Math 314
Computer Project

The goal of this project is to use a computer algebra system (such as Maple V or Matlab) to find patterns in the probability distribution vectors arising from a Markov chain. Your write-ups will be due in class on Thursday, March 30. If you wish to have me (i.e., the instructor) look over a preliminary version of your write-up, you should get that to me by Friday, March 24, and I will try to get it back to you the following class (or earlier).

The specific situation is this:

You, as founder and president of the Ace Marketing Analysis Group, have been hired by daVinci's Pizza (dVP) to determine the best way to retarget their advertising campaign to steal market share from Domino's (DP) and Pizza Hut (PH). They plan a smear campaign, but can only afford to target one of the two. Currently, their analysis indicates that, each week, 50% of their customers remain loyal to dVP (i.e., return the following week), while 30% will switch to DP and the remainder to PH. Their spies within the other corporations tell them that 45% of DP customers remain loyal each week, while 35% switch to dVP, and 40% of PH customers stick with PH, while 30% switch to dVP. The people at daVinci's feel that, using the same amount of money, they can:

(a) convince an additional 10% of their current customers, that would ordinarily switch to Domino's, to instead remain loyal;

or

(b) convince an additional 10% of their current customers, that would ordinarily switch to Pizza Hut, to instead remain loyal;

or

(c) convince an additional 10% of Domino's customers, that would ordinarily remain loyal, to instead switch to daVinci's;

or

(d) convince an additional 10% of Pizza Hut's customers, that would ordinarily remain loyal, to instead switch to daVinci's.

What they wish you to determine is: which of these strategies will give them the greatest market share in the long run?

To answer this, you should set up each of these four scenarios as a Markov chain, identifying the transition matrix for each. For comparison (and to show daVinci's what kind of market advantage their money will be buying) you might also set up the original data from before their planned smear campaign. Then look at what happens to the market share for each company under successive iterations of your transition matrices. Sample *Maple V* code for carrying out such calculations can be found on our course web page:

http://www.math.unl.edu/m̃britten/classwk/314s2k/

You are not provided with data on the original market share for each franchise at the begining of the campaign; by choosing several initial examples to start with (e.g., all with

daVinci's, all with Domino's, etc.), explore how sensitive your estimates of eventual (i.e., after many iterations) market share are to such changes in initial shares.

Then, with your success in showing daVinci's how to spend their advertising money, sit back and watch the dough roll in.

Your final report to the board of directors of daVinci's Pizza should include a summary of the techniques you used to reach your conclusions; make sure to include sufficient detail and explanatory material to make your work understandable to someone with a basic knowledge of linear algebra, but who does not have a knowledge of the specific techniques you employed in your analysis. I expect that a good job of it can be done in under 5 pages, but would probably need more than 2?

You may choose to work on this project individually, or to work with some of your fellow students, in groups of up to three in size. Each group need only turn in one report, headed by all of the names of your consulting team.

(P.S.: 'Market share' means the fraction of the total number of customers that each pizza place serves.)