

<b>Computer Networks Technologies and Services</b>	<b>September 8<sup>th</sup>, 2017</b>
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) Considering an optical network, (7 points)**

A) Briefly explain what characterizes it with respect to other networking technologies.

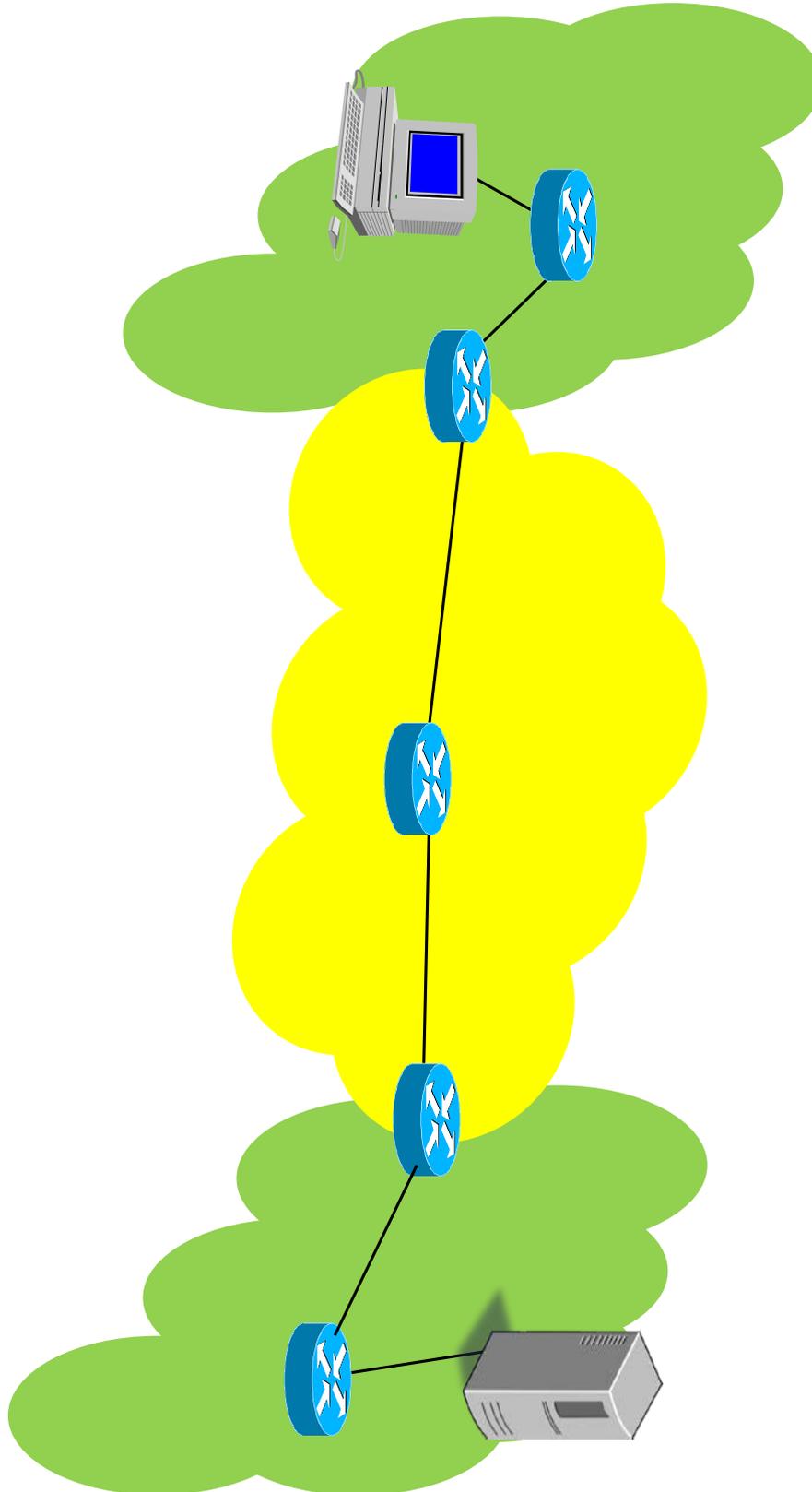
B) List two functions performed by the control plane.

C) Mention one protocol possibly used for routing.

D) Mention a protocol possibly used for lightpath setup.

