SFWR ENG/COMP SCI 4/6E03 — Questions for December 2nd tutorial

1. Consider the following task sequence. Task 1 is performed in isolation. Following the completion of Task 1, Tasks 2, 3, and 4 are performed in parallel. Following that, Task 5 is performed in isolation. The whole cycle then repeats. The processing times of each task are exponentially distributed with means 2, 5, 1, 5, and 1, respectively.
   (a) Model this system as a Stochastic Petri Net.
   (b) Draw the state transition diagram and use it to solve for the throughput in steady-state.
   (c) The speed-up is defined as the ratio of the mean time to complete the task sequence to the sum of the individual mean task processing times. Compare the speed-up for this system to one in which the processing times are constant.

2. Suppose that particles arrive, one at a time, at a counter. A particle arrives at time 0 and locks the counter for a time interval of fixed length T. If no further particles arrive in $(0, T]$, the counter becomes unlocked at time T; the next particle particle gets registered and the counter is lokced again for a time interval of length T. A particle that arrives when the counter is locked does not get registered but extends the locked interval so that the counter remains locked for an interval of length T after the arrival. The successive interarrival times for particles are exponentially distributed with rate λ. Model this as a Stochastic Petri Net.

3. Consider a closed, cyclic queueing network with two nodes and five jobs circulating. Each node has a single server with processing times exponentially distributed with rate 1. Can this be modeled as a Stochastic Petri Net? If so, give the model, otherwise give an explanation as to why this cannot be done.