Link Layer Quiz

Name: _____

Choose **one** answer unless the item says **select all that apply**.

Q1 MAC vs IP addresses Ch. 6 slides 6-41–43 You unplug your laptop in a GW lab and connect it to the network at a coffee shop. Its network card uses the MAC address burned in at the factory. Which of the laptop's addresses are **different** at the coffee shop?

- ◯ **A** Its MAC address only
- ◯ **B** Its IP address only
- ◯ **C** Both its MAC address and its IP address
- ◯ **D** Neither: both addresses belong to the laptop's network card, wherever it is

Q2 ARP on one subnet Ch. 6 slides 6-44–47 Hosts A and B are on the same subnet. A has a datagram for B, but B's MAC address is not in A's ARP table, so A sends an ARP query and B answers it. Where does each frame go at the link layer?

- ◯ **A** The query goes to B's MAC address; the reply goes to A's MAC address
- ◯ **B** The query goes to the broadcast address FF-FF-FF-FF-FF-FF; so does the reply
- ◯ **C** The query goes to the broadcast address FF-FF-FF-FF-FF-FF; the reply goes to A's MAC address
- ◯ **D** The query goes to the first-hop router's MAC address, which looks B up; the reply goes to A's MAC address

Q3 ARP for another subnet Ch. 6 slides 6-48–53 Host A is **10.0.1.15** on subnet 10.0.1.0/24. Its first-hop router's interface on that subnet is **10.0.1.1**. A has a datagram for host B at **10.0.7.40**, on a different subnet. A's ARP table is empty. Which IP address does A put in its ARP query?

- ◯ **A** 10.0.7.40, B's address
- ◯ **B** 10.0.1.1, the router's address
- ◯ **C** 255.255.255.255, the broadcast address
- ◯ **D** 10.0.1.15, A's own address, so the router can answer with B's MAC address

Q4 Switch self-learning Ch. 6 slides 6-62–66 *select all that apply* A switch has four ports. Its switch table has one entry: MAC address **Z** is on port **3**. A frame **from X to Y** arrives on port **1**. Select **every** action the switch takes.

- ☐ **A** Adds an entry: X is on port 1
- ☐ **B** Sends the frame out ports 2, 3 and 4
- ☐ **C** Sends the frame out ports 1, 2, 3 and 4
- ☐ **D** Sends the frame only out port 3, where its one known host is
- ☐ **E** Broadcasts an ARP query to find out which port Y is on

Q5 Switches vs routers Ch. 6 slides 6-62, 6-73 *select all that apply* Select **every** statement that is true of an **Ethernet switch** but **not** of a router.

- ☐ **A** It fills its forwarding table by noting the source address of each frame that arrives and the port it arrived on
- ☐ **B** Hosts never put its MAC address in the frames they send
- ☐ **C** It receives and stores each whole packet before it forwards it
- ☐ **D** It chooses each packet's output port from the packet's destination IP address

Q6 Hidden terminals Ch. 7 slides 7-23–24 Laptops A and C are on opposite sides of access point B. Each laptop can hear B, but A and C cannot hear each other. Both laptops listen before they send (carrier sensing). What goes wrong?

- ◯ **A** While A is sending, C hears nothing and starts sending too; the two frames collide at B
- ◯ **B** A's and C's signals collide at each other's radios, so neither laptop can receive from B
- ◯ **C** B's replies reach A but not C, so C never learns whether its frames arrived
- ◯ **D** Nothing: B repeats every frame it receives, so C hears A's frame through B and waits

Q7 Handover in 5G Ch. 7 slides 7-125, 7-133–135 A phone is streaming a video when it hands over from base station 1 to base station 2. Which change makes the video's datagrams from the Internet arrive at base station 2 from then on?

- ◯ **A** The phone gets a new IP address on base station 2's subnet, and the video server starts sending to it
- ◯ **B** The SMF tells the phone's UPF to change the far end of its tunnel from base station 1 to base station 2
- ◯ **C** Internet routers update their forwarding tables to send the phone's IP address toward base station 2
- ◯ **D** Base station 1 keeps receiving every datagram from the UPF and passes each one on to base station 2, for the rest of the session

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Q8 **One Datagram, Three Links** Ch. 6 slides 6-44–53, Ch. 7 slides 7-71–72

Laptop **H1** is on WiFi. Its access point, **AP**, connects by Ethernet to router **R1**. Server **S** is on R1's other subnet, also by Ethernet. H1 sends one datagram to S. **H1's and R1's ARP tables start empty.** Each MAC address is written as a single letter.

