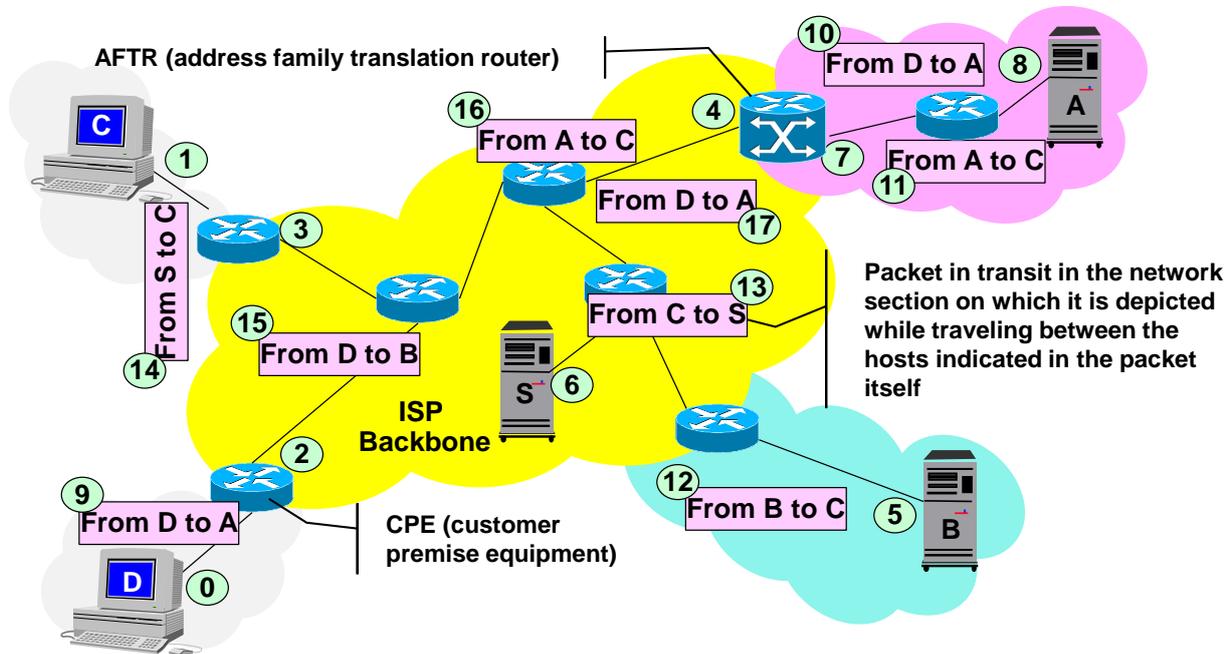NOTES
   i. Nothing else than what is needed to write (pen, eraser), a piece of ID, and possibly water and food can be taken at the seat where you take your exam. Please leave any other non allowed item you might have (coat, bag, phone, calculator, and any other object) at the front or back of the classroom.
   ii. The answers to all questions must be written exclusively on the provided sheets of paper. Do not forget to write your name and student ID on each sheet of paper deployed.
   iii. In case you will use whole pages or part of pages as a draft copy, please indicate it clearly and possibly cross out such parts before handing in the exam.
   iv. The score assigned to answers varies from zero to the maximum score reported at the end of the question.
   v. When answering questions, please feel free to use drawings whenever they can help expressing and clarifying the answer.
   vi. Answers that are not understandable (for example because written badly or with bad handwriting) might be considered wrong.
   vii. During the test, any communication with other classmates is prohibited and will cause the student to be sent away from the classroom
   viii. 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) With reference to the MPLS-based layer 3 VPN solution depicted in the following figure, specify (directly in the boxes in the figure) the information MPLS routers must have to enable any pair of hosts in the networks 10.x.x.x of Company A to exchange packets. The IP addresses near the MPLS router interfaces should be interpreted as the IP addresses of the interfaces themselves. (7 points)
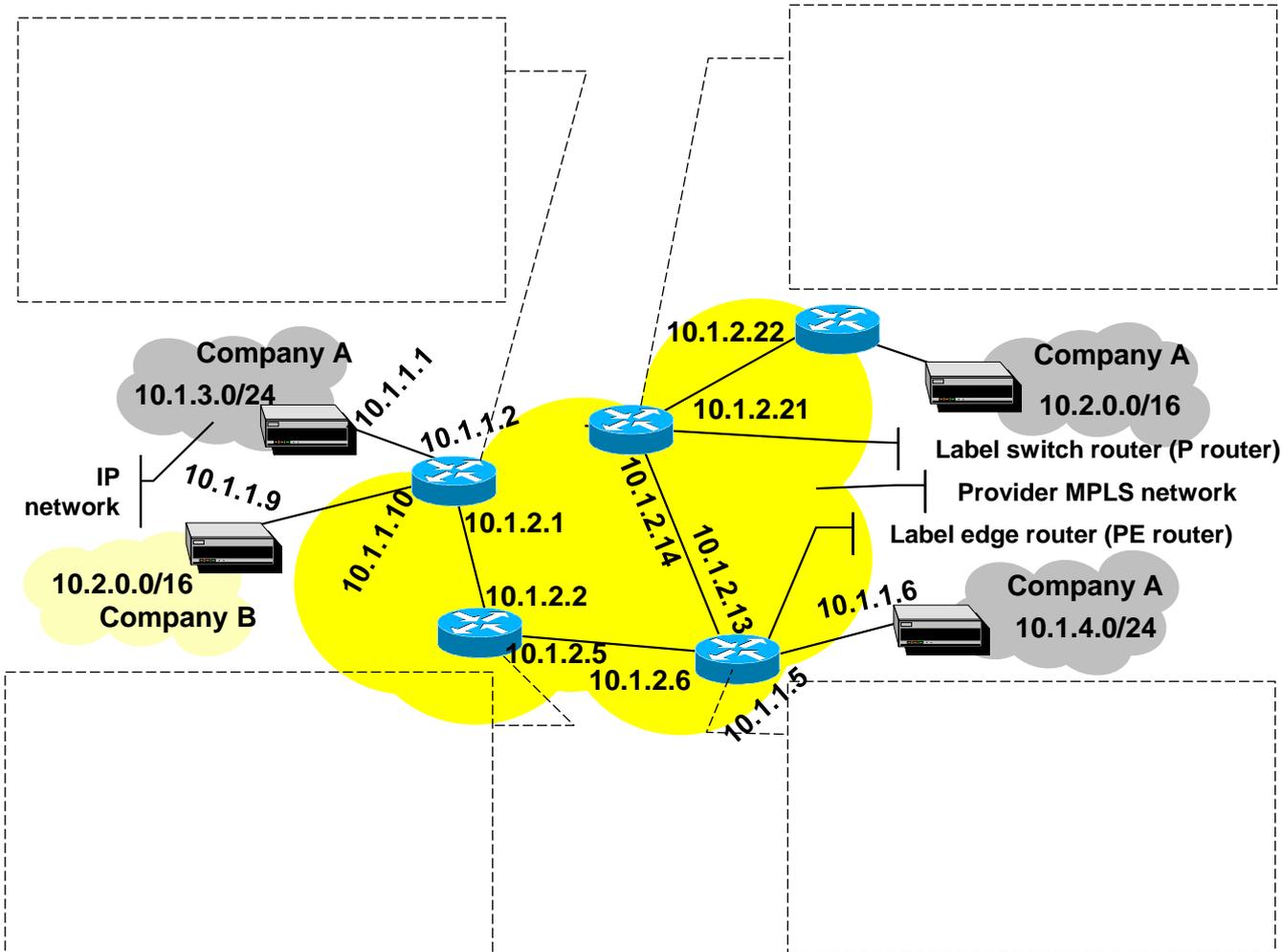
