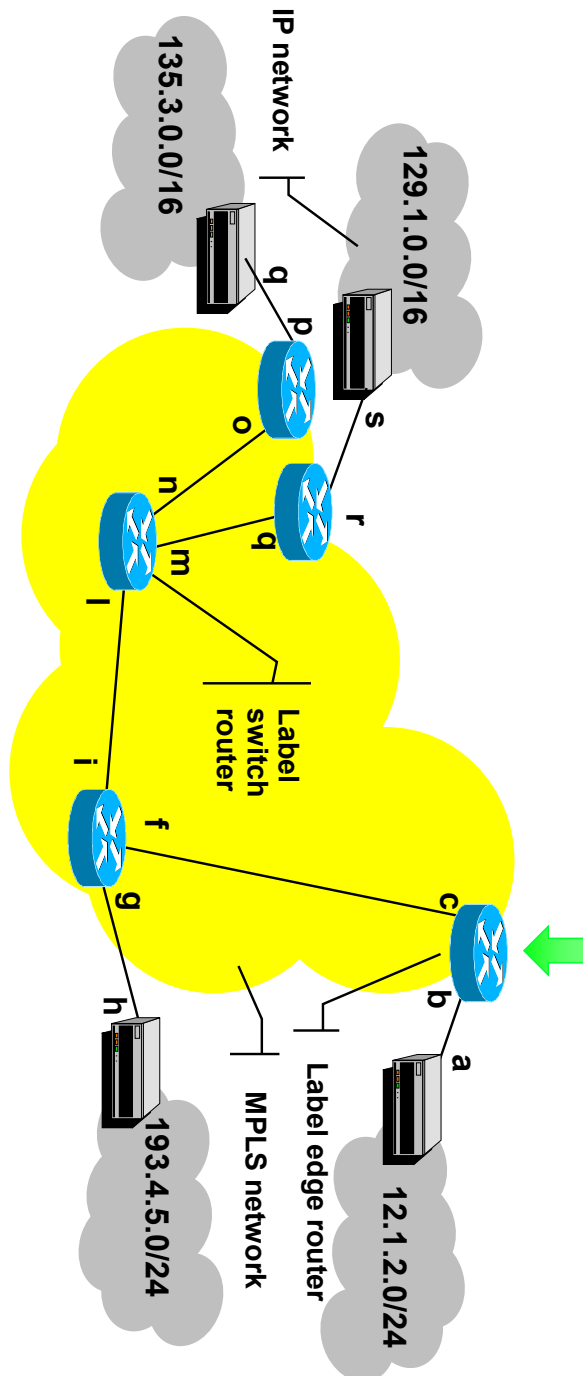
Question 3) Write, directly in the table below, relevant information in packets exchanged on the network when the user of H1 sets up an FTP session to an FTP server running on H2. Use the "Upper layers" cell to specify information related to upper layer protocols encapsulated inside IP packets that are relevant in this scenario. Please list at most 7 packets; in case fewer are generated, it is not necessary to use all the rows in the table below. (10 points)

Internet

R1

2001:1:0:1::1/64
2001:1:0:2::1/64
MAC: 00-AA-BB-CC-DD-EE

H1

H2

IPv6: 2001:1:0:1::2/64
DG: 2001:1:0:1::1
MAC 00:01:04:76:2A:5C

IPv6: 2001:1:0:2::2/64
DG: 2001:1:0:2::1
MAC 00:01:04:78:8D:2B

Pkt. 1	MAC src.	MAC dest.
	IP src.	IP dest.
	Upper layers	
Pkt. 2	MAC src.	MAC dest.
	IP src.	IP dest.
	Upper layers	
Pkt. 3	MAC src.	MAC dest.
	IP src.	IP dest.
	Upper layers	
Pkt. 4	MAC src.	MAC dest.
	IP src.	IP dest.
	Upper layers	
Pkt. 5	MAC src.	MAC dest.
	IP src.	IP dest.
	Upper layers	
Pkt. 6	MAC src	MAC dest.
	IP src.	IP dest.
	Upper layers	
Pkt. 7	MAC src.	MAC dest.
	IP src.	IP dest.
	Upper layers	

Question 4) An employee at a corporate site in Torino connects from her/his desktop (with IP address 10.1.1.1) to a corporate server (with IP address 10.2.2.2) hosted in a data center located at a corporate site in Milano. Traffic between the two corporate sites flows through the Internet.

A) Represent with a drawing the network setup including any devices that are key in enabling the communication among the corporate hosts and their IP addresses.

Concisely describe (best if with a drawing) a packet sent from the employee's desktop and going to the corporate server captured

B) On the link connecting the Torino corporate site to the Internet

C) On the network interface of the server

Please explicitly show all of the protocol headers deployed and for each of them the content of the fields that play a key role in ensuring proper functioning (e.g., source and destination IP addresses, etc.) (10 points)

A)

B)

C)