**Question 2)** Considering that the figure below represents a typical DS-Lite deployment scenario, (14 points)

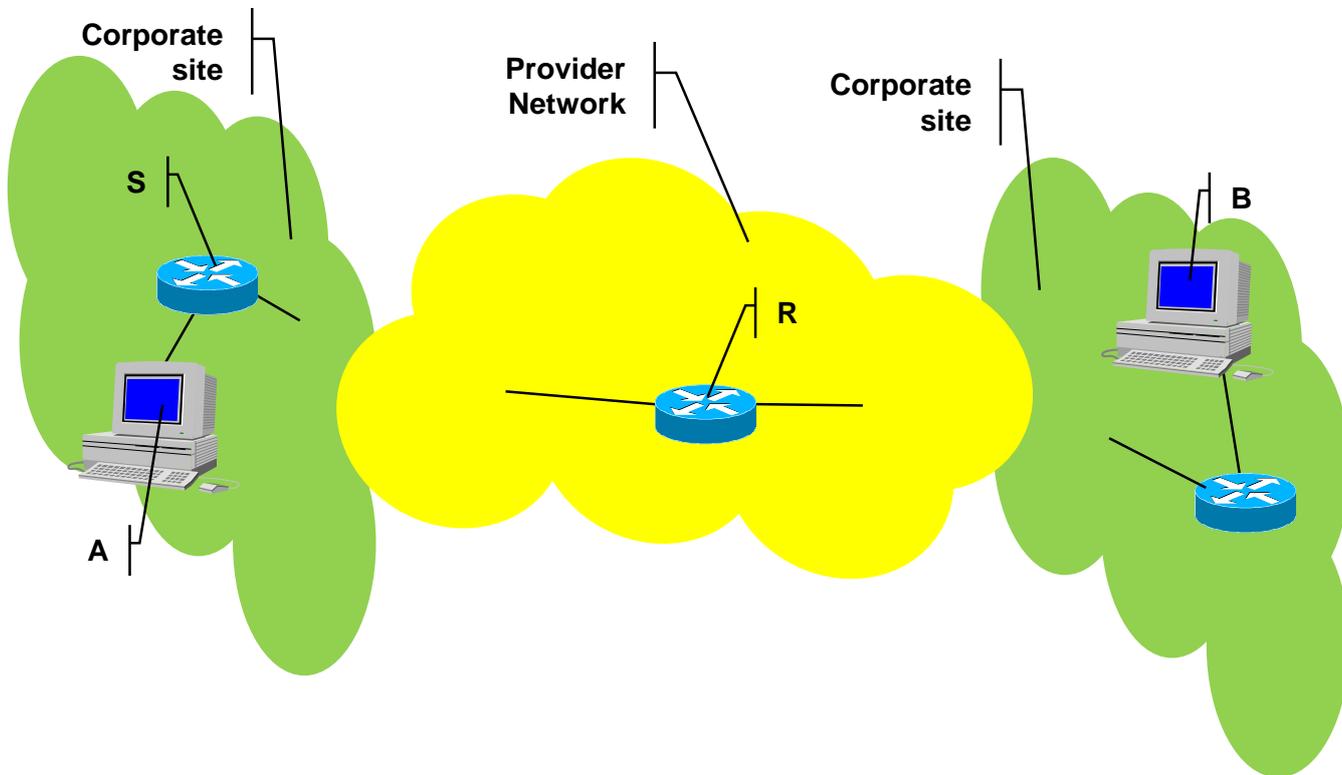
1. Assign an IP address to each interface of each host and network device (writing it directly on the figure, close to the interface itself).
2. Annotate (directly on the figure) the role played by devices offering specific functions (beyond forwarding IP packets) that are key for the solution to actually work.



**Question 3)** Given the scenario depicted in the figure below, in which two corporate sites must be connected through a Layer 3 MPLS VPN, (i) draw directly on the picture the key devices required to implement the solution (specifying their role) and (ii) concisely describe (best with a drawing) a packet sent from host A to host B captured

- A) On the right hand side link of router S;
- B) On one of the links of router R.

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.) (12 points)



A)

B)

**Question 4)** A SIP user with address `alice@xyz.com` is connected to the network of her Internet service provider and starts her software phone to call `bob@iptel.org`. Assuming that the softphone static configuration includes only the SIP address of its user, list in a schematic fashion all the messages sent and received by the SIP client, from the instant the software phone is launched to the instant in which the user starts talking to the called party. Consider messages of all possible involved protocols and show information they contain that is key to the operation of the VoIP call. (10 points)