(1) (5 points) Give an example of a 3×3 transition matrix that is regular.

(2) (5 points) Is the following transition matrix regular? Why or why not?

$$\begin{pmatrix} 0 & 0.2 & 1 \\ 0 & 0.3 & 0 \\ 1 & 0.5 & 0 \end{pmatrix}$$

(3) (5 points) Sally's hometown only has one restaurant in it. Every night Sally eats at this restaurant or at home. If Sally ate at home last night, there is a 75% she eats out tonight. If Sally ate out last night there is only a 50% chance she eats out tonight. Write the transition matrix for this Markov process.

(4) (5 points) Compute the following limit,

$$\lim_{N \to \infty} \begin{pmatrix} 0.2 & 0.4 \\ 0.8 & 0.6 \end{pmatrix}^N$$

(5) (5 points) Compute the following limit,

$$\lim_{N \to \infty} \begin{pmatrix} 0 & 0.5 \\ 1 & 0.5 \end{pmatrix}^N$$

(6) (5 points) Compute the following limit,

$$\lim_{N \to \infty} \begin{pmatrix} 0.3 & 0.5 \\ 0.7 & 0.5 \end{pmatrix}^N$$