

Spring 2015 COMP4621 Homework Assignment #1
Handout Date: Feb 14, 2015 (Saturday)

Due Date: March 3, 2015 (Tuesday)

Name: _____ ID: _____

E-Mail: _____ Section L ____

Please read the following instructions carefully before answering the questions:

- This assignment must be completed **individually**.
- There are a total of **4** questions.
- When you write your answers, please try to be precise and concise.
- Fill in your name, student ID, email and Section number at the top of the first page.
- Please print this homework and fill in your answers in the space provided, or you can type your answers in the MS word file and print it out.
- **Homework Collection:** the **hardcopy** is required and the homework is collected at the **Collection BOX** outside **Room 4030 (Lift 3)**.

1. (30 points) Please briefly answer the following questions in 2-3 sentences only.

(a) Please list *six* Internet applications

(b) What is a protocol?

(c) What are the five layers in the Internet protocol stack?

(d) What is the difference between routing and forwarding?

(e) What is the difference between circuit-switching and packet-switching?

(f) What is the difference between propagation delay and transmission delay?

2. (20 points) Suppose users share a **6 Mbps** link. Also suppose each user requires **100 kbps** when transmitting, but each user transmits only **5 percent** of the time.

(a) When circuit switching is used, how many users can be supported?

(b) For the remainder of this problem, suppose packet switching is used. Find the probability that a given user is transmitting.

(c) Suppose there are **180** users. Find the probability that at any given time, exactly **x** users are transmitting simultaneously. (Hint: Use the binomial distribution.)

(d) Can the 180 users be supported by this 6 Mbps link with packet switching, why?

3. (20 points) Consider the queuing delay in a router buffer (preceding an outbound link). Suppose all packets are **m bits** in length, the link transmission rate is **r bps**, and that **N** packets **simultaneously** arrive as a batch at the buffer every mN/r seconds.

(a) To prevent packet loss, what is the **minimal** switch buffer size?

(b) Assuming the size of switch buffer is infinite. Find the average queuing delay of a packet. (Hint: The queuing delay of the first packet is zero; for the second packet m/r ; for the third packet $2m/r$. The N -th packet has already been transmitted when the second batch of packets arrives.)

4. (30 points) Consider sending a large file of F bits using packet switching from Host A to Host B. There are **three** links (i.e., **two** switch) between A and B, and the links are uncongested (that is, no queuing delays). Host A divides the large file into segments of S bits each and adds 40 bits of header to each segment, forming packets of $L = 40 + S$ bits. Each link has a transmission rate of R bps. Packets are sent along each of the two links one by one (store and forward). Find the value of S that minimizes the delay of moving the file from Host A to Host B. Disregard propagation delay. (*Hints*: Find the total time T for moving the file from Host A to Host B; take the derivative with respect to S and set to zero).

