1) A new grocery store has just opened. From past observations of new stores it has been determined that 70% of people who go to the new grocery store will go again next week, while 20% of the people who went to the old grocery store will go to the new store next week.

A. Set up the transition matrix for this situation. Label your rows and columns with new and old.

\[
P = \begin{bmatrix} .7 & .3 \\ .2 & .8 \end{bmatrix}
\]

B. If during grand opening week, 60% of the people went to the new grocery store. Set up the initial-state matrix for this situation.

\[
S_0 = \begin{bmatrix} .6 & .4 \end{bmatrix}
\]

C. What percentage of the people will be going to the new grocery store 3 weeks after the grand opening? Clearly show what matrices you multiplied. Give answer to one decimal place.

\[
S_0P^3 = \begin{bmatrix} .425 & .575 \end{bmatrix} \Rightarrow 42.5\%
\]

D. What percentage of people will be going to the new grocery store in the long run?

\[
S_0P^{100} = \begin{bmatrix} .4 & .6 \end{bmatrix} \Rightarrow 40\% \text{ go to the new grocery store in the long run.}
\]

SECTIONS 9.1 AND 9.2
2) An insurance company classifies drivers as low-risk if they are accident-free for 1 year. Past records indicate that 98% of the drivers in the low-risk category (L) on year will remain in that category the next year, and 78% of the drivers who are not in low-risk category (L') one year will be in the low-risk category the next year.

a) Draw the transition diagram

![Transition Diagram]

b) Draw the tree diagram

```
START
    L
      0.98
    L'
      0.78
        L
          0.98
          L'
            0.22
```

c) Write the transition matrix

\[
P = \begin{bmatrix}
L & L' \\
0.98 & 0.02 \\
0.78 & 0.22
\end{bmatrix}
\]
d) If 90% of the drivers in the community are in the Low-Risk category this year, what is the probability that a driver chosen at random from the community will be in the low-risk category next year?

\[ S_0 = \begin{bmatrix} L & L' \\ .9 & .1 \end{bmatrix} \]

\[ S_1 = \begin{bmatrix} .9 & .1 \\ .78 & .22 \end{bmatrix} \begin{bmatrix} .98 & .02 \\ .96 & .04 \end{bmatrix} = \begin{bmatrix} .96 & .04 \end{bmatrix} \]

In conclusion, the probability that a driver chosen at random from the community will be in the low-risk category next year is 0.96 or 96%.

e) If 90% of the drivers in the community are in the Low-Risk category this year, what is the probability that a driver chosen at random from the community will be in the low-risk category in the Year after that next year?

\[ S_2 = \begin{bmatrix} .9 & .1 \\ .78 & .22 \end{bmatrix} \begin{bmatrix} .98 & .02 \\ .96 & .04 \end{bmatrix} = \begin{bmatrix} .972 & .028 \end{bmatrix} \]

In conclusion, the probability that a driver chosen at random from the community will be in the low-risk category the year after next year is 0.972 or 97.2%.
3) Mice in a certain experiment involving a choice between path A and B are observed to have the following pattern:
Of those who choose path A one day, 30% choose path A the next day and 70% choose path B, while of those who choose path B one day, 80% choose path B the next day and 20% choose path A.

a) Set up the transition matrix for this situation.

\[
P = \begin{bmatrix}
.3 & .7 \\
.2 & .8 
\end{bmatrix}
\]

b) If 50% of mice choose path A on Monday and 50% of mice choose path B, what percentages choose each path on Tuesday?

\[
S_0 = \begin{bmatrix}
.5 \\
.5 
\end{bmatrix}
\]

\[
S_1 = \begin{bmatrix}
.5 \\
.5 
\end{bmatrix} \begin{bmatrix}
.3 & .7 \\
.2 & .8 
\end{bmatrix} = \begin{bmatrix}
.25 \\
.75 
\end{bmatrix}
\]

In conclusion: On Tuesday 25% of mice will choose path A and 75% of mice will choose path B.

c) If 50% of mice choose path A on Monday and 50% of mice choose path B, what percentages choose each path on Wednesday?

\[
S_2 = \begin{bmatrix}
.5 \\
.5 
\end{bmatrix} \begin{bmatrix}
.3 & .7 \\
.2 & .8 
\end{bmatrix}^2 = \begin{bmatrix}
.225 \\
.775 
\end{bmatrix}
\]

In conclusion: On Wednesday 22.5% of mice will choose path A and 77.5% of mice will choose path B.

d) If 50% of mice choose path A on Monday and 50% of mice choose path B, what percentages choose each path on Sunday?

\[
S_6 = \begin{bmatrix}
.5 \\
.5 
\end{bmatrix} \begin{bmatrix}
.3 & .7 \\
.2 & .8 
\end{bmatrix}^6 = \begin{bmatrix}
.2222 \\
.7778 
\end{bmatrix}
\]

In conclusion: On Sunday 22.22% of mice will choose path A and 77.78% of mice will choose path B.
e) In the long run, what portion of the mice choose path A each day and what portion of mice choose path B?

\[
S_{100} = \begin{bmatrix} .5 \\ .2 \end{bmatrix} \begin{bmatrix} .3 & .7 \end{bmatrix}^{100} = \begin{bmatrix} .2222 \\ .7778 \end{bmatrix} = \begin{bmatrix} \frac{2}{9} \\ \frac{7}{9} \end{bmatrix}
\]

In conclusion: in a long run, \( \frac{2}{9} \) of mice choose path A each day and \( \frac{7}{9} \) of mice choose path B.