1. In a CSMA/CD network n stations transmit each with a binary probability p. The probability of no transmission is then $1 - p$. Show that the probability of exactly one transmission is maximized if $p = 1/n$.

2. Consider a CSMA/CD network with a big number of stations ($n \gg 1$). Denote the normalised throughput $\rho \equiv \lambda m$, where λ is the average number of messages/time transmitted over the channels from all users combined, and m is the time required to transmit a message. Derive the upper bound for ρ as a function of $a = \tau/m$, where τ is a time required to sense completion of transmission.

3. A cable TV company is using the CSMA/CD for provision of Internet. The maximum distance from the headend to a user is 10 km (the network has a tree topology with the headend as a root). Consider the two cases: data frames 512 and 1200 bits long. What is the maximum line capacity (transmission rate) in each case if $a = \tau/m$ is to be less than 0.1. Take the propagation delay to be $5\,\mu sec/km$. Find the maximum number of users that can be accomodated for the user input of 1 data frame in 5 and 10 sec.

4. One hundred stations are distributed over a 1-km bus. A CSMA/CD protocol is used. The transmission rate is 10 Mbps and data frames are 1000 bits long, on the average. Calculate the maximum number of frames per second that each station can generate. Repeat if the bus length is reduced to 500 m. Repeat if the transmission capacity is 100 Mbps. Repeat if the frames are 10 000 bits long. Explain the results. Use $5\,\mu sec/km$ as the bus propagation delay.