# Minor-II, COL 334/672

October 8, 2016

**Duration:** 1 hour

**Maximum Marks:** 40

**Note from Assoc. Dean Academics: (i) You are NOT allowed to stand up or leave the seat at the end of exam till all answer scripts are collected and counted. (ii) You are NOT allowed to leave the exam hall during the exam period unless on medical emergency.**

1. *(24 marks)* Answer the following in brief (one page for each sub-question should suffice). You may draw diagrams, if necessary, to clearly explain your answers.

   (a) What is the minimum frame size in bytes used in Ethernet (IEEE 802.3)? How is this minimum frame size related to the maximum Ethernet segment length? Explain with a diagram what can go wrong if someone transmitted a frame much smaller than this minimum frame size.

   (b) Assume that a frame ends with a CRC computed using the divisor (generator) polynomial $x^5 + 1$. Explain whether or not this CRC detects

   i. all "odd number" of bit-errors that occur in the frame

   ii. all "even number" of bit-errors,

   iii. all "bursts of error" of burst-length 4 (that is, errors in 4 consecutive bits anywhere in the frame).

   (c) In Figure 1, various Ethernet bridges along with their IDs (assume B1 has ID 1, B2 has ID 2 etc.) are depicted which connect various Ethernet segments. Assume that the spanning tree protocol described in class is executed. Redraw the figure on your answer sheet and indicate on the diagram the following.

   i. Which bridge becomes the root of the tree?

   ii. Which ports become "root ports" of the various bridges?

   iii. Which ports become "designated ports" of the various Ethernet segments?

   iv. Which ports are disabled as "blocked ports"?

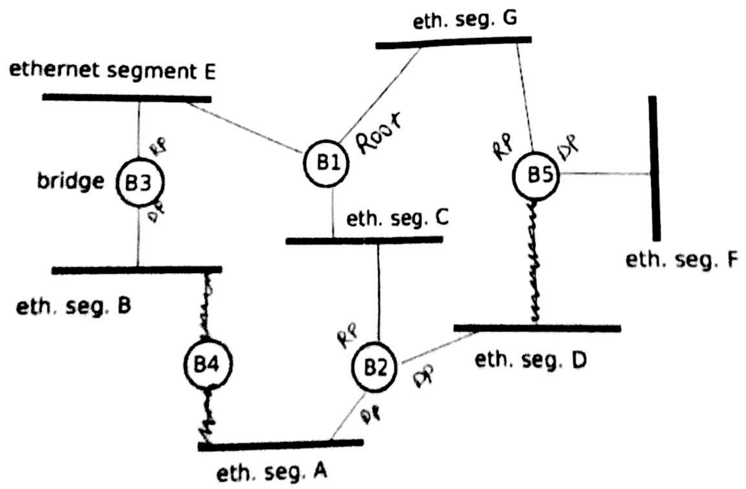


Figure 1: Ethernet Topology

   (d) Explain what the "Split Horizon" solution for the count-to-infinity problem is in the context of Distance Vector routing protocols. Give an example where the Split Horizon method to prevent the count-to-infinity problem.

2. *(16 marks)* Two Wi-Fi scenarios are shown in Figures 2 and 3. All WiFi nodes use virtual carrier sensing to solve the hidden terminal problem. Assume that any node can both carrier sense and also receive packets (RTS, CTS, DATA, or ACK) from another node *if and only if* the two nodes are within distance 3 units of each other. All DATA packets are assumed to be of the same size. Assume that no DATA packets are sent between pairs of nodes other than the ones explicitly mentioned below.

(a) In Figure 2 we see six Wi-Fi nodes located on a two-dimensional plane: $A_1$, $B_1$, and $C_1$ at (1,0), (3,0), and (5,0) respectively, and $A_2$, $B_2$, and $C_2$ at (1,2), (3,2), and (5,2) respectively. Assume that $A_1$ has an infinite amount of data to send to $A_2$, that is, $A_1$ always has a data packet available to send to $A_2$. Similarly $B_1$ has an infinite amount of data to send to $B_2$, and $C_1$ has an infinite amount of data to send to $C_2$. Let $T_A$ denote the resulting data throughput from $A_1$ to $A_2$. Let $T_B$ denote the data throughput from $B_1$ to $B_2$, and let $T_C$ be the data throughput from $C_1$ to $C_2$. Assume that these throughputs are the average throughputs measured over a period of time which is large enough to smoothen out the effects of random selection of contention window sizes etc.

Discuss qualitatively the relationship (greater than, less than, equal to etc.) between $T_A$, $T_B$, and $T_C$. Should all three be roughly equal? If so, why? And if not, why? Your answer should be explained in terms of the Wi-Fi virtual carrier sensing protocol.

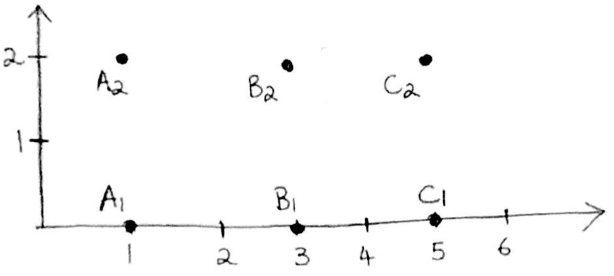


Figure 2: Wi-Fi Three-Pairs topology

(b) In Figure 3 we see four Wi-Fi nodes located on a two-dimensional plane: $A$, $B$, $C$ and $D$ located at (0,0), (2,0), (4,0), and (6,0) respectively. Assume that $A$ has an infinite amount of data to send to $B$, and that $C$ has an infinite amount of data to send to $D$. Let $T_A$ be the resulting data throughput from $A$ to $B$. Let $T_C$ denote the data throughput from $C$ to $D$.

Discuss qualitatively the relationship between $T_A$ and $T_C$. Should they be roughly equal? If so, why? And if not, why?

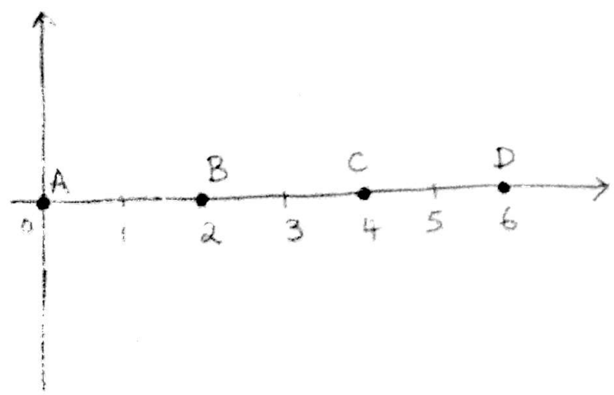


Figure 3: Wi-Fi Four Node topology