NOTES:
- For all questions, when you are asked to give evidence to support your answers, be sure that your evidence thoroughly supports your statements and proves to the grader that the experiment was carried out.
- When VPCs are shown in the labs, this is just a recommendation. You are free to use either VPCs or VirtualBox PCs.

**STP Lab (105 pts)**

**NOTE:** The switches in the topology above are 3640 routers with an attached NM-16ESW module in order to simulate a 16 port Layer 2 switch.

**Part A: Without STP**

**Step 1** - Implement and configure the topology above, and populate the tables below (use the command `show interfaces` on the switches to get MAC addresses). Configure the router interfaces connected to the hubs as SPAN ports (hint: to make this easier use ports fa0/0-2 for the non-SPAN ports, allowing the SPAN port to be configured with a port range). Also, to avoid ARP traffic confusing the traces, configure static ARP entries on both PCs to reach the
other PC (we don’t use VPCs because of this need for static ARP entries). *Fill out the tables below for the PC and switch-port information (the second table is for MAC addresses of switch-to-switch ports)* (10 pts).

<table>
<thead>
<tr>
<th>PC</th>
<th>IP Address</th>
<th>MAC of eth0</th>
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<tbody>
<tr>
<td>PC1</td>
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<tr>
<td>PC2</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Switch</th>
<th>Port</th>
<th>MAC Address</th>
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</table>

**Step 2** - Ensure STP is **disabled** on all switches and clear their forwarding tables, and start packet captures on the SPAN ports. Now, try pinging between the PCs. *Explain what is happening to the ICMP packets, providing packet captures and forwarding table information to support your reasoning.* (20 pts)

**Part B: With STP**

**Step 3** - Enable STP on all bridges and make sure the priority is set to 4096 for each one. Clear the forwarding tables again and attempt to ping between VPCs. *Using packet captures and spanning tree information as evidence, illustrate the constructed spanning tree. Be sure to include each port’s state in the tree and indicate which bridge is the root. Explain the flow of traffic through this tree.* (25 pts)
**Step 4** - Now, issue a continuous ping from VPC1 to VPC3. Delete one of the links between the root bridge and another bridge and wait for STP to re-converge. *Illustrate the new spanning tree using packet captures and spanning tree information to support this tree. Explain the process that STP goes through in order to create a new tree when a link fails.* (25 pts)

**Step 5** - Lastly, while packets are being captured, make a different bridge the root. *Verify that this new bridge has been selected as root and illustrate the new spanning-tree. Provide packet captures and spanning tree information as evidence.* (25 pts)