1. IPv6 Addresses

   (a) Write the following IPv6 address in shortened form:
   `2041:0000:140F:0000:0000:0000:875B:131B`

   (b) Suppose the network interface has hardware id `00:e0:4c:53:44:58`. What *should* the link-local IPv6 address for that interface be? Explain why on Windows and Mac OS X the address the computer picks might not match the address specified in the RFC.

   (c) My ISP provides each customer a /56 IPv6 network block. If my IP is `2a00:23c4:bfb9:6801:a58f:b33f:26ad:d13c`, what is the routing prefix? How many subnets can I have on my network?

2. DHCP and SLAAC

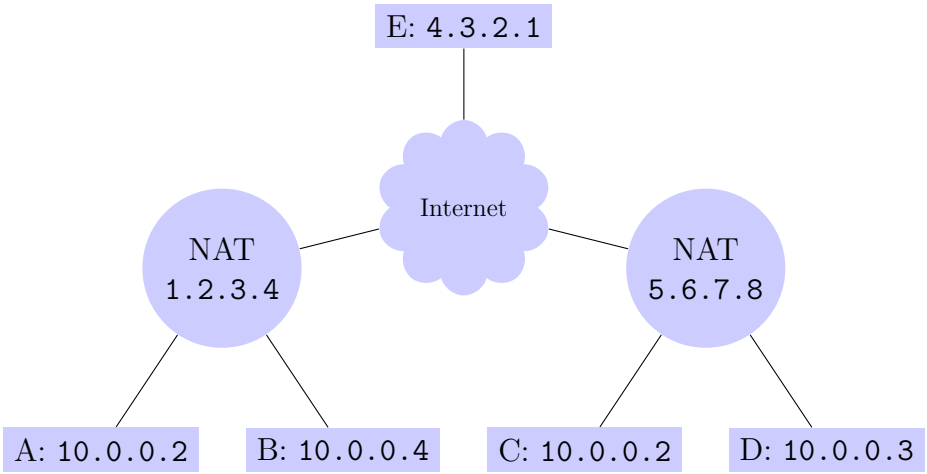
   (a) When a host first joins an IPv4 network, to obtain an IP address via DHCPv4, how does it know the IP address of the DHCP server to send a packet to?

   (b) How does a DHCPv4 server send a reply message back to a new host when the new host does not have an IP yet?

   (c) What is the point of the gateway IP provided in the DHCPv4 message?

   (d) DHCPv6 messages differ from DHCPv4 messages in that they no longer require information about DNS servers and gateway IPs. What other source can hosts obtain this information from instead?

3. Consider the following network topology where some residential hosts connect to the Internet via NAT devices:



(a) Host A has an active SSH connection (Port 22) to Host E. Give a plausible value for the (source address, destination address, source port, destination port) 4-tuple for packets in this connection as they exit Host A's computer. Indicate what elements of the tuple would be assigned at connection time (pick whatever value you want for these *ephermeral* ports).

(b) What is a plausible value for the (source address, destination address, source port, destination port) 4-tuple for packets for the connection in (a) when they arrive at Host E? Again, indicate what elements would be assigned at connection time.

(c) Suppose Host D wishes to serve web pages (on port 80) to the Internet. What must happen in order for devices on the Internet to access the server on Host D?

(d) Host B attempts to connect Host D (i.e. by sending a packet to D). List out how the (source address, destination address, source port, destination port) 4-tuple evolves as it traverses the network from B to D. Indicate what elements would be assigned at connection time.

(e) Host A and Host C have the same IP address. Is this an issue? Explain why it is or isn't.