Question 1) With reference to the network scenario depicted in the following figure, specify (directly in the boxes in front of packets in the figure) the MPLS labels possibly prepended to each of the packets shown in the figure. (6 points)

There are two VPN networks.

Penultimate hop popping on the last.
The internal label identifies the VPN network.
Question 2) With reference to the IPv6 network depicted in the following figure, assign an address to each of the router interfaces and indicate it directly in the figure close to the interface itself. Also specify (directly in the dashed boxes) the information contained in the routing table of the corresponding router to enable it to route packets to each of the destination networks depicted in the figure (9 points).
Question 3) Given the following capture file with SIP messages, answer the following questions: (7 points)

A. Indicate the IP addresses of the caller UA
B. Indicate the IP address of the called UA.
C. Knowing that the capture was taken on the interface of one of the systems involved in the message exchange, please indicate which one.
D. Is record routing enabled? (Please motivate the answer)

<table>
<thead>
<tr>
<th>Source IP</th>
<th>Destination IP</th>
<th>Protocol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>130.192.18.23</td>
<td>130.192.16.62</td>
<td>SIP/SDP</td>
<td>INVITE SIP:mario@130.192.16.62:7234</td>
</tr>
<tr>
<td>130.192.16.62</td>
<td>130.192.18.23</td>
<td>SIP</td>
<td>Status: 180 RINGING</td>
</tr>
<tr>
<td>130.192.16.62</td>
<td>130.192.18.23</td>
<td>SIP/SDP</td>
<td>Status: 200 OK</td>
</tr>
<tr>
<td>120.149.210.3</td>
<td>130.192.16.62</td>
<td>SIP/SDP</td>
<td>ACK SIP:mario@130.192.16.62:7234</td>
</tr>
<tr>
<td>130.192.16.62</td>
<td>120.149.210.3</td>
<td>SIP</td>
<td>BYE SIP:lina@120.149.210.3:6734</td>
</tr>
<tr>
<td>120.149.210.3</td>
<td>130.192.16.62</td>
<td>SIP</td>
<td>Status: 200 OK</td>
</tr>
</tbody>
</table>

A. 120.149.210.3 (lina)
B. 130.192.16.62 (mario)
C. mario selected interface
D. No, it is not enabled because from the ACR and beyond the two peers to communicate directly without using any proxy.
Question 4) The employees of a company can connect to their corporate network through a VPN software, which terminates all its traffic on a VPN gateway with address 11.2.1.3. Through that connection, employees have access to all the services available on the corporate network. Concisely describe (best with a drawing) a packet sent from a remote employee's laptop (while the VPN service is in use) and going to a corporate server (IP address 11.3.3.3) captured

A) On the link connecting the corporate network to the Internet

B) On the network interface of the server with address 11.3.3.3

C) On the network interface of the employee's laptop.

Assume a centralized Internet access, the IP address of the client to be 1.2.3.4, while the IP address assigned to the client within the VPN is 11.2.2.5.

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.) (8 points)

\[ \text{Protocol: Proxied VPN} \]

A)

\[
\begin{array}{cccccc}
& & & \text{dest} & & \text{src} \\
& & & M.2.1.3 & & M.2.3.4 \\
& & \text{GRE header} & \text{PPP header} & M.3.3.3 & M.2.2.5 \\
& & \text{payload} & \text{payload} & \text{payload} & \text{payload} \\
\end{array}
\]

B)

\[
\begin{array}{ccc}
& & \text{src} \\
& & M.3.3.3 \\
& & M.2.2.5 \\
& \text{TCP/UDP header} & \text{payload} \\
\end{array}
\]

C)

\[
\begin{array}{cccccc}
& & & \text{dest} & & \text{src} \\
& & & M.2.1.3 & & M.2.3.4 \\
& & \text{GRE header} & \text{PPP header} & M.3.3.3 & M.2.2.5 \\
& & \text{payload} & \text{payload} & \text{payload} & \text{payload} \\
\end{array}
\]

The traffic for the corporate network is processed by the VPN software which provides encapsulation.