Assignment One

Due Date: 11:00 AM, January 23, 2014
Written Assignment (50 points)
Please provide your answers with clear explanations of how to get them.
Please write your full name, computer science account ID and last five digits of your ISU student ID on the paper.

1. In this problem we consider sending real-time voice from Host A to Host B over a packet-switched network (VoIP). Host A converts analog voice to a digital 64 kbps bit stream on the fly. Host A then groups the bits into 56-byte packets. There is one link between Host A and Host B; its transmission rate is 2 Mbps and its propagation delay is 10 msec. As soon as Host A gathers a packet, it sends it to Host B. As soon as Host A gathers a packet, it sends it to Host B. As soon as Host B receives an entire packet, it converts the packet’s bits to an analog signal. How much time elapses from the time a bit is created (from the original analog signal at Host A) until the bit is decoded (as part of the analog signal at Host B)? (Page 74, P6)

2. (a) A packet switch receives a packet and determines the outbound link to which the packet should be forwarded. When the packet arrives, one other packet is halfway (1/2) done being transmitted on this outbound link and four other packets are waiting to be transmitted. Packets are transmitted in order of arrival. Suppose all packets are 1,500 bytes and the link rate is 2 Mbps. What is the queuing delay for the packet?
(b) More generally, what is the queuing delay when all packets have length L, the transmission rate is R, x bits of the currently-being-transmitted packet have been transmitted, and n packets are already in the queue? (Page 75, P11)

3. Consider the queuing delay in a router buffer (preceding an outbound link). Suppose all packets are L bits, the transmission rate is R bps, and that N packets simultaneously arrive at the buffer every LN/R seconds. Find the average queuing delay of a packet.
(Hint: The queuing delay for the first packet is zero; for the second packet L/R; for the third packet 2L/R. The Nth packet has already been transmitted when the second batch of packets arrives.) (Page 75, P13)

4. Suppose two hosts, A and B, are separated by 20,000 kilometers and are connected by a direct link of R = 2 Mbps. Suppose the propagation speed over the link is 2.5\times10^8 meters/sec.
a. Calculate the bandwidth-delay product, R\cdot d_{prop}.
b. Consider sending a file of 800,000 bits from Host A to Host B. Suppose the file is sent continuously as one large message. What is the maximum number of bits that will be in the link at any given time?
c. What is the width (in meters) of a bit in the link?
d. Now consider a link of R = 1 Gbps, all other things being equal, repeat (b) and (c). (Page 77, P24, P26)
Programming Assignment (50 Points)
Due Date: 12:00 PM, January 23, 2014

Problem Description
In this programming assignment, you will be asked to implement a simple client/server based cryptographic
system using connection-oriented communication (socket programming using TCP). In this program, it uses a
very simple symmetric key algorithm Caesar cipher (refer the book section 8.2.1 for more detail information).
A client can send plaintext to the server. The server will get the cipher text after it receives the original
message from the client. Then the server will reply the encrypted message to the client, and the client will
display the result on screen.

Submitting your program
1. You can use the last four or five digits of your student ID as the port number in your program.
2. You are suggested to implement this homework via Java. Compile all of your .java files, Create the .class
files, and include a readme.txt file in your source code specifying how to compile and run your programs.
3. In your readme, please attach the example that how to test your program, such as the example on the
textbook: The key k is equal to 3; plaintext message is “bob, I love you. alice” becomes “ere, l oryh brx. dolfh”
in cipher text.
4. Follow the instructions specified in the Turnin Instructions page to submit your programming assignment
electronically.
5. Use “hw1” as the argument to submit the first programming assignment.

Grading guideline for programming assignment
Total Score: 50 points
1. Program Correctness (40 points)
a. Your program are successfully compiled and created, respectively.
b. Correctly send/receive the plaintext/encrypted messages

2. Program Robustness and Friendly (5 points)
a. Properly handling errors in socket operations
b. Your client should be friendly program which is easy to operate and use.

3. Program Components and Comments (5 points)
a. Your client program is named client.java, as instructed
b. Your server program is named server.java as instructed