Device	IP address	MAC
H1	`10.1.1.20`	**a**
AP	—	**b**
R1, left interface	`10.1.1.1`	**c**
R1, right interface	`10.1.2.1`	**d**
S	`10.1.2.50`	**e**

Reference

ARP query: asks which MAC address belongs to an IP address on this subnet. A node sends one only when it has a datagram to send and the MAC address it needs is not in its ARP table.

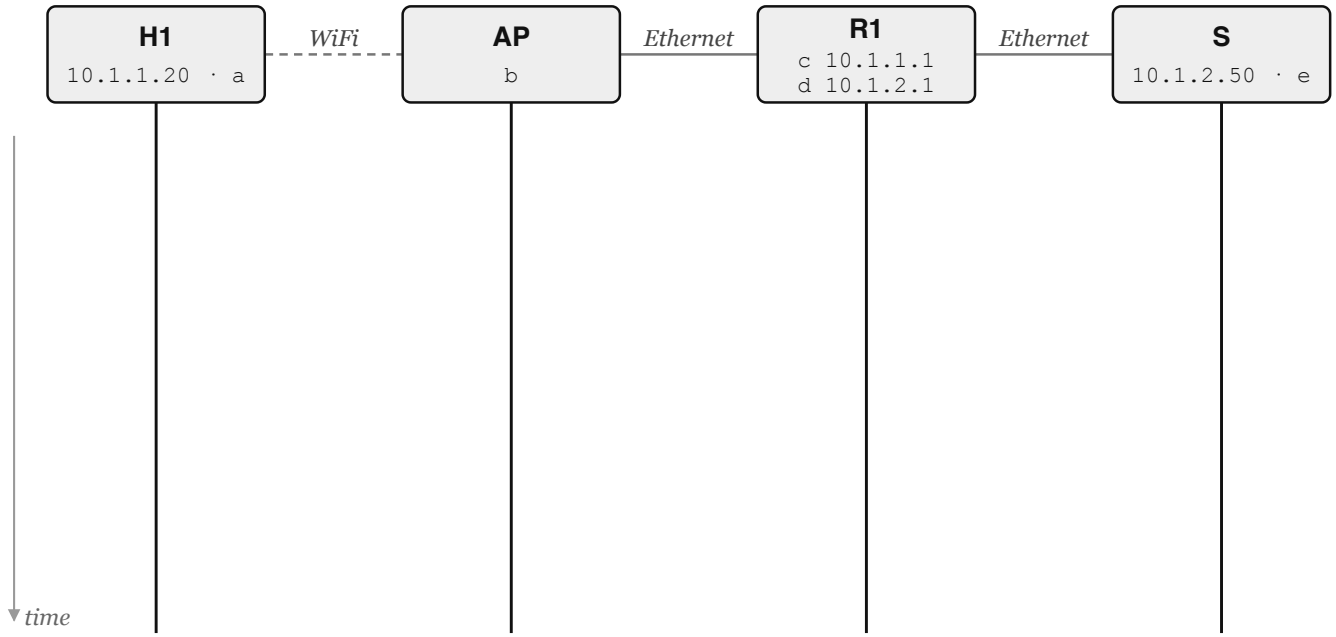
ARP reply: the owner of that IP address answers with its MAC address.

The **AP** is a link-layer relay: a frame it receives on its WiFi side it sends again on its Ethernet side, and the reverse.

802.11 (WiFi) frame: Address 1 = MAC of the device receiving this frame over the air. Address 2 = MAC of the device transmitting it. Address 3 = MAC of the router interface the AP is attached to.

Ethernet frame: destination MAC, source MAC.

1. Draw every frame, from H1's first ARP query until the datagram reaches S. Draw each frame as an arrow from the device that sends it to the device that receives it. Number the arrows in the order they are sent and label each one "ARP query", "ARP reply" or "DATA", e.g. "1 ARP query".



2. Fill in the addresses on the frames that carry the **datagram**. Use the MAC letters from the table.

Link	Address 1 / Dest MAC	Address 2 / Source MAC	Address 3	Source IP	Destination IP
H1 → AP (WiFi)					
AP → R1 (Ethernet)			—		
R1 → S (Ethernet)			—		

3. One minute later, H1 sends a second datagram to S. Which arrows from part 1 happen again? Give their numbers.

Arrows: _____