

# Assignment - 2

CS224, Max. Marks: 25

Note: You may upload scanned images of your handwritten solutions to Moodle. This assignment should be done individually. Discussions are allowed, but the final solution should be written down individually.

1. (15 marks) Consider an Ethernet LAN in which several nodes are connected to the same co-axial cable bus and all (except one malicious node) run the standard Ethernet CSMA/CD protocol. The malicious node is greedy and wants to transmit at least  $N\%$  of successfully transmitted frames, that is  $N\%$  of frames which do not face collisions. Here  $N$  is a tunable parameter between 0 and 100 which can be set by the person using the malicious protocol. Assume that the malicious node has an infinite amount of data to transmit to some other node(s) in the LAN. Give details of how the malicious node may go about achieving its goal. You should draw a flow chart explaining your protocol. For this question, solutions which are more elegant will receive more marks.
2. (10 marks) A Wi-Fi scenario is shown in Figures 1. 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.

In Figure 1 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.

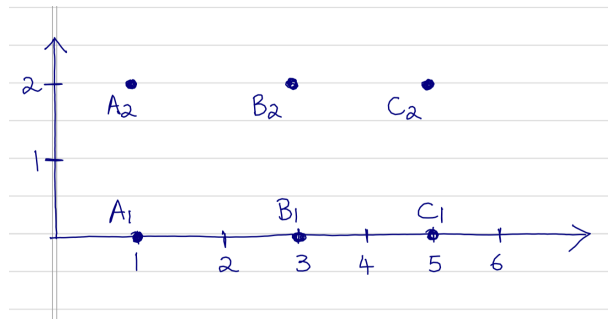


Figure 1: Wi-Fi Three-Pairs topology