# City University of Hong Kong
## Department of Electrical Engineering

### EE3009 Data Communications and Networking

## Tutorial 4

1. Suppose that the ALOHA protocol is used to share a 56 kbps satellite channel. Suppose that frames are 1000 bits long. Find the maximum throughput of the system in frames/second.

2. *M* terminals are attached by a dedicated pair of lines to a hub in a star topology. The distance from each terminal to the hub is 500 meters, the speed of the transmission lines is 100 Mbps, all frames are of length 1,500 bytes, and the signal propagation on the line at a speed of $2.5 \times 10^8$ meters/second. Compare the maximum network throughput achievable when the hub is implementing slotted ALOHA and CSMA-CD.

3. A token-ring LAN interconnects M stations using a star topology in the following way. All the input and output lines of the token-ring station interfaces are connected to a cabinet where the actual ring is placed. Suppose that the distance from each station to the cabinet is 100 meters and that the ring latency per station is eight bits. Assume that frames are 1250 bytes and that the ring speed is 25 Mbps. Also assume that the signal propagation speed is $2 \times 10^8$ m/s.

   i)   What is the maximum possible arrival rate that can be supported if stations are allowed to transmit an unlimited number of frame/token?
   ii)  What is the maximum possible arrival rate that can be supported if stations are allowed to transmit 1 frame/token using single-frame operation?
   iii) What is the maximum possible arrival rate that can be supported if stations are allowed to transmit 1 frame/token using multi-token operation?