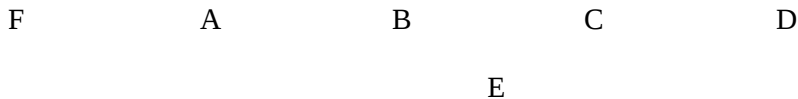


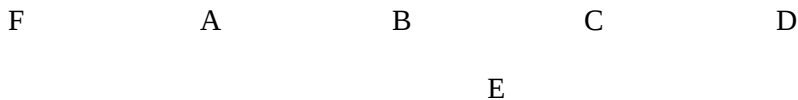
Numerical Problems from Medium Access Control (MAC) Layer

1. Consider building a CSMA/CD network running at 1 Gbps over 1 km cable with no repeaters. The signal speed in the cable is 2,00,000 km/sec. What is the minimum frame size required?
2. Assume the stations A, B, C, D, E and F use CSMA/CA for their data transmission. The position and the range of each station are shown below. For the transmission from B to C to be successful, how the other stations will cooperate (show it using appropriate diagrams) ? If A want to have the data transmission with F simultaneously with B's transmission, what are the restrictions ? and when it will be successful ?

A: F & B; F: A; B: A, C & E; C: B, D & E; E: B & C; D: C



3. A large population of ALOHA users manages to generate 50 requests/sec, including both originals and retransmissions. Time is slotted in units of 40 msec. (i) What is the chance of success on the first attempt? (ii) What is the probability of exactly k collisions and then a success? (iii) What is the expected number of transmission attempts needed?
4. Sixteen stations numbered 17-32, are contending for the use of a shared channel by using Tree-splitting algorithm. If all the stations whose addresses are prime numbers suddenly become ready at once, how many slots are needed to resolve the contention? Indicate the result (which station is successfully transmitted or which have received collision) of each of the slots in sequence (i.e., 1,2,3,). Also draw the tree diagram.
5. A 2-km long, 20 Mbps CSMA/CD LAN has a propagation speech of 200 m/μsec. Data frames are 256 bits long, including 32 bits of header, checksum and other overhead. The first slot after successful transmission is reserved for the receiver to capture the channel in order to send a 32-bit acknowledgement frame. Before transmission of data/acknowledgement frame, the sender has to capture the channel. For capturing the channel, stations use dummy frames. What is the effective data rate for the transmission of one data frame, excluding the overhead, assuming that there are no collisions.
6. Assume the stations A, B, C, D, E and F use CSMA for their data transmission. The position and the range of each station are shown below. List the hidden and exposed stations for the following transmissions: (i) F → A, (ii) A → B, (iii) B → C, and (iv) C → D. **(2M)**



Transmitting station	Range of transmission (stations receive the transmission)
F	A
A	F, B
B	A, C, E
E	B, C
C	B, E, D
D	C

7. Measurements of a slotted ALOHA channel with an infinite number of users show that 20% of slots are idle. (i) What is the channel load, G? (ii) What is the throughput, S? And (iii) Is the channel underloaded or overloaded?