Math 166 Week in Review 10
Sections M.1, M.2, M.3

1. Determine if the following matrices are stochastic. If stochastic, is it regular? Is it absorbing?

(a) \[
\begin{pmatrix}
1 & 0.6 & 0.7 \\
0 & 0.4 & 0.3 \\
\end{pmatrix}
\]

(b) \[
\begin{pmatrix}
0.1 & 0.2 & 0.4 \\
0.1 & 0.6 & 0.3 \\
0.8 & 0.2 & 0.3 \\
\end{pmatrix}
\]

(c) \[
\begin{pmatrix}
0.4 & 0.2 & 0.1 \\
0.3 & 0.5 & 0.6 \\
0.3 & 0.2 & 0.3 \\
\end{pmatrix}
\]

(d) \[
\begin{pmatrix}
1 & 0.1 & 0.3 \\
0 & 0.5 & 0.5 \\
0 & 0.4 & 0.2 \\
\end{pmatrix}
\]

(e) \[
\begin{pmatrix}
0.3 & 0.3 & 0.4 \\
0.1 & 0.2 & 0.7 \\
0.6 & 0.5 & -0.1 \\
\end{pmatrix}
\]

(f) \[
\begin{pmatrix}
0.8 & 1 & 0.4 \\
0.1 & 0 & 0.3 \\
0.1 & 0 & 0.3 \\
\end{pmatrix}
\]

(g) \[
\begin{pmatrix}
1 & 0 & 0 \\
0 & 0.4 & 0.3 \\
0 & 0.6 & 0.7 \\
\end{pmatrix}
\]

(h) \[
\begin{pmatrix}
0.5 & 0 & 0.4 & 0 \\
0.2 & 1 & 0 & 0 \\
0.3 & 0 & 0.6 & 0 \\
0 & 0 & 0 & 1 \\
\end{pmatrix}
\]
2. (Modified from *Finite Mathematics* by Waner/Connencible)

At a certain college, 10% of all business majors switched to another major the next semester. Of all nonbusiness majors, 20% switched to a business major the following semester.

(a) Determine the transition matrix for this Markov process.

(b) In a certain freshman class, currently 40% are business majors and 60% are not. What will be the distribution a semester later? 3 semesters later?

(c) What is the probability that a student who is initially a business major will not be a business major during the first semester of their junior year (4 semesters later)?
(d) Is this Markov process regular? If so, find the steady-state distribution.

3. Data was collected about the types of toothpaste that were used among households in a certain city. It was found that if a household is currently using Crest, 40% will continue to use Crest the next month whereas 10% will switch to Aquafresh and the remaining 50% will switch to Colgate Total. If a household is currently using Aquafresh, the next month 30% will continue to use Aquafresh, 50% will switch to Crest, and 20% will switch to Colgate Total. Finally, if a household is currently using Colgate Total, 30% will switch to Crest and 50% will switch to Aquafresh the next month.

(a) If 35% of households are currently using Crest, 20% are using Aquafresh, and 45% are using Colgate Total, what is the household toothpaste distribution in this city 5 months later?
(b) If a household is currently using Colgate Total, what is the probability that they will be using Aquafresh 3 months later?

(c) Is this Markov process regular? If so, find the steady-state distribution.
4. A certain city has four newspapers: The Times, The Report, The Journal, and the The Statesman. Every year, each citizen of this city makes a choice about what newspaper they want to read the next year. The following data was obtained. Once a person orders The Times, they always order The Times. Once a person orders The Report, they will always order The Report. If a person orders The Journal in one year, 10% will switch to The Times, 10% will switch to The Report, and 50% will stay with The Journal in the next year. If a person orders The Statesman one year, 15% will switch to The Times, 20% will switch to The Report, and 25% will stay with The Statesman in the next year.

(a) Determine the transition matrix for this Markov process.

(b) Find the limiting matrix $L$.

(c) Describe the long-term probabilities for someone who currently reads The Journal.