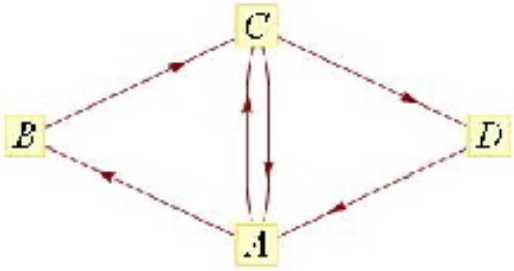
Math 201 Homework #3

Instructions: you must work by yourself. The easiest way to turn this in is electronically as a Mathematica file. Just email it to me. You can turn in hard copy if you prefer. It is due Wednesday, November 18, at 1:10. Late papers lose 10% for each day or partial day late. I will be glad to discuss the assignment with you until, but not including, Tuesday night. Start early, ask questions, and do well!

We will spend some time in class talking about graphs, Markov chains, steady states and how to generate them in Mathematica. The sample file is posted on Y (Public): \Mathmatica as 201Markov.

1. Suppose that for some metropolitan area 10% of those living in the city move to the suburbs, while 5% of those living in the suburbs move into the city. If 40% currently live in the city, find the percentage in the city
   (a) 1 year from now
   (b) 2 years from now
   (c) in the long run

2. For the four web pages and links shown,



   (a) write out the transition matrix for following random links
   (b) write out the PageRank equation with 0 weight on the personalization vector and use Mathematica to find its steady state.
   (c) write out the PageRank equation with standard weights and personalization vector $\begin{pmatrix} 1/4 \\ 1/4 \\ 1/4 \\ 1/4 \end{pmatrix}$. Use Mathematica to find several iterates and estimate the steady state. How much does this personalization vector change the steady state? Briefly explain.
   (d) repeat part (c) with personalization vector $\begin{pmatrix} 1/8 \\ 1/4 \\ 1/2 \\ 1/8 \end{pmatrix}$.

3. Choose 10 pages on the Roanoke College web site. Five of them must be
   1. roanoke.edu/index.xml
   2. roanoke.edu/Academics.htm
   3. roanoke.edu/Apply_to_Roanoke.htm
   4. maroons.roanoke.edu
   5. roanoke.edu/Academics/Academic_Departments/Math_CS_and_Physics.htm

   The other 5 can be any pages that you want, as long as they are part of roanoke.edu.

   (a) List your pages and all of the links among your 10 pages (other pages don't count, but you may count obvious intermediate links), and write out the transition matrix for following random links

   (b) Write out the PageRank equation with 0 weight on the personalization vector and use Mathematica to find its steady state.

   (c) Make up a reasonable personalization vector; explain your logic! Write out the PageRank equation with standard weights and your personalization vector and use Mathematica to estimate the steady state.

4. Steady states in this assignment could be found in two ways: by solving an equation that states that the vector remains unchanged, or by computing iterates until they stop changing. Briefly explain how this process compares to the Collage Theorem and our use of iterates in the second assignment.