

CS422 Computer Networks (Fall 2025): Homework 2

(Due Date: **23:59:59PM Tue Sep 30, 2025**, Total: 40 points)

1. **(5 points)** Web browsing and HTTP
 - (a) (2 points) Alice uses Chrome on her laptop to visit `www.amazon.com` and finds that she is already logged in. How does this happen?
 - (b) (3 points) Alice used Chrome on her laptop to visit `www.lego.com` yesterday. Later, she used Chrome on her laptop to visit a new website, say A (which has been never visited before), she saw an LEGO advertisement in the webpage displayed in Chrome. After a while, she used Chrome on her laptop to visit another new website, say B (which has been never visited before), she saw the same LEGO advertisement in the webpage displayed in Chrome. How does it happen?
2. **(8 points)** Domain Name System (DNS) and *nslookup*
 - (a) (4 points) Suppose Alice's laptop does NOT know the IP address of "`www.lego.com`" at the start. And the cache in the local DNS server is empty. Assume the local DNS server uses **recursive** inquiry. Please explain the procedure of DNS inquiry with main steps.
 - (b) (2 points) Suppose Alice wants to get the IP address of the mail server for *gmail.com*. How could she use *nslookup* to achieve it? Please list the commands (choose one mail server is enough)
 - (c) (2 points) Explain why DNS messages are not human-readable, and provide one example of a human-readable application-layer protocol.
3. **(6 points)** UDP uses checksum to detect error.
 - (a) (2 points) Suppose you have the following 2 bytes: 01011100 and 01100101. What is the checksum of these 2 bytes?
 - (b) (2 points) Suppose you have the following 2 bytes: 11011010 and 01100101. What is the checksum of these 2 bytes?
 - (c) (2 points) Given the bytes in part (a), given an example where the bit errors occur and yet the checksum doesn't change.
4. **(6 points)** In RDT2.0, ACK and NAK both are used; In RDT2.2, only ACK is used. Can we get rid of NAK in RDT2.0? If no, please explain why. What will RDT2.2 do if the packet has error?
5. **(10 points)** Please follow the examples given in the class and plot the diagram of RDT3.0 in action. The sender uses RDT3.0 to send 5 packets to the receiver. The third packet experiences a super long delay but its ack is received just after the timeout. Afterwards, there are no errors, losses, or long delays. That is, all other packets and their acks are received correctly without triggering any timeout.
 - (a) (3 points) Please use a diagram to plot how these 5 packets are sent out. How many packets in total are sent by the sender?
 - (b) (3 points) By default, RDT3.0 ignores duplicate acks (check FSM). Suppose instead that RDT3.0 behaves like RDT2.2 (the sender resends a packet upon receiving a duplicate ack). Please use a diagram to plot how these 5 packets are sent out. How many packets in total are sent by the sender?
 - (c) (4 points) Does RDT3.0 have a fatal flaw? If yes, please give an example. If no, please explain why not.
6. **(5 points)** In Selective Repeat, suppose the window size is 4.

- (a) (3 points) List all the possible ranges for the receiver's window when the sender's window is currently [501, 502, 503, 504].
- (b) (2 points) List all the possible ranges for the sender's window when the receiver's window is currently [501, 502, 503, 504].