

The Chinese University of Hong Kong
Department of Systems Engineering and Engineering
Management

**SEEM5770/ECLT5840 Open Systems/Electronic
Commerce**

2013-14 Assignment 1: Networking

The assignment is due at 11:00pm on October 21. This assignment counts for 15% of the unit's assessment. You must submit to the assignment box **B10** (ERB 5th floor). You need to put down your student id and your name.

The questions in this assignment ask for explanations. Answer all the questions. The explanations should be concise descriptions of your understanding. You should clearly show all the formulas you use, and all the steps followed to get your answers.¹

Q-1: Consider two hosts **A** and **B**, connected by a single link of rate R bps (bits per second). Suppose that the two hosts are separated by m meters, and suppose the propagation speed along the link is s meters/sec. Host **A** is to send a packet of size L bits to Host **B**.

- (a) Express the propagation delay, d_{prop} , in terms of m and s .
- (b) Determine the transmission time of the packet, d_{trans} , in terms of L and R .
- (c) Ignoring processing and queuing delays, obtain an expression for the end-to-end delay.
- (d) Suppose Host **A** begins to transmit the packet at time $t = 0$. At time $t = d_{trans}$, where is the last bit of the packet?
- (e) Suppose d_{prop} is greater than d_{trans} . At time $t = d_{trans}$, where is the first bit of the packet?
- (f) Suppose $s = 2.5 \cdot 10^8$, $L = 100$ bits, and $R = 28$ kbps (kilo bits per second). Find the distance m so that d_{prop} equals d_{trans} .

¹Departmental Guideline for Plagiarism (Department of Systems Engineering and Engineering Management): If a student is found plagiarizing, his/her case will be reported to the Department Examination Panel. If the case is proven after deliberation, the student will automatically fail the course in which he/she committed plagiarism. The definition of plagiarism includes copying of the whole or parts of written assignments, programming exercises, reports, quiz papers, mid-term examinations and final examinations. The penalty will apply to both the one who copies the work and the one whose work is being copied, unless the latter can prove his/her work has been copied unwittingly. Furthermore, inclusion of others' works or results without citation in assignments and reports is also regarded as plagiarism with similar penalty to the offender. A student caught plagiarizing during tests or examinations will be reported to the Faculty office and appropriate disciplinary authorities for further action, in addition to failing the course.

Q-2: Consider a simple network where a data can be transmitted at a rate of 150 bit/sec in both directions (link bandwidth). A user wants to download a webpage which is 100,000 bits long, containing 10 referenced objects (images), and each of the 10 referenced objects is 100,000 bits long. To show the webpage at the user's browser, it needs to download the webpage and its 10 referenced objects. For simplicity, we assume that an HTTP-request packet is 200 bits long, and an HTTP-respond packet is 100,000 bits long to handle the webpage and each of the 10 referenced objects. In addition, HTTP is built on top of TCP, and for TCP protocol, a TCP handshaking packet and a TCP control message (for example, ACK) is 200 bits long. Furthermore, for the simple network, we assume the distance between the user's host and the web server is d meter link and the propagation speed over the link be s . Let $d = 10$, and $s = 3 \cdot 10^8$.

- (a) Suppose we use non-persistent HTTP, but we can download referenced objects in parallel at the same time by opening multiple TCP connections. Here, we assume that N parallel connections each get $1/N$ of the link bandwidth. How long does it take to get all needed to user's host?
- (b) Suppose we use persistent HTTP. How long does it take to get all needed to user's host?
- (c) Do you see significant gains of persistent HTTP over the non-persistent HTTP in this case?

Q-3: The finite-state machines for the sender and the receiver of **Go-Back-N** are given in the lecture note for Chapter 3 (slide 3-34 and slide 3-35), respectively. In the same lecture note for Chapter 3, slide 3-36, it shows the operations of the **Go-Back-N** protocol for the case of a window size of 4 packets.

Following the **Go-Back-N** protocol, explain step-by-step, in paragraphs, how the sender and the receiver take actions in detail when the corresponding events occur. Hint: where are their initial states? What are sent from one side to another side? What conditions make them transit from the only one state to itself? What actions do they take when transit from the only one state to itself? Show how the pointers like **base**, **nextseqnum**, and **expectedseqnum** changes. (Note: these pointers are used to control window size as given in the finite-state machines.) What does the window for? Why do we need to use a window? In addition, when does the timer start and when does it stop, and how to handle timeout.

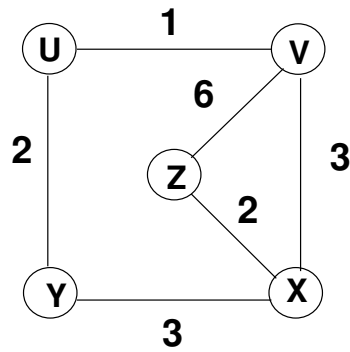


Figure 1: Network 1

Q-4: Consider the network shown in Figure 1. Assume that each node initially knows the costs to each of its neighbors. Following the distance-vector algorithm, and show the steps to compute the distance tables until it converged.