4.14 Matrices Modeling Contexts

AP Precalculus Name: _____ **CA #1**

CALCULATOR ACTIVE: Directions: Use the given information to answer the questions.

1) Each year Buffalo has seen a migration of its fan base between its beloved Bills and the Cleveland Browns. About 17% of Bills fans each season leave the team and become Browns fans. While only 3% of Browns fans are becoming Bills fans. Assume these are the only two choices for the fans and that currently there are 10,000 Bills fans and 18,000 Browns fans.

A) Find a transition matrix.

B) How many Bills and Browns fans will there be after 1 year? 2 years?

C) What will be the eventual long-term distribution of fans be?

D) How many fans did each fan base have last year?

2) Everyone knows that there are only two choices for Pop (soda…soda pop…cola…whatever you call it). There is Pepsi with 42% share of the market and Coke with the rest of the market. Pepsi decided to invest a ton of money into advertising to see if they could get more Pepsi fans. They find that each year about 9% of Coke drinkers switch to Pepsi. Meanwhile, only 2% of Pepsi drinkers are changing to Coke each year.

A) Find a transition matrix.

B) What will be the distribution of Pepsi and Coke drinkers in 3 years?

C) Is there a steady state for this situation? If so what is it?

D) What was the distribution of Pop drinkers last year before they started their marketing campaign?

ANSWERS

1) $A)$ $\begin{matrix} & Bills & Browns \\ Bills & .83 & .03 \\ Browns & .17 & .97 \end{matrix}$

B) 1 year: $\langle 8840,\ 19160 \rangle$

$\begin{matrix} Bills & Browns \end{matrix}$

2 years: $\langle 7912,\ 20088 \rangle$

$\begin{matrix} Bills & Browns \end{matrix}$

C) $\langle 4267,\ 23733 \rangle$

$\begin{matrix} Bills & Browns \end{matrix}$

D) $\langle 11450,\ 16550 \rangle$

$\begin{matrix} Bills & Browns \end{matrix}$

2) $A)$ $\begin{matrix} & Pepsi & Coke \\ Pepsi & .98 & .09 \\ Coke & .02 & .91 \end{matrix}$

B) 3 years: $\langle 54\%,\ 46\% \rangle$

$\begin{matrix} Pepsi. & Coke \end{matrix}$

C) $\langle 82\%,\ 18\% \rangle$

$\begin{matrix} Pepsi. & Coke \end{matrix}$

D) $\langle 37\%,\ 63\% \rangle$

$\begin{matrix} Pepsi. & Coke \end{matrix}$