Question 4) Given the IPv4 to IPv6 transition scenario based on the DS-lite solution depicted in the following figure, indicate (directly in the table below) the IP addresses assigned to the interfaces and included in the packets marked with a number. Interface addresses can be chosen freely as long as they are compatible with the operating principles of IP and the DS-lite solution. As far as packets are concerned, please explicitly provide both source and destination IP addresses and, in case multiple IP headers are deployed (tunneling), explicitly list the IP address pair (source and destination) within each of the headers, clearly specifying the header (i.e., internal or external) they belong to. As far as interfaces are concerned, please list all IP addresses assigned to them if the specific deployment scenario requires them to have more than one address. (10 points)

AFTR (address family translation router)

From A to C 16
From D to A 10
From D to A 8
A
C 1
From S to C
From A to C 7 11
4
From D to A 17
3
15
From D to B
14
From C to S 13
ISP Backbone
S 6
Packet in transit in the network section on which it is depicted while traveling between the hosts indicated in the packet itself
CPE (customer premise equipment)
From D to A 9
D 0
From B to C 12
B 5

0)	1)
2)	3)
4)	5)
6)	7)
8)	9)
10)	11)
12)	13)
14)	15)
16)	17)

Question 3) A SIP user alice@provider1.com is connected to its own service provider network and start its own software phone to connect to its own SIP domain. Assuming that the SIP user does not know either the name or the IP address of its own SIP server, list all the messages sent and received by the SIP client from the software phone activation time to the instant at which the user is actually registered in the domain. Consider messages of all possible involved protocols. (5 points)

Question 4) Pictorially describe (i.e., with a drawing) the header of an IPv6 packet for which the header should be authenticated and the payload encrypted. Graphically highlight the various elements needed to obtain the required protection and the fields used to handle the encapsulation. In addition, depict in a similar way (highlighting relevant elements and fields) the header used when in addition addresses should be encrypted. (5 points)