# Assignment 4, Queueing Network

Due Date is: Nov. 9th 2021

## Question 1, about series network

Consider a 3-station series queueing network with Poisson arrival (rate $\lambda$) and exponential service time (parameters $\mu_1$, $\mu_2$, and $\mu_3$). There is no capacity limit on the queue in front of the first two stations, but at the third station there is a limit of $K$ allowed (including the one in service). If already $K$ customers are in the third station, then any subsequent arrivals to the third station will directly leave the network. Question:

a) Find the expected number of customers in the network (all the 3 stations);

b) Find the expected time spent in the network by a customer who completes all three stages of service.

# Question 2, MATLAB Simulation

Use MATLAB to code a discrete-event simulation program for an detecting QoS in a sensor network shown below



$$\sum_i T_i + \tau^k \leq T_{QoS}$$
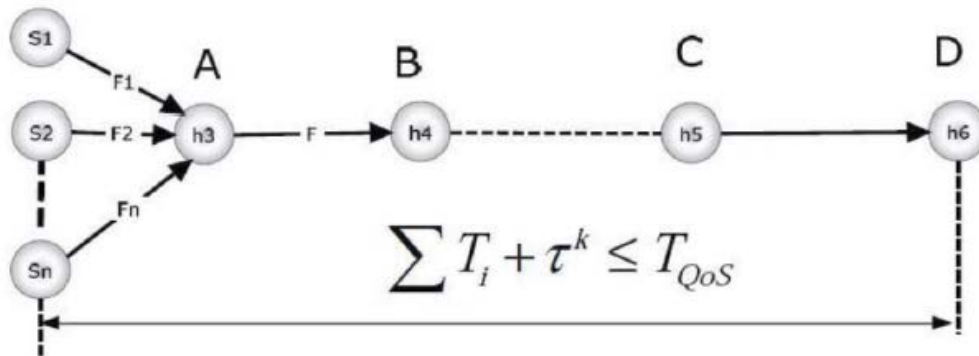
Consider a time-driven wireless sensor network, where sensors sample the environment and report their readings to the data sink periodically in a Stop-and-Go routing according to the above Figure where $T_i$ is the total time that a packet spends in a node, $\tau^k$ is the propagation delay. Each sensor report is associated with a delay constraint $T_{QoS}$, which defines the maximum sensor-to-sink delay allowed. There are two types of packets, data and control packets. Control packets have higher priority than Data packets and scheduled to queue high $Q_h$ while Data packets are scheduled to queue low $Q_l$. In some emergency cases, Data packets are scheduled at $Q_h$ with probability 1-$p_\tau$. Sensor nodes are working in two modes: working mode and sleeping mode.

Simulate how to compute the maximum hop-count allowed in the system to meet $T_{QoS}$ requirements. Vary $T_{QoS}$ and compute the dropping probability due to violating $T_{QoS}$ under different loads.

The MATLAB code along with the README file should be submitted electronically in a single zip file.