

INSTRUCTIONS: This is a graded assignment. Each person must submit their own solution. Document your assistance in accordance with (IAW) the Documentation of Written Work (DOWW).

- In class, we created the state change diagram for the win-by-two scenario of Rock, Paper, Scissors. After some experimentation, we found that people do not have the equal opportunity to move between states. People that are leading are more likely to win and people that are losing are more likely to lose. The findings are summarized in Figure 1.

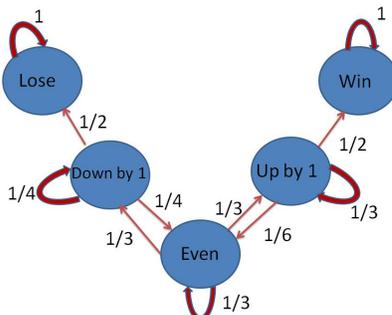


Figure 1: State Change diagram for Rock, Paper Scissors win-by-two.

- Determine the transition matrix for this game of Rock, Paper, Scissors.
 - Would you prefer to play with these odds or the usual probabilities? Justify your answer.
- Fierce competition exists between Facebook and MySpace social networking websites. Each year 20% of all MySpace users switch to Facebook, while 75% remain active MySpace users. Each year 10% of all Facebook customers switch to MySpace, while 80% remain Facebook users. Through their networking campaign MySpace gets 7 million new customers each year, while Facebook gains 12 million new customers each year. Currently, MySpace has 106 million customers and Facebook has 120 million customers.
 - Develop a model to represent the number of customers using each site after n years (Be sure to define variables, state domain, assumptions, initial conditions and the math model).
 - Does the system reach equilibrium? If so, find the equilibrium values. If not, state why not.
 - If the initial number of customers for each website were doubled, state the effect, if any, it would have on the long-term behavior of the system. Explain why this is so.
 - Three fast food establishments have been in business for many years in BeatAirForceLand. McDonalds, Wendy's and Burger King have been content with their respective shares of the market and have been living in harmony. One arbitrary day, the three restaurants saw 11,970 customers collectively walk through their doors; McDonald's ≈ 4246 , Burger King ≈ 4234 , Wendy's ≈ 3490 . Taco Bell is interested in this market, because their analysts believe that once established they can garner a majority of the market. The Taco Bell analysts, through previous historical investigation of other market take-overs, have found that once they enter a market, the following generally happens:

	Stay with their Restaurant	Switch to Mc Donald's	Switch to Burger King	Switch to Wendy's	Switch to Taco Bell
McDonald's Customers	80%	N/A	10%	0%	10%
Burger King Customers	70%	10%	N/A	10%	10%
Wendy's Customers	50%	20%	20%	N/A	10%
Taco Bell Customers	85%	5%	10%	0%	N/A

- Develop a system of recursive equations to investigate the Taco Bell analyst's claims. Don't forget the big five.
- Determine an analytic equation modeling this problem. Make sure to indicate the steps of your process in arriving at your result.
- Does Taco Bell achieve market superiority?
- How many customers does each business end up with? Describe how you can use the analytic solution to predict this.

4. Sketch the graph of function f satisfying the following conditions:

$$\lim_{x \rightarrow 1} f(x) = 3, \quad \lim_{x \rightarrow 4^-} f(x) = 3, \quad \lim_{x \rightarrow 4^+} f(x) = -3, \quad f(1) = 1, \quad f(4) = -1$$

5. Guess the value of

$$\lim_{x \rightarrow 0^+} x \ln(x + x^2)$$

(if it exists) by evaluating the function at $x = 1, 0.5, 0.1, 0.05, 0.01, 0.005, 0.001$.

6. Find

$$\lim_{x \rightarrow -3^-} \frac{x + 2}{x + 3}.$$

7. If a rock is thrown upward on the planet Mars with a velocity of 10 m/s, its height in meters t seconds later is given by $y = 10t - 1.86t^2$.

(a) Find the average velocity over the given intervals:

i. $[1, 2]$

ii. $[1, 1.15]$

iii. $[1, 1.1]$

iv. $[1, 1.01]$

v. $[1, 1.001]$

(b) Estimate the instantaneous velocity when $t = 1$.