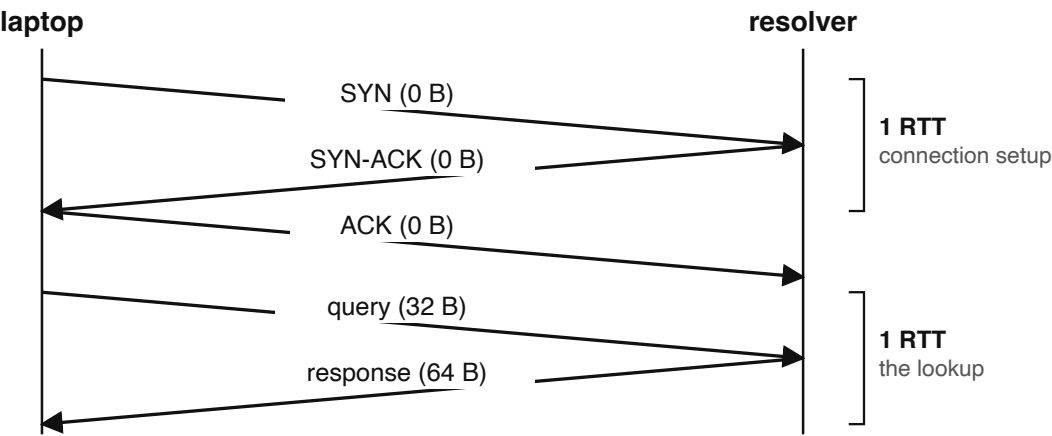


Names: _____

A campus DNS resolver answers name lookups for the whole university. A laptop sends a **32-byte** query and the resolver returns a **64-byte** response. The round-trip time between them is **RTT = 20 ms**. Both messages are small, so **ignore transmission time** — only round trips matter.

Here is the same lookup over **TCP**. Each arrow is one segment, labelled with what it carries.



1. Draw the same lookup over **UDP** on the timeline below. Label every arrow with what it carries and how many bytes of application data are in it.



2. Using both diagrams, fill in the table. “Bytes on the wire” counts every arrow shown, in both directions, including transport headers. Each **UDP** header is **8 bytes**; a **TCP** header is **20 bytes**.

	Time	Bytes on the wire
UDP	ms	bytes
TCP	ms	bytes

Week 4: UDP Worksheet *continued*

3. The resolver answers **50,000 lookups per second**. If every one of them ran over TCP instead of UDP, how much extra traffic would its link carry, in **Mbps**?

Extra bytes per lookup: _____ Extra load: _____ Mbps

4. Over TCP each connection stays open about **40 ms**. At 50,000 lookups per second, how many TCP connections is the resolver holding open at any one instant, and how many sockets does that take? Serving the same load over **UDP** takes how many sockets — and what fact about UDP makes the two answers different?

TCP sockets: _____ UDP sockets: _____

5. On **your UDP diagram**, draw a query that never arrives, and mark the moment the laptop finds out. The laptop has to choose how long to wait before deciding the query was lost. What goes wrong if it waits too little? What goes wrong if it waits too long?

Discuss with your partner

This time the query arrives safely but the **response** is lost. The laptop's timer expires and it asks the same question again — and the resolver, holding no state, cannot tell a repeat from a brand-new question. For a name lookup, does that matter? Now suppose the message were not “what is the address for `gwu.edu`” but “transfer \$100” or “add one to my score”. What would a server need in order to tell a retransmission from a genuinely new request? Your Project 1 protocol runs over UDP — will it have this problem?