1. **[2.5 points]** Consider a switch in an Ethernet network with a port to a LAN segment that is configured as a blocking port. Which of the following statements describe the switch behavior for that port: (i) The switch receives data packets from the port, but does not forward data packets on that port; (ii) the switch forwards data packets on that port, but does not receive packets from that port; (iii) the switch receives and forwards data packets from/on that port, but neither receives nor transmits BPDUs from/on that port; or (iv) the switch receives and forwards BPDUs from/on that port, but neither receives nor transmits data packets from/on that port. **Justify your answer (no points without justifications)**.

   The correct answer is (iv). A port is blocked if it is not the root port and a there is another switch on the LAN which is the DB for that LAN, i.e., either its cost to the root is lower, or it has the same cost to the root but a lower ID. When that happens, that other switch (the DB) is responsible for all communication needs to and from the LAN segment. BPDUs must, however, be still transmitted to allow the spanning tree protocol to react to changes in the network and adjust the tree in response to those changes.

2. **[5 points]** Consider a host connected to an Ethernet network. In the DHCP message it received after connecting to the Ethernet network the host was assigned IP address 11.0.5.65 in subnet 11.0.5.0/24, a gateway router with IP address 11.0.5.47, and a DNS server with IP address 11.0.34.59.
   a. **[2 points]** The host needs to send packets to a department printer whose IP address is 11.0.5.129, describes **all** the steps involved in delivering packets to the printer, including any intermediaries and the addresses used to reach them.

   The host knows the IP address of the printer and determines that it is in its subnet. As a result, it issues an ARP query for 11.0.5.29, and sends packets directly to the printer using the MAC address for the printer which it receives in the reply to its MAC query.

   b. **[3 points]** The host needs to access a remote web server hosted at <u>www.companyX.com</u>, describes **all** the steps involved in ensuring that the `http` request from the host is delivered to the web server, including any intermediaries and the addresses used to reach them.

   The host first needs to determine the IP address of the web server and therefore query the DNS server. Because the DNS server is not in its subnet, it needs to send packets destined for the DNS server to its gateway router. Assuming it does not have the MAC address of its router, it needs to first do an ARP query for 11.0.5.47. It then sends its DNS query in an IP packet encapsulated in an Ethernet frame with the MAC address of the router. The router is then responsible for forwarding the IP packet towards the DNS server. Once the host receives the response from the DNS server with the IP address of the company's web server, it sends its `http get` requests to that address, again encapsulated in Ethernet frames with a MAC destination address of its gateway router since the web server is remote, i.e., not in its subnet.

3. **[2.5 points]** Consider three BGP routers, A, B, and C, in the same routing domain, which advertise to each other routes for the same prefix *r*. Router A's route has an AS_HOP attribute of length 3, and a LOCAL_PREF value of 100. Router B's route has an AS_HOP attribute of length 1, and a LOCAL_PREF value of 50. Router C's route has an AS_HOP attribute of length 2, and a LOCAL_PREF value of 70. Identify which route is installed in the local routing table of **each** router.

   All routers install the route advertised by router A, as it has the highest LOCAL_PREF value.