**MIE 524/624- Discrete time Markov chain and simulation - Refresher**

1. A machine is inspected at the end of each day, and rated as excellent, good, fair, or inoperable. If a machine is E on day t, is found to be in G, F, or I on day t+1 50%, 30%, and 20% of the time respectively. A machine found to be in state G on day t, is found to be in G, F, and I on day t+1 30%, 40%, 30% of the times, respectively. A machine found to be in state F on day is found to be in F and I, 50% and 50% of the time respectively. A machine in I, is inoperable after.
   1. Represent the system as a Markov chain.
   2. Define the random variable, and stochastic process for this system.
   3. Write the state space, and transition probability matrix.
   4. What is average life of machine? How to calculate analytically and through simulation?
2. Same as #1, except that when machine is in I it is replaced the next day. Also, based on the condition of the system, there is a certain cost due to defective items created by the machine. G and F are associated with a cost of $1000 and $3000 respectively. New machines cost $6000. What is the average cost of maintaining the system?

Solution:

1: First passage time from I to j