

# CS536 (Spring 2023): Homework 2

(Due Date: **11:59:59PM EDT, Feb 10, 2023**, Total: 30 points)

1. (15 points) A client is fetching a base html file with 10 referenced objects from an Internet server. Assume the base html file is extremely small,  $<1\text{KB}$  and each object file size is  $2^{10-k}\text{MB}$ ,  $k = 1, 2, 3, \dots, 10$ . Assume the transmission rate for each file and referenced objects is constant, if any, is  $R = 100\text{Mbps}$ . Assume that the only transmission/reception bottleneck in the network is the access link through which the client is connected to the Internet and the RTT is also constant, say  $rtt = 1s$ .
  - (a) (3 points) If the client uses HTTP/1.1, compute the delay for non-persistent HTTP connection without parallel TCP connections.
  - (b) (3 points) If the client uses HTTP/1.1, compute the delay for the persistent HTTP without pipelining.
  - (c) (4 points) If the client uses HTTP/2.0, compute the delay to get all the object and compute the delay when the first object (but not necessarily  $k=1$ ) is received (assume frame size is 1MB).
  - (d) (5 points) To avoid HOL blocking, would you like to propose another solution different from HTTP/2.0?
2. (5 points) Alice (last111@purdue.edu) sends an email to Bob (bob@gmail.com). Alice uses Microsoft Outlook (an email client) over her laptop. Bob uses a web browser to get access to his gmail. Please briefly describe how this email is sent by Alice and finally reaches Bob step by step. Please specify the used protocols (for Email) at each step.
3. (10 points) Read the help page for *nslookup* (**man nslookup**). If you are not very familiar with UNIX man pages, start with **man man**. Please describe the commands you use to obtain the answers, as well as the results.
  - (a) (2 point) What is the IP address of the machine www.cs.purdue.edu?
  - (b) (2 point) If you enter the IP address obtained above into a web browser, can you see the homepage of www.cs.purdue.edu? If yes, why; If no, why not?
  - (c) (2 point) What is the IP address of the machine data.cs.purdue.edu? If you enter the IP address obtained above into a web browser, can you see a webpage data.cs.purdue.edu? If yes, why; If no, why not?
  - (d) (2 points) What are the name and the IP address of the authoritative name server for **cs.purdue.edu**
  - (e) (2 points) How can you find the IP address of the mail server for alice@purdue.edu?