COMP9121 Assignment 1 2024 S2

In this assignment, some questions are student number dependent; you will get zero in that question if you use another student's number.

10 questions in total. Questions 6-10 will be released later.

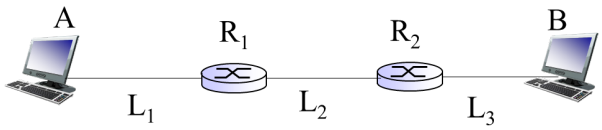
1. **CRC.**

(1) What is your student number? Convert your student number to binary and hexadecimal numbers.

(2) Let D be the binary number your derived above. The generator G starts with 1 and ends with 1, with all intermediate bits being zero, so G = 10…01. The CRC should be 1 byte in length. Calculate the CRC derived by D and G.

2. **Delay.**

Consider two hosts, A and B, are connected by three links and two routers as shown the figure below. Suppose node A sends two packets consecutively to B. Each packet is with the size of 100 bytes. Each router applies store and forward. There is no bit error or packet loss.



We have: Bandwidth of L_1 = 0.8 Mbps. Bandwidth of L_2 = 0.4 Mbps. Bandwidth of L_3 = 0.8 Mbps. Length of L_1 = 100 km. Length of L_2 = 200 km. Length of L_3 = 200 km. Propagation speed of links = 2×10^8 (m/s).

(1) What is the overall delay to deliver the two packets? (From the start of sending first packet at A till the second packet is completely received by B)

(2) At $\frac{k}{10}$ ms, where is the first bit of the **second** packet? *k* is the last **two** digits of your student number. (0ms is defined as the instant when A starts sending the first bit of the first packet).

3. **Parity**.

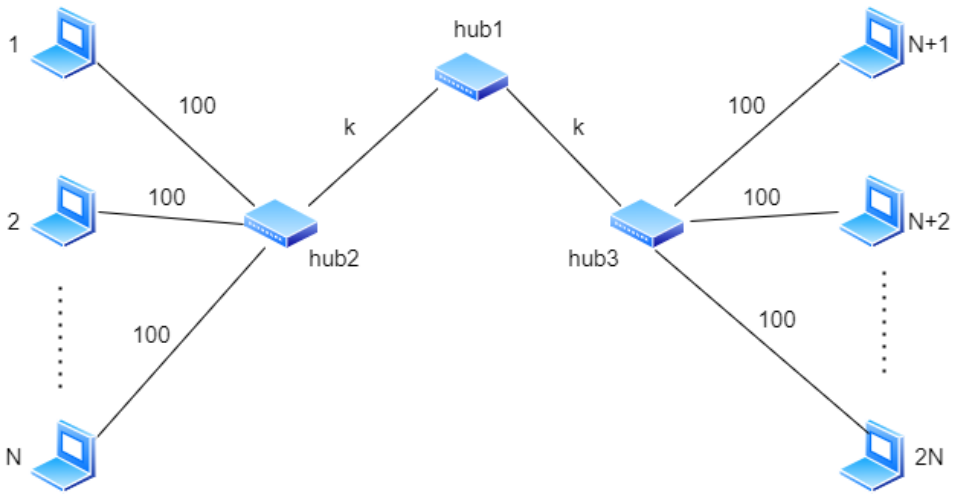
Using the last 6 bits of your student number in binary form (which you should have already calculated it in Question 1), to form a 6-bit information stream. Generate the parity bit and you can derive a 7-bit coded stream.

1) Send the coded stream through a random flipping channel with bit-flip probability p=0.05. Each bit is flipped independently. Assume that only the information bits may flip, and the parity bit will **not** flip. Please calculate the probability that some of the bits are flipped, but this is **not** detected by the parity check.

2) Send the coded stream into a random lossy channel with bit-lost probability p=0.05. Each bit is lost independently. Assume that only the information bits may be lost, and the parity bit will **not** be lost. Please calculate the probability that some of the bits are lost, but this is **not** detected by the parity check.

4. **CSMA-CD Performance.**

2N computers have been connected in a network as illustrated. The length of each link is written in meters. Let k be the last **three** digits of your student number. Each computer generates 1000 packets per second with each packet being 500 bytes. The maximum rate of all links is 1 Gbps. The propagation speed in the medium is 2.0×10^8 meters/second.



(1) What is the maximum number of nodes supported in the network if CSMA-CD is used on the shared medium?

(2) Assume that hub1 is replaced with a switch. Find the maximum number of nodes supported in the network if CSMA-CD is used on the shared medium. Assume that 3/4 of the traffic is kept in its own side and 1/4 of the traffic goes to the other side.

5. **Address allocation.**

A company has been granted a block of IP addresses starting with 150.12.32.0/20. The address space should be allocated to four subnets A, B, C and D. Let k be the last digit of your student number. Subnet A needs (k+18) addresses, subnet B needs (k+40) addresses, subnet C needs (k+80) addresses, and subnet D needs (k+253) addresses.

(1) The IP addresses have been assigned in the following order A, B, C, and D (subnet A has the smallest IP addresses and subnet D has the largest IP addresses). What is the starting IP address of subnets A, B, C, and D?

(2) The IP addresses have been assigned in the following order D, C, B, and A. Redo the question (1).