Problem 10.1

Assume a slotted Aloha system with 2 nodes and parameters $\sigma = 2/3$ and $\nu = 1/3$. Suppose that one of the nodes is faulty and transmits always with probability σ (even if backlogged).

10.1.A Draw the state transition diagram and compute the stationary distribution using the flux balancing method.

10.1.B Compute the throughput of each node.

Problem 10.2

Assume a slotted Aloha system with 2 nodes and parameters $\sigma = 2/3$ and $\nu = 1/3$. Suppose that packets are transmitted only once. So, if a backlogged node collide again, the packet is discarded and the node becomes thinking.

10.2.A Draw the state transition diagram and compute the stationary distribution using the flux balancing method.

10.2.B Compute the throughput.

10.2.C Compute the probability that a new arriving packet is eventually discarded.

Problem 10.3

Assume a slotted Aloha system with 2 nodes. Node 1 and node 2 transmit with probability $\sigma_1 = 2/3$ and $\sigma_2 = 1/2$, respectively, when they are in thinking state. Both nodes transmit with probability and $\nu = 1/3$ when they are backlogged.

10.3.A Draw the transition diagram and derive the one step transition probabilities.

10.3.B Compute the stationary distribution using the flow balancing method.

10.3.C Compute the throughput of node 1.

10.3.D Assume both nodes are in thinking state. Let N be the random variable equal to the number of steps until node 1 becomes backlogged for the first time. Compute $\mathrm{E}[N]$ using the mean recurrent time of the previous DTMC.

10.3.E Compute the distribution of N. Compute $\mathrm{E}[N]$ using the distribution and compare it with the previous item.

10.3.F Assume slots of 1 ms and packets of 1 kbyte. What is the average transmission time of a file of 1 Mbyte, transmitted by node 1? (in seconds)

10.3.G How many packets have been transmitted by node 1 (successful or not) during the transmission of the file in the previous item? How many of them are successful transmissions?