TELE3118 Tutorial 2: Link Layer: Error control, MAC, Switching

Q1: [Error Coding]
You are designing an error control strategy for sending 4-bit messages.

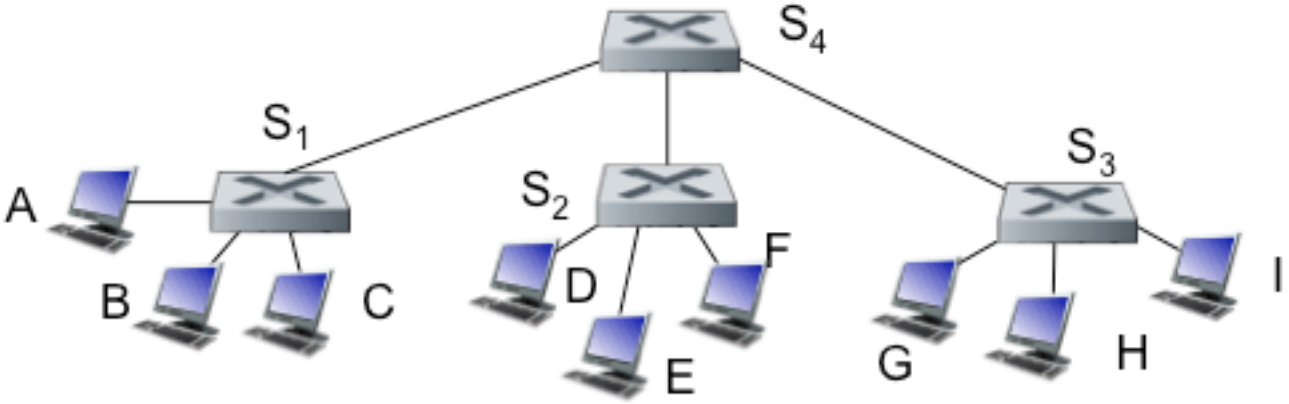
(a) What is the minimum number of redundant bits required for the receiver to be able to detect all 1-bit errors? Describe how the redundant bit(s) are generated.

(b) What is the minimum number of redundant bits required for the receiver to be able to correct all 1-bit errors? Show how you determine this.

Q2: [Ethernet CSMA/CD]
Consider a 100 Mbps Ethernet LAN that is 500 m long. How long does a signal take to traverse from one end of the wire to the other, assuming that the signal travels at 2 x 10^8 m/s? Based on this, compute the minimum frame size that ensures that collisions do not go undetected (in other words, a node should not finish its transmission before it can detect that another node is transmitting). Explain your answer.

Q3: [Wireless MAC]
Five stations, A through E, are arranged in a line, with each station only within communication range of its immediate neighbors. If these stations are using the CSMA/CA protocol and two transmissions are to take place simultaneously, then between which stations (name both the source and destination) can these transmissions occur? Explain your answer.

Q4: [Ethernet switching]
Consider the topology below showing 4 switches S_1-S_4 and 9 hosts A-I.



Assume that the learning switch table is initially empty at all switches. Show the state of the switch table at each switch after the following transmissions:

(i) B sends a frame to E;
(ii) E replies with a frame to B;
(iii) G sends a frame to B;
(iv) B replies with a frame to G.

Now repeat the above question starting with an empty switch table at all switches, but this time assuming that A, D, G are in VLAN-111; B, E, H are in VLAN-112, and C, F, I are in VLAN-113.

Q5: [Switching and Loops]

Consider the topology of switches and LAN segments below. Suppose initially that B1 is the root, and spanning tree disables the ports shown by dashed lines below. Consider host A1 on LAN segment A and host D1 on LAN segment D – indicate the port on each switch on which these MAC address will be learnt. Now suppose switch B2 becomes the root bridge – draw the new spanning tree showing the switch ports that will be disabled to break loops, and now indicate which ports will A1 and D1 be learnt on at each switch.