Nareshit Mawandia 2020CS10340

1) $p = 0.7$ $q = 0.3$

computer $\rightarrow$ 3 identical switches

X_n is the no of switches not working at the end of n^{th} day.

a) Hence the Parameter space will be

$n = 0, 1, 2, 3 \ldots$

where n represents the number of days.

Hence parameter space $= \{0, 1, 2, 3 \ldots\}$

Now state space is all the possible values that X_n takes over time, which is the no. of not working switches at the begining of n^{th} day.

State Space $= \{0, 1, 2, 3\}$

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b) One sample path of the stochastic process can be

$x_0 = 2$

$x_1 = 1$

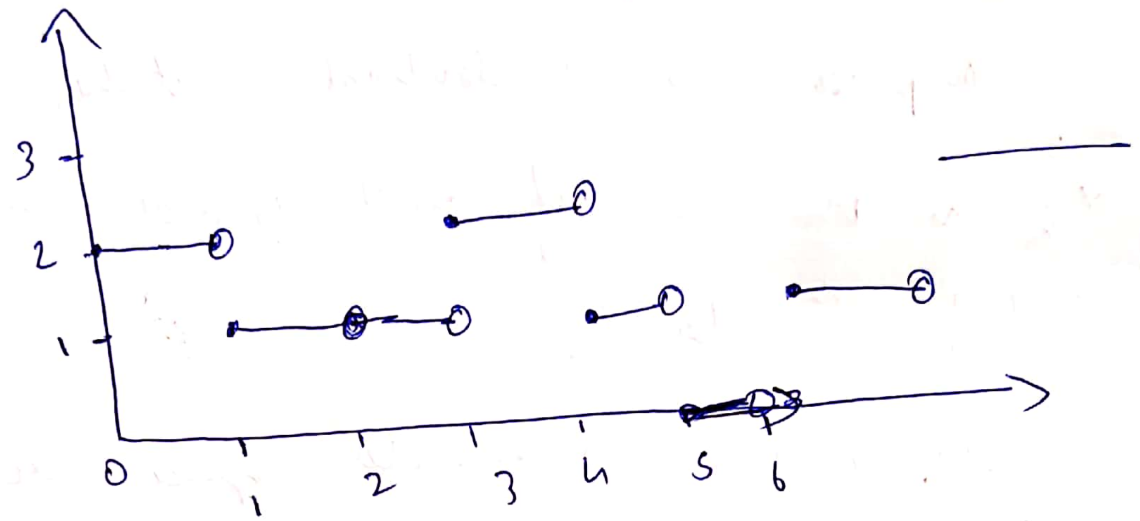
$x_2 = 1$

$x_3 = 2$

$x_4 = 1$

$x_5 = 0$

$x_6 = 1$



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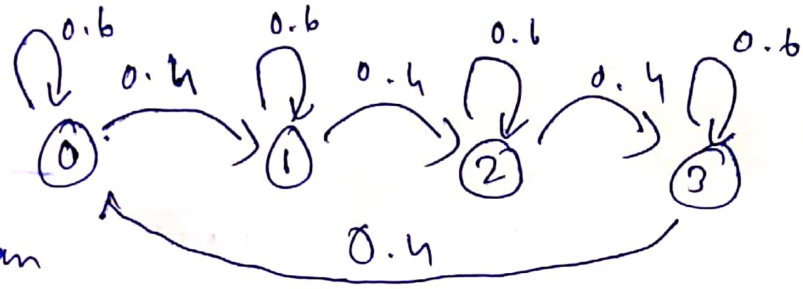
Q2) a) All the states are +ve recurrent

Since the DTMC is

- Irreducible
- ~~Aperiodic~~



because all states can be reached again and again.

- Aperiodic because $P_{ii} \neq 0$ for $\forall i$ and $P_{ij} \neq 0$ for $\forall i$ for some j

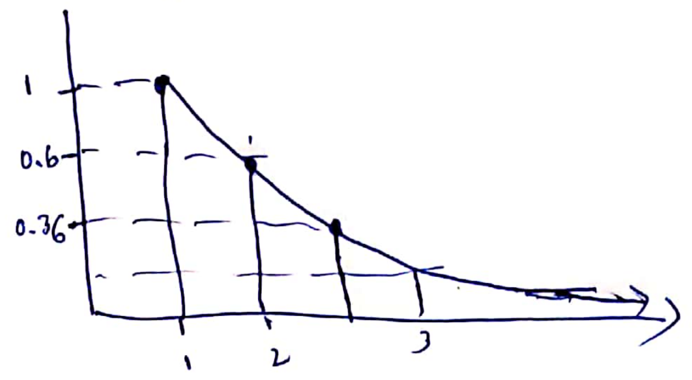
~~Because~~ So μ will be finite since all states are Irreducible and aperiodic.

b) $X_0 = 3$

Probability mass function of random ~~vars~~ T_3 will

$$P(T_i = k) = 0.6\, P(T_i = k-1)$$

which gives us $P(T_i = k) = (0.6)^{k-1}$



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c) $\pi = \pi P$

$$(\pi_0, \pi_1, \pi_2, \pi_3) = (\pi_0, \pi_1, \pi_2, \pi_3) \begin{pmatrix} 0.6 & 0.4 & 0 & 0 \\ 0 & 0.6 & 0.4 & 0 \\ 0 & 0 & 0.6 & 0.4 \\ 0.4 & 0 & 0 & 0.6 \end{pmatrix}$$

$\pi_0 = 0.6\pi_0 + 0.4\pi_3 \Rightarrow 0.4\pi_0 = 0.4\pi_3$

$\pi_1 = 0.4\pi_0 + 0.6\pi_1 \Rightarrow 0.4\pi_1 = 0.4\pi_0$

$\pi_2 = 0.4\pi_1 + 0.6\pi_2 \Rightarrow 0.4\pi_2 = 0.4\pi_1$

$\pi_3 = 0.4\pi_2 + 0.6\pi_3 \Rightarrow 0.4\pi_3 = 0.4\pi_2$

$\Rightarrow \pi_0 = \pi_1 = \pi_2 = \pi_3$

$\pi_0 + \pi_1 + \pi_2 + \pi_3 = 1$

$\Rightarrow \pi_0 = \pi_1 = \pi_2 = \pi_3 = 1/4